People in a Changing Land

The Archaeology and History of the Ballona in Los Angeles, California

VOLUME 3

Material Culture and Subsistence Practices

edited by Seetha N. Reddy and John G. Douglass

Statistical Research, Inc.
Technical Series 94

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edited by
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ABSTRACT

Sponsor: Playa Capital Company, LLC

Volume Title: Material Culture and Subsistence Practices. People in a Changing Land: The Archaeology and History of the Ballona in Los Angeles, California.

Project Location: The project area is located in an area formerly containing the Ballona Lagoon, a prehistoric wetland complex in west Los Angeles that is known collectively as the Ballona in Los Angeles County. This area is today bounded roughly by Playa del Rey to the west, Marina del Rey to the north, the Ballona Escarpment (a high bluff) and Del Rey Hills/Manchester Bluffs to the south, and Interstate 405 to the east. It is located approximately 0.5 km east of the Pacific Ocean near an area referred to as Santa Monica Bay along this section of the coast, 1.3 km west of the Baldwin Hills, and 1.6–2.6 km north of Los Angeles International Airport. Ballona Creek, a drainage that is now channelized, crosses the project area; Centinela Creek, a spring-fed drainage, once ran along the southern portion of the project area along the base of the Ballona Escarpment.

Project Description: Statistical Research, Inc. (SRI), conducted research, including testing, evaluation to determine eligibility for listing in the National Register of Historic Places (NRHP), and data recovery at eight sites in the Ballona (CA-LAN-54/H, CA-LAN-62/H, CA-LAN-193/H, CA-LAN-211/H, CA-LAN-1932/H, CA-LAN-2676/H, CA-LAN-2768/H, and CA-LAN-2769/H) (hereafter, the prefix CA- and the suffix /H will be omitted). Of these sites, five were recommended eligible for listing in the NRHP: LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768. Data recovery was conducted on these five sites (Altschul 1991; Altschul et al. 1991; Altschul et al. 1998; Altschul et al. 1999; Altschul et al. 2003; Keller and Altschul 2002; Van Galder et al. 2006; Vargas and Altschul 2001; Vargas et al. 2005). Research designs and plans of work were developed and implemented after review by regulatory agencies. In addition, related research in the Ballona included a paleoenvironmental study of the area (Homburg et al. 2015). This study presents the results of the analysis of seven classes of material culture and six classes of subsistence-related data.

Project Summary: This volume of the Playa Vista Archaeological and Historical Project (PVAHP) presents important research findings on continuity and change in the artifacts and subsistence of the prehistoric occupants in the Ballona from 8,000 years ago through the Mission and early historical periods. Large data sets characterized by broad ranges of temporal, spatial, and contextual variability are summarized. These data are among the very few detailed presentations of analyzed cultural materials for the southern California coastal region, and especially for the Mission period Gabrielino/Tongva territory. The data presented here illustrate synchronic and diachronic trends in lifeways and sociocultural choices, and both stability and changes in cultural systems extending back 8,000 years, with denser occupations in the protohistoric and Mission periods. Artifactual and subsistence data repeatedly identified continuity in tradition, punctuated by occasional changes. The most pronounced changes occurred at the beginning and end of the Intermediate period and at the start of the protohistoric and Mission periods. In elucidating the major diachronic and synchronic trends in the PVAHP data, we have identified five research issues upon which the data have shed valuable insight: chronology and culture change, technology and trade, site function, subsistence, and mortuary ritual.

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2005 *Preliminary Report on Data Recovery with the Phase I Project Area at CA-LAN-62, Playa Vista, California*. Playa Vista Archaeological and Historical Project. Technical Report 12. Statistical Research, Redlands, California.

ACKNOWLEDGMENTS

In 2016, Statistical Research, Inc. (SRI), began its 25th year of work on the Playa Vista Archaeological and Historical Project (PVAHP), the project that ultimately resulted in this five-volume series. These final reports offer a broad, as well as specific, understanding of more than 8,000 years of human occupation of the Ballona region and of the relationship between that occupation and the evolution of the Ballona environment. Over the long course of the project, a large number of extraordinary people contributed to its success; to all these people, we are deeply indebted. Although we cannot adequately thank everyone here, below we acknowledge the contributors to the research presented in these report volumes.

First and foremost, we thank the project sponsors for giving us the opportunity to conduct this important work. In 1989, two years before the PVAHP proper began, SRI was hired by Camp, Dresser, McKee (CDM, now CDM Smith) and Planning Consultants Research (PCR) to survey the project area and develop a research design as part of the environmental review process; Jane Yager (PCR) was our initial contact person for the project. After the completion of the initial environmental impact report, SRI was retained by Maguire Thomas Partners (MTP), then the developer of Playa Vista. Robert Miller of MTP ably provided SRI with corporate assistance and was a strong supporter of the PVAHP. In the late 1990s, MTP was replaced by Playa Capital Company, LLC[1], as the project developer. We are indebted to Bruce Harrigan, Marc Huffman, Randy Johnson, Pat Larkin, Cliff Ritz, Patricia Sinclair, Steve Soboroff, and Catherine Tyrrell, who oversee or have overseen the implementation of the PVAHP. Patti Sinclair worked closely with SRI during much of the field and postfield efforts and deserves an advanced degree in archaeology for the amount of knowledge she has gained over this time. During field efforts, Cliff Ritz offered many helpful suggestions on using heavy equipment for the efficient collection of required information on the sites. Specifically, Cliff designed and built a large-diameter coring system that helped us recover buried archaeological sites below groundwater. Marc Huffman has worked side-by-side with SRI on a number of matters related to the implementation of the PVAHP over the years and has been a great facilitator for the project. In 2012, Playa Capital Company, LLC, was purchased by Brookfield Residential.

Compliance with Section 106 of the National Historic Preservation Act was accomplished through a Programmatic Agreement (PA). The signatories to the PA for the PVAHP are the U.S. Army Corps of Engineers (Corps), the California State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP). The lead federal agency for this work is the Corps. We appreciate the help of a number of current and former Corps employees, including Aaron Allen, D. Stephen Dibble, John Killeen, Patricia Martz, Pamela Maxwell, Roderic McLean, and Richard Perry. Three consecutive SHPOs, Knox Mellon, Milford Wayne Donaldson, and Carol Roland-Nawi served as important guides for this project; the current SHPO is Julianne Polanco. We thank both of these agencies, as well as members of the ACHP who participated in the project, including the current chairperson, Milford Wayne Donaldson, and Reid Nelson, the director of Federal Agency Programs. Phillip de Barros, John McAlister, and William Want were all instrumental in drafting the PA, and Hans Kreutzberg, Chief of Review and Compliance for the California Office of Historic Preservation helped bring it to a successful conclusion. George Mihlsten and others at Latham and Watkins were a great help with advice on particular aspects of the project.

Peer review has been an integral part of the PVAHP from beginning to end—during prefield research-design creation and fieldwork and during postfield analysis and report writing. The peer-review team reviewed the research design and treatment plans for various sites, met with us multiple times in the field during various excavations, offered important feedback during analysis, and gave critical review of reports. We appreciate and value the feedback from our peer reviewers, John Johnson, Patricia Lambert, Patricia Martz, Charles Rozaire, and the late Phillip Walker.

Two Tongva/Gabrielino tribal groups signed the PA as concurring parties: the Gabrielino People (represented by Vera and Manuel Rocha) and the Tongva/Gabrieleno Tribal Council of San Gabriel (represented by Cindi Alvitre). As discussed below, we have enjoyed working with these and other Gabrielino/Tongva tribal groups and appreciate the opportunities we have had to interact with them over the course of two decades. We have also enjoyed our interactions with Robert Dorame, who was named Most Likely Descendent for the project by the Native American Heritage Commission, and appreciate his recommendations. We also thank the Native American monitors who worked side by side with SRI on the PVAHP. These monitors, all representatives of various Gabrielino/Tongva Tribal groups, included Martin

[1] The several stages of the Playa Vista development project were overseen by a series of different corporate entities.

Alcala, Richard Alcala, Dana Alcala, Evan Alcala, Tonantzin Carmelo, Virginia Carmelo, Jordan David, Katy Dorame, Mat Dorame, Mercedes Dorame, Robert Dorame, George Dorame, Sam Dunlap, Adrienne Kinsella, Edgar Perez, Theresa Richau, and Abel Silvas. We are proud to have developed such a strong working relationship with these individuals during the PVAHP. We also thank the late Vera Rocha for blessing the PVAHP at the outset of the project.

A number of past and present SRI employees have contributed to project direction, oversight, and management, including Kenneth Becker, Su Benaron, Amanda Cannon, Christopher Doolittle, John Douglass, David Ferraro, Jeffrey Homburg, Janet Grenda, Angela Keller, David Maxwell, Seetha Reddy, Steven Shelley, and Anne Stoll. We are especially grateful to Benjamin Vargas and Sarah Van Galder Wollwage for their multiple roles directing fieldwork, analysis, and the writing of volumes. The initial survey for the PVAHP was directed by James N. Spain, while Mark Swanson conducted the initial historical research.

Laboratory direction was overseen by a number of different individuals, principally James Clark, Elizabeth Denniston, William Feld (who also did remarkable work with field logistics and setup of the water screening apparatus), Jennifer Howard, Scott Kremkau, LaShawn Lee, Katherine Pollock, and Susan Seifried. Database work (including the creation of a relational database that we have since adapted to use companywide) was essential for all aspects of investigation, and the diligence of Andrew Bean, Robert Heckman, Jim LoFaro, Carey Tilden, and Mark Woodson was indispensible to the project. We thank the many field crew and laboratory technicians who labored so assiduously on different aspects of the fieldwork, laboratory sorting, and analysis. Their efforts are truly appreciated.

The geoarchaeology and geomorphological work was accomplished by many individuals. Led by Jeffrey Homburg, the geoarchaeology team included Eric Brevik, Diane Douglas, David Ferraro, Antony Orme, Manuel Palacios-Fest, Steven Shelley, Caroline Tepley, and Lance Wollwage. We are also indebted to many individuals at SRI who played crucial roles in support of the paleoenvironmental project. Richard Boettcher, Diane Douglas, John Douglass, David Ferraro, Dennis Gallegos, Paul Goldberg, Jeffrey Homburg, Stanley Kling, Doug Macintosh, Richard Macphail, Russell Morse, Manuel Palacios-Fest, Seetha Reddy, Neil Rhodes, Paul Sauder, Peter Wigand, and Steve Williams all played various roles in the field and postfield efforts. A number of consultants contributed to the paleoenvironmental study, including Matt Rowe, Roy Shlemon, Jacob Lipa, Douglas Howard, and William Nailling III, and surveyors at Psomas and Associates; they are acknowledged for mapping the original cores collected for this study. We thank Tracy Spilotro of West Hazmat Drilling Corporation and Tony Morgan of Quaternary Investigations for collecting these cores. Foothill Engineering also collected cores for this project, and we are grateful to Delta Group for sharing data on other cores with us throughout the years. The chronostratigraphical analysis for the project was conducted by William Deaver, Stacey Lengyel, Jill Onken, Benjamin Vargas, and Lance Wollwage.

Material culture studies were conducted by SRI archaeologists and consulting specialists. John Griswold and his associates helped a great deal in the field with conservation of fragile material culture. Lithic analysis was led by Kathleen Hull and Polly A. Peterson, with contributions from Amanda Cannon, Robert Elston, Henry Koerper, Scott Kremkau, Seetha Reddy, Mark Sutton, and Robert Wegener. Shell-bead analysis was conducted by Amanda Cannon after initial contributions from Angela Keller. During the initial identification of shell bead types, Angela Keller consulted with Chester King. Worked-bone studies were led by Janet Griffitts, with assistance from Tina Fulton and Justin Lev-Tov. Glass-bead studies were done by Lester Ross with assistance from Amanda Cannon, John Douglass, and Scott Kremkau. Basketry analysis was conducted by Judith Polanich, while Owen Davis and Peter Wigand conducted the pollen analysis and Seetha Reddy studied the macrobotanical remains. Christopher Garraty analyzed the Native American ceramics, and Karen Swope studied the historical-period artifacts in collaboration with John Douglass. Marcy Gray also analyzed selected historical period artifacts. Faunal analysis (vertebrate and invertebrate) was led by David Maxwell and Sarah Van Galder, with assistance from Justin Lev-Tov, John Goodman, and Robert Wegener. Ethnohistoric research has principally been conducted by John Douglass, Steven Hackel, and Anne Stoll. An important component of this research was conducted using the Early California Population Project database, housed at the Huntington Library and directed by its general editor, Steven Hackel.

Osteological analysis of remains from CA-LAN-62 was among the most important cultural and scientific components of the project. Osteological work was overseen by Patrick Stanton, with guidance from Phillip Walker. A number of other individuals were important to this analysis—namely, Rhonda Bathurst, Joseph Hefner, Mitch Keur, Tamara Leher, Lorrie Lincoln-Babb, Kenneth Maes, Christopher Nagle, Korri Turner, and Bonnie Yoshida. We acknowledge the generous support and consultation of the late Phillip Walker, who not only was a peer reviewer for osteology, but also offered important insight throughout excavation and subsequent analysis; we appreciate Patricia Lambert taking over as the osteological peer reviewer after his passing.

The PVAHP had several research components, and SRI archaeologists worked closely with a large number of consultants conducting specialized studies, including paleoenvironmental study, radiometric studies, chronological analysis, osteological analysis, ceramic analysis, lithic analysis, faunal analysis, micro- and macrobotanical studies, and historic-artifact analysis. We thank each of these scholars for their participation and their role in making the project a resounding success.

We appreciate the help of SRI's publications staff in completing these five volumes. We thank María Molina, SRI's director of publications for overseeing the many tasks involved. We are especially indebted to Steve Bradberry, John

Cafiero, Diane Holliday, Grant Klein, April Moles, Jason Pitts, Peg Robbins, Jennifer Shopland, Luke Wisner, and Linda Wooden for their work in editing, graphics, and production, which made the volumes read and look as they do. Others who helped with the massive amount of illustrations, graphs, and maps include Ileana Bradford, Marie Echevarría-Delgado, Cindy Elsner-Hayward, William Hayden, Steve Norris, Nicholas Reseburg, James Wallace, and Deland Wing. Seetha Reddy and John Douglass deserve special recognition for coediting and coordinating all five volumes through various drafts and peer and regulatory review, with help from colleagues Jeff Homburg, Patrick Stanton, and Benjamin Vargas on specific volumes.

Finally, we thank Wendy Teeter, curator of the Fowler Museum at the University of California, Los Angeles, for guiding us as we prepared the massive collection of non-burial-related PVAHP material for curation at the Fowler. Wendy was a great help throughout the entire process.

Donn R. Grenda, Richard Ciolek-Torello, and Jeffrey H. Altschul
Series Editors

LIST OF ABBREVIATIONS AND ACRONYMS

ACHP	Advisory Council on Historic Preservation
ASM	Arizona State Museum
BLAD	Ballona Lagoon Archaeological District
CDM	Camp, Dresser, and McKee
CEQA	California Environmental Quality Act
CU	control unit
EMDT	Entertainment, Media, and Technology District
EU	excavation unit
FAR	fire-affected rock
FB	feature block
FSTA	fire safety training area
GIS	geographic information system
HIHD	Hughes Industrial Historic District
LAX	Los Angeles International Airport
LAICP-MS	Laser Ablation Inductively Coupled Plasma Mass Spectrometry
MCM	Macrophysical Climate Model
MLD	Most Likely Descendant
MNI	minimum number of individuals
MTP-PV	Maguire Thomas Partners–Playa Vista
NAHC	Native American Heritage Commission
NEPA	National Environmental Policy Act
NHMLAC	Natural History Museum of Los Angeles County
NHPA	National Historic Preservation Act
NISP	number of identified specimens
NRE	nonrepetitive elements
NRHP	National Register of Historic Places
PA	programmatic agreement
PD	provenience designation
PVAHP	Playa Vista Archaeological and Historical Project
SFU	Simon Fraser University
SHPO	State Historic Preservation Officer
SRI	Statistical Research, Inc.
SU	stripping unit
TOF	time-of-flight
UCLA	University of California, Los Angeles
USACE	U.S. Army Corps of Engineers

Note: Dates presented in this volume as years before present (b.p.) are assumed to be radiocarbon years unless noted as calibrated years (e.g., "cal B.P.").

Introduction

Seetha N. Reddy,
with contributions from Justin Lev-Tov

This third volume of the Playa Vista Archaeological and Historical Project (PVAHP) data recovery report series focuses on the material culture and subsistence practices of the Ballona region, located along Santa Monica Bay in west Los Angeles County. Other volumes in this series contain an introduction and background to the PVAHP and the paleoenvironment of the Ballona region (Volume 1), the methods and results of archaeological work (Volume 2), bioarchaeological studies (Volume 4), and mortuary analysis, ethnohistory, and project synthesis (Volume 5).

This volume—described by our peer reviewers as a significant contribution to the archaeology of the greater Los Angeles Basin—contains some of the very few detailed analyses of cultural materials from the southern California coastal region. The large data sets involved are characterized by a broad range of temporal, spatial, and contextual variability. Data were collected through standardized methods and rigorously analyzed. No comparable data set of this size from a single set of sites in southern California has been previously reported in such detail. Furthermore, the lithics, ceramics, faunal, floral, and other cultural material recovered from well-preserved Mission period occupation and mortuary contexts have yielded the first such data to be analyzed and presented for the area occupied by the Gabrielino (also known as the Tongva) people. Although other Mission period occupations and burial contexts within traditional Gabrielino territory have been analyzed and reported, the PVAHP data allow a more thorough and insightful understanding of the complex domestic and mortuary contexts of the Mission period, especially when combined with ethnohistoric data. The analyses presented in this volume provide the most comprehensive and detailed depiction yet of Gabrielino material culture from the Late period to the transformation of Gabrielino culture following contact with the Spanish. These data derive from five sites with occupations dating from the Millingstone period through the Historical period (CA-LAN-54/H, CA-LAN-62/H, CA-LAN-193/H, CA-LAN-211/H, and CA-LAN-2768/H) (hereinafter, the prefix "CA-" will be omitted for all sites, and the suffix "/H" will be omitted for PVAHP sites). For additional information regarding the information presented in this chapter, please see Appendixes A.1–A.6 on the accompanying disk.

The PVAHP Context

The PVAHP is located near the Pacific Ocean within the City of Los Angeles, in an area formerly containing the Ballona Lagoon, a drowned river valley immediately to the south and east of Marina Del Rey, in the western Los Angeles Basin (Figure 1). The low wetlands are defined on the south by Pleistocene terraces occupied by modern housing developments and Loyola Marymount University. Now surrounded by extensive urban development, the Ballona Lagoon area was home to aboriginal peoples, including the Gabrielino, beginning approximately 8,200 years ago and continuing until the early 1800s. (More detailed discussion of the local environment and previous archaeological research can be found in Volume 1.)

Ballona Creek, occupying a remnant channel of the Los Angeles River, drains about 230 km^2 (90 square miles) of the Los Angeles Basin. Prior to modern channelization, Ballona Creek flowed into the lagoon roughly where Lincoln and Culver Boulevards now intersect. Ballona Creek was improved in stages, and its course and banks were kept in a natural state until the 1920s. A concrete lining to channelize the entire length of Ballona Creek was completed in 1935 (Altschul et al. 1991:76).

The Ballona area has been subjected to archaeological investigations since the early twentieth century. Amateur collectors were the primary explorers during the first half of the century, but the first professional study was by Nels Nelson in 1912. For additional information on early and modern researchers in the Ballona, see Chapters 1 and 9 in Volume 2 of this series and Chapters 3 and 4 in Volume 1 of this series.

Statistical Research, Inc. (SRI), has been involved in archaeological research in the Ballona area for more than two decades (Altschul 1991; Altschul et al. 1991; Altschul, Homburg, et al. 1992; Altschul et al. 2003; Altschul et al. 2005; Altschul et al. 2007); the PVAHP is the latest project involving excavations in the Ballona Lagoon lowlands (Figure 2). SRI has also conducted archaeological research at several sites located on the Pleistocene terraces immediately to the south and east of the PVAHP (Altschul and

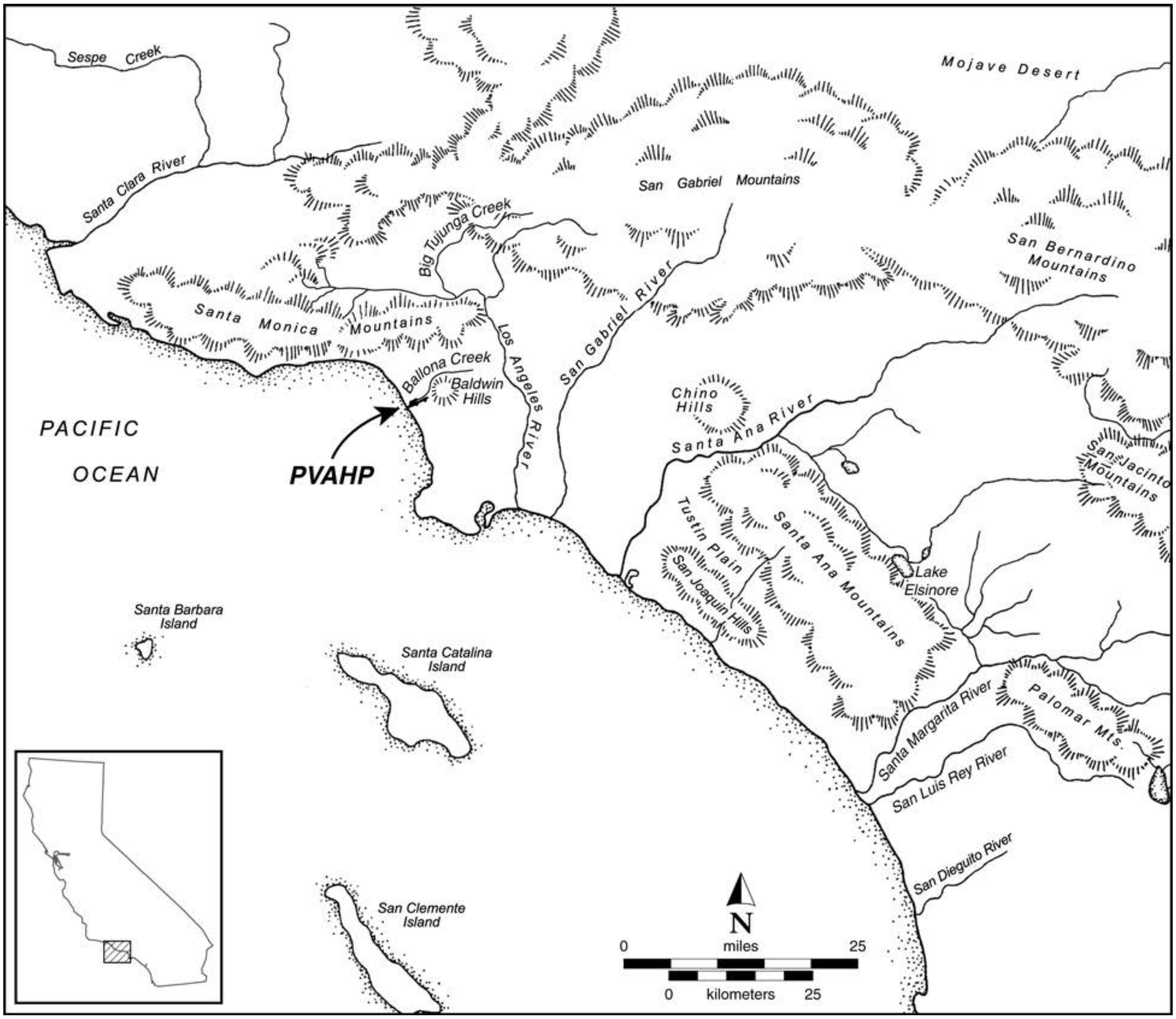


Figure 1. Location of the PVAHP in California.

Ciolek-Torrello 1997; Douglass et al. 2005; Grenda et al. 1994), as well as on the northern edge of the former Ballona Lagoon (Altschul, Homburg, et al. 1992). SRI was hired in 1989 by Camp, Dresser, and McKee (CDM) as part of the Environmental Impact Report team for the then-developer of Playa Vista, Maguire Thomas Partners–Playa Vista (MTP-PV). In 1990–1991, SRI began working directly for MTP-PV, at which point we developed the PVAHP as a phased archaeological and historical project to comply with federal, state, and municipal regulations protecting cultural resources. In 1997, the Playa Capital Company, LLC, took over ownership and development of Playa Vista.

The existence of wetlands within the Playa Vista development area, as well as the development of a riparian corridor draining into the wetlands, meant that the project required a permit from the U.S. Army Corps of Engineers (USACE) under Section 404 of the Clean Water Act, which, in turn, required the USACE to comply with the National Environmental Policy Act (NEPA) and Section 106 of the National Historic Preservation Act (NHPA). In addition, the City of Los Angeles required compliance with the California Environmental Quality Act (CEQA), and the Coastal Commission required compliance with the California Coastal Act for the portions of the project in the coastal zone. To comply with these requirements, SRI conducted records searches and inventories of cultural resources and developed a research design (Altschul et al. 1991). Because of the complexity of the depositional history of the Ballona and the potential for buried cultural deposits, a Programmatic Agreement (PA) was created among the USACE, the California State Historic Preservation Officer (SHPO), and the Advisory Council on Historic Preservation (ACHP). Two organizations representing

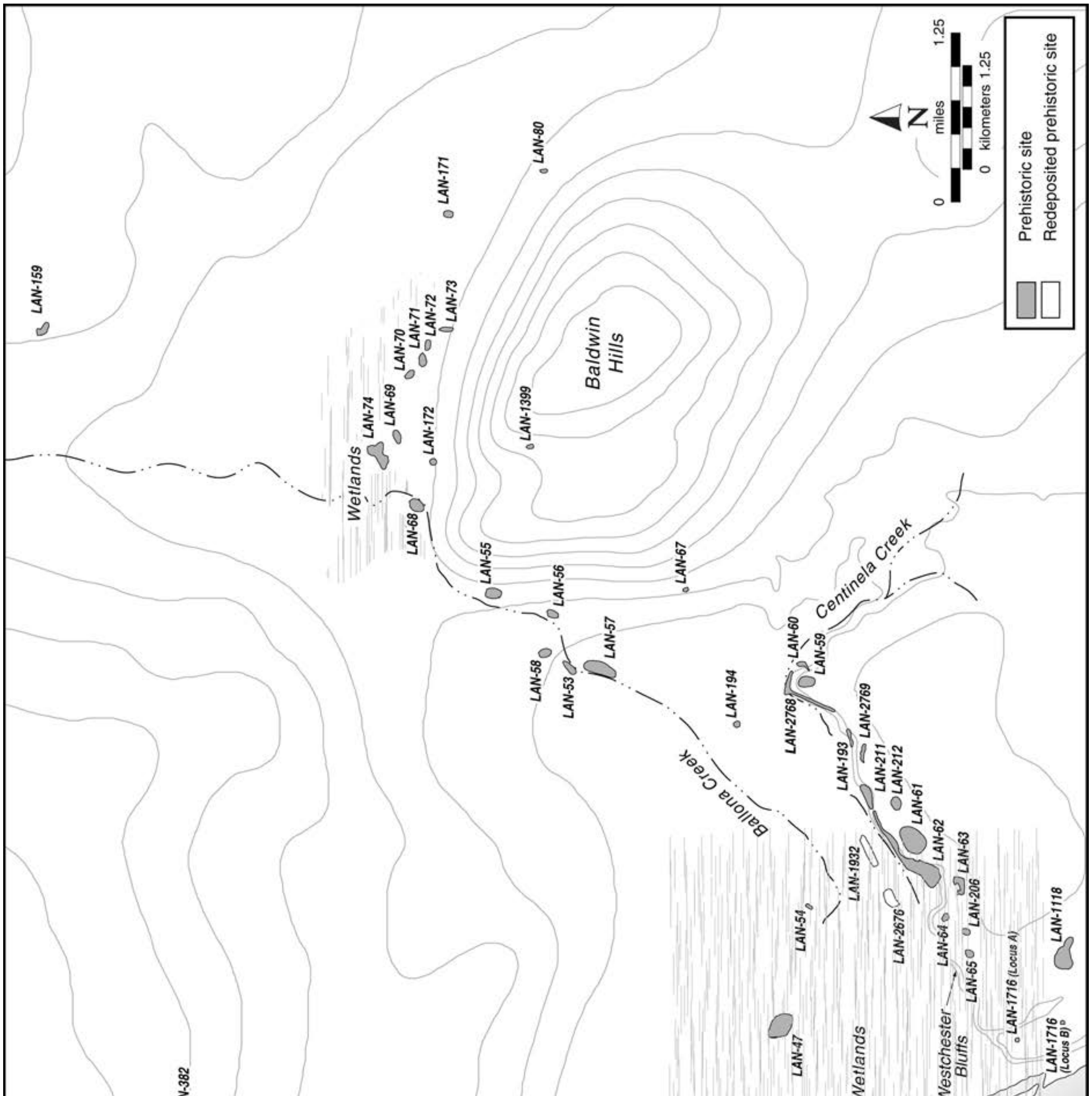


Figure 2. Archaeological research by SRI in the vicinity of the PVAHP.

the Gabrielino concurred with the PA, as did the developer, MTP-PV. Subsequent to the PA, SRI conducted additional inventory, tested sites, and implemented data recovery at various locations across the Playa Vista project area (Altschul 1991; Altschul et al. 1991; Altschul et al. 1998; Altschul et al. 1999; Altschul et al. 2003; Keller and Altschul 2002; Van Galder et al. 2006; Vargas and Altschul 2001; Vargas and Douglass 2009; Vargas et al. 2005).

The project area includes two sets of archaeological and historic properties: the Ballona Lagoon Archaeological District (BLAD), which encompasses the prehistoric archaeological sites, and the Hughes Industrial Historic District (HIHD) (Altschul et al. 1991). Both districts have been determined eligible for listing in the National Register of Historic Places (NRHP). All archaeological work undertaken within these two districts contributes to the ultimate goal of documenting past occupation and activities throughout the area. For detailed discussions of the history of archaeological research in the Ballona and the history of the PVAHP, please refer to Volumes 1 and 2 of this series.

This volume presents the results of analyses of artifacts and ecofacts obtained from data recovery investigations conducted at five sites recommended eligible for listing in the NRHP (Altschul 1991; Altschul et al. 1991; Altschul et al. 1998; Altschul et al. 1999; Altschul et al. 2003; Keller and Altschul 2002; Van Galder et al. 2006; Vargas and Altschul 2001; Vargas et al. 2005; Vargas and Douglass 2009) (Figure 3). Four of the five sites (LAN-62, LAN-193, LAN-211, and LAN-2768) are located at the base of the Westchester Bluffs, on the southern boundary of the project area; LAN-54 is located north of the other sites, in an area that was originally on a low island in the middle of the Ballona Lagoon and wetlands. LAN-54 is also no longer on land that is part of the Playa Vista property, because this portion of the original development is now owned by the State of California. In addition to these five sites, three sites, LAN-1932, LAN-2676, and LAN-2769, were also excavated. Testing at LAN-2769 revealed that it was heavily disturbed, probably as a result of earthmoving and construction activities likely conducted by Hughes Aircraft Company in the middle to late twentieth century (Altschul et al. 2003). The prehistoric cultural materials at the site probably derive from redeposited fill or from colluvial and alluvial deposits from the overlying bluffs (Ciolek-Torrello 2003). LAN-1932 was recommended as ineligible for listing in the NRHP after extensive testing. LAN-2676 was recommended eligible for listing in the NRHP (Altschul et al. 1998), but was subsequently determined during data recovery to be redeposited archaeological sediments (from LAN-62 and LAN-211) and therefore were not subjected to intensive study. Methods and results of the field investigations at the five sites are discussed in Volume 2 of this series; this volume presents the results of analyses. The analyses included flaked stone, worked shell, worked bone, basketry, glass beads, ceramics, historical-period artifacts, and pollen, as well as vertebrate and invertebrate studies and paleoethnobotany. This introductory chapter presents the setting for the analyses, including a brief discussion of the paleoenvironment, the modern ecological setting, and the approaches and methods and a short discussion of the various analyses.

Paleoenvironmental Setting

Paleoenvironmental changes had a direct and irreversible effect on human culture across the globe. In this light, two of the most striking changes to impact humans were the terminal Pleistocene/early Holocene postglacial rise in sea level and the trans-Holocene sea-surface water-warming and -cooling trends (Boxt et al. 1999; Inman 1983; Kennett and Kennett 2000). Over the past 10,000 years, during the time of human occupation of the project area, the paleoenvironment of southern California has changed dramatically. Inman (1983:9) and Curray (1965) have noted that the shoreline was significantly different in the past, starting at the onset of the Holocene with sea levels at least 30 m below present sea level. The sea levels rose dramatically during the early Holocene, and the rate of their rise slowed down noticeably during the last 4,000 years. Prior to the melting of continental glaciers at the end of the Pleistocene, sea levels were much lower, and the northern Channel Islands were connected as a single landmass now known as Santarosae. During this time, the southern Channel Islands were closer to the mainland, although they were never connected as a single landmass.

Fast-paced sea-level rise during the late Pleistocene and early Holocene shifted the shoreline eastward, resulting in inundated valley floors and the creation of steep and narrow bays in some areas (Inman 1983; Kern 1995; Masters 1994; Orme 1993). Between 5,000 and 9,000 years ago (B.P.), melting of continental glaciers caused sea levels to rise approximately 2–3 cm annually, if not faster (Schneider 1997:112–117). Coastal estuaries, lagoons, and sandy beaches began to be established when the marine transgression slowed during the middle Holocene (ca. 6000–3000 B.P.) (Nardin et al. 1981). This rise in the sea level ultimately resulted in aggradation in some estuaries and the silting of some lagoons. The shoreline continued to retreat in the late Holocene with the erosion of coastal cliffs by sea-wave action (Inman 1983; Kern 1995). Between 5000 and 3000 B.P., the rate of sea-level rise slowed and reached current levels (Inman 1983).

Inman's (1983) model presents four stages of coastal evolution: formation of deeply cut valleys when sea levels fell (as they did at the last glacial maximum 20,000 years ago), formation of bays as these valleys were flooded when the sea levels rose, formation of salt-marsh ecozones as the sea levels continued to rise, and ultimate inundation of the lagoons and transformation of rocky beaches to sandy beaches (Masters 1985). These paleoenvironmental changes are of critical importance in modeling, interpreting, and understanding the timing and pace of prehistoric human adaptations in the study area.

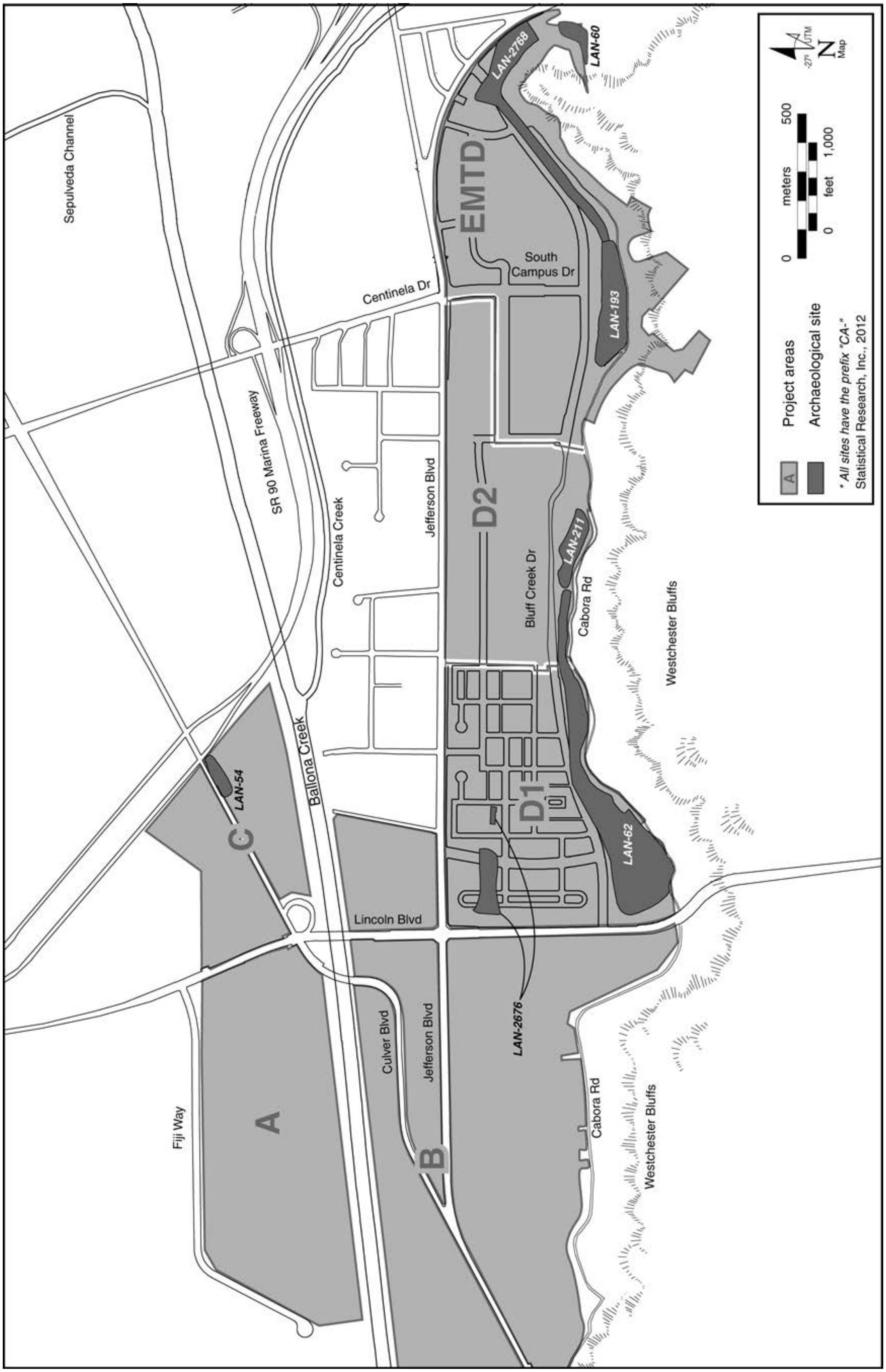


Figure 3. Locations of primary PVAHP sites.

Paleoenvironmental reconstructions indicate that other climatic changes in addition to rising sea levels occurred during this time. A growing body of palynological, isotopic, and tree-ring data suggests that between 8,000 and 10,000 years ago, the climate was much cooler and moister (Heusser 1978; Pisias 1978). This was followed by a period of warmer and drier conditions known as the Altithermal, which lasted until approximately 5,000 years ago (Antevs 1955). A study of oxygen isotopes indicated that environmental fluctuations were particularly dramatic during the past 3,000 years. Sea-surface temperatures were relatively warm and stable between 3000 and 1550 B.P.; however, the period following this was marked by cold and unstable sea-surface temperatures that lasted until 700 B.P. (Boxt et al. 1999; Kennett and Kennett 2000). Recent palynological studies on San Nicolas Island suggested that there were two periods of relatively dry conditions in the late Holocene: 1375–1250 B.P. and 920–420 B.P. (Davis et al. 2003). Wet and cool conditions preceded each of these intervals. Considering that humans were intricately connected to their environment, paleoenvironmental changes undoubtedly had a dramatic impact on human populations and culture.

Potential effects of these changes on prehistoric coastal California inhabitants in the Ballona have been explored in detail by Homburg et al. (2015). The Ballona paleoenvironmental study was designed to provide a geoarchaeological context for interpreting the evolution of the landscape and human settlement in a dynamic habitat (see Homburg et al. 2015:Chapters 6–8). Reconstruction of the changing landscape during the Holocene in the Ballona Lagoon and surrounding wetlands was based on sedimentology, chronometric analysis, and microfossil, shellfish, and pollen data from geological cores obtained from within the Ballona. The resulting model shows a succession of landscapes and the development of the lagoon over the last 8,000 years (Figure 4). Starting during the early portion of the Holocene epoch, around 7850 cal B.P., seawater began to fill the Ballona Creek/Los Angeles River channel mouth at the Pacific Ocean and was subsumed by the rising ocean levels of the era, thus forming a relatively small bay at the edge of the larger Santa Monica Bay. By 5730 cal B.P., the water channel had been further flooded, causing various preexisting side channels to be covered by shallow bay waters downstream, and formerly low-lying riparian areas upstream became marshlands. By 4500 cal B.P., most of the margins of the embayment and river channel had become marshland, and the river itself had deposited so much sediment that mudflats began to form within the channel's mouth, and sand bars evolved at the former shoreline, partially restricting water flow between the bay and ocean. Around 3200 cal B.P., marshlands became much more extensive, and sandbars almost entirely enclosed the embayment. The process of continuing siltation led to further reduction in tidal flow, and expansion of sand bars, mudflats, and marshes continued apace over approximately the next 3 millennia. According to radiocarbon dates recovered from soil cores in the Ballona, the landform had reached an approximation of its recent form—an extensive marsh with a number of shifting water channels penetrating a constricted lagoon—by the eighteenth century A.D., or about 200 cal B.P. The Ballona at that time was cut off from the ocean by sand dunes cut only by a single tidal channel.

Preliminary research (Altschul et al. 2003; Altschul et al. 2007; Douglass et al. 2005) delineated four distinct cultural adaptations associated with particular landscape/lagoon development. The first (between 7850 and 3200 cal B.P.), during the Millingstone period, is characterized by short-term occupations on Pleistocene terraces and alluvial fans. The subsequent Intermediate period (3200–930 cal B.P.) witnessed an influx of populations, as evidenced by the widespread distribution of sites on the Pleistocene terraces and creek edges and in wetland settings. The Late period (A.D. 950–1542) was marked by population aggregation around the wetlands and lagoon. During the historical period, which includes the Protohistoric period (A.D. 1540–1770) and the Mission period (A.D. 1771–1834), human settlement was concentrated on the alluvial fans, with small, isolated settlements on the Pleistocene terraces. Of note to this settlement model is the timing of the barrier that closed off part of Santa Monica Bay around 4500 cal B.P. This barrier resulted in the creation of the lagoon, which was stabilized by 3200 cal B.P. The lagoon began silting around 1950 cal B.P. with sediment from the Ballona Creek and Centinela Creek. It is important to note that the Los Angeles River also contributed to the siltation of the Ballona. The Los Angeles River has changed course over time and flowed into the Pacific Ocean near either Long Beach or the Ballona at different times (Gumprecht 1999). Archival and geomorphological data indicate that the Los Angeles River discharged into Ballona Creek in prehistory as well as in historical times. For example, in the late eighteenth and early nineteenth centuries, the Los Angeles River turned southwest after leaving the Glendale Narrows, where it joined Ballona Creek, and discharged into Santa Monica Bay. During a catastrophic flash flood in 1835, the river changed to its current course to flow due south just east of present-day downtown Los Angeles and discharge into San Pedro Bay. This course has been largely stabilized since the river was channelized by the USACE in the late 1930s, although periodic flooding continued.

A final note on the paleoenvironmental setting for the PVAHP concerns the Medieval Climatic Anomaly (A.D. 800–1400). Paleoclimatic records from a wide variety of contexts have consistently indicated that the period between 1,000 and 700 years ago (A.D. 1000–1300) was characterized by generally higher temperatures and had periods of extreme drought. This event, known as the Medieval Warm Period or the Medieval Climatic Anomaly, has received considerable attention in archaeological literature, and there has been much debate about the extent of its impact (Jones et al. 1999; Kennett and Kennett 2000; Larson and Michaelson 1989; Raab and Larson 1997). The apparent severity of the droughts and their potential coincidence with important cultural changes described throughout the prehistoric archaeological record

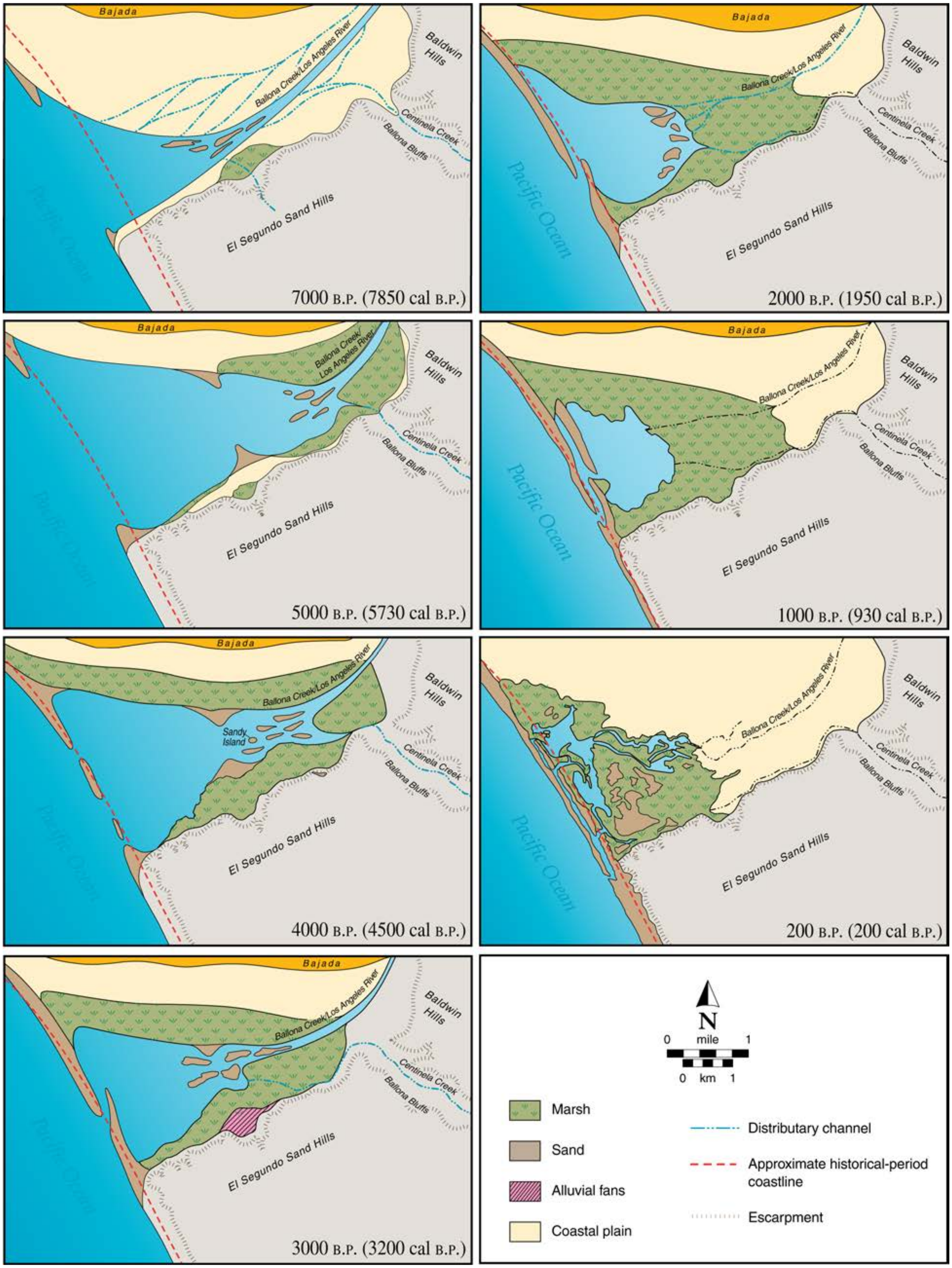


Figure 4. Evolution of the Ballona Lagoon.

for California (Raab and Larson 1997) have been of considerable interest in regard to this topic. In particular, Larson and Michaelson (1989) have argued that the interval between A.D. 1100 and 1250 was one of continued drought, particularly between about A.D. 1120 and 1150. Wigand (2005) has argued that the Late period in the Ballona generally was a continuous cycle of prolonged drought followed by periods of above-average precipitation. Raab and Larson (1997) have tentatively linked these periods to contemporaneous increases in interpersonal violence, periods of health decline and population decrease, and occupational hiatuses in the prehistoric archaeological record of coastal southern California. Similarly, scholars have also attributed an importance to these disruptions in the emerging cultural complexity among Late Prehistoric hunter-gatherers in coastal southern California (Kennett and Kennett 2000; Raab and Larson 1997; Wigand 2005).

At a more general level, Jones et al. (1999) have argued that the Medieval Climatic Anomaly had profound impacts on hunter-gatherer settlement throughout California. Little research has been conducted on this topic regarding the southern California mainland coast, however. Byrd and Reddy (2002) have noted that major residential sites farther to the south, in present-day San Diego County, continued to be occupied on the central Camp Pendleton coastal landscape during this time period but that other site types became rare. After the Medieval Climatic Anomaly, specialized sites became widespread, which suggests that populations increased in this area. Early occupations in the Ballona (8000–1000 B.P.) were on the Pleistocene bluff tops and on alluvial fans surrounding the Ballona (Altschul et al. 2005). Starting around 1000 cal B.P., there was a fundamental change in settlement not unlike that observed farther south in coastal northern San Diego County (Byrd and Reddy 2002). As the Ballona Lagoon became a sediment-choked estuary, there was a dramatic change in settlement location, most likely in response to this changing environment. By 1000 B.P., most areas of the Ballona were abandoned, and the population had congregated along the lagoon edge at the base of the bluff (Altschul et al. 2005).

Modern Environment and Ecology

Prior to early-twentieth-century development, the Ballona was an area of great natural diversity, as is typical of estuarine environments (Figure 5), which are diverse because of their unique conditions of freshwater sources converging with saltwater and the formation of brackish water. Because of these unique and varied combinations of water chemistry, estuaries feature plants and animals that thrive in ecological zones in and around freshwater, those species typical of saltwater zones, and those specifically adapted to brackish conditions. In this section, three main aspects of environment and ecology are discussed as relevant to the PVAHP: human alterations of the Ballona, the present ecology of the Ballona, and habitat categories in the project area and Native American exploitation of these habitats.

A Summary of Human Alterations to the Ballona

Human alteration of the Ballona's natural landscape and biological diversity necessarily began with the earliest human settlement of the region, which had certainly occurred by ca. 6500 B.C., and possibly earlier (cf. Altschul et al. 2003:7–16). Extensive modification of the landscape may have begun some 2,000–3,000 years before the arrival of Spanish missionaries and colonists in the eighteenth century A.D., when Native American settlement of the area reached its maximum density, by around 1000 B.C. (Davis 1998:4). At that time, human settlers may have significantly affected plant (and, by extension, animal) communities by burning parts of the landscape to encourage certain plants to thrive while discouraging others (Lewis 1993; Timbrook et al. 1993). In addition, they may have affected some animal-species populations positively or negatively through hunting.

It is clear that European and European-derived populations in the area made increasingly permanent, and largely negative, impacts on the estuary. These impacts began with the transformation of the area into cattle ranches and continued to its use for agriculture in the middle and late nineteenth century. In the early twentieth century, parts of the area became the playground of recreational hunters and beachgoers, and the railroad was brought in around that time. Originally, railroads were part of a large development scheme planned for the area, to build a seaside city named Port Ballona. Although the planned community did not come to fruition, the planning implementation left behind partially completed dredging, railroad lines extending through the estuary, and a pier (which later was washed away) as the only testaments to the failed venture. In the 1890s, separate projects—the construction of the Venice community and the beginnings (and later expansions) of gas and oil exploration and drilling—made even greater impacts. Subsequently, through the mid-twentieth century and up to the present day, other industries made use of the estuary, including Hollywood film studios and Howard Hughes's aircraft facility and airstrip. Also during the early twentieth century and up until their forced internment beginning in 1942, Japanese immigrants and/or Japanese-Americans leased much of the Ballona land and utilized it for the truck-farming of various vegetables, most notably celery, which required heavy labor (Altschul et al. 1991:63–84). In addition to truck-farming, there is evidence that at least one hog farm dating to the 1920s was located within the site boundaries of LAN-193. Historical-period photographs and the identification and analysis of a large historical-period feature containing burned and unburned

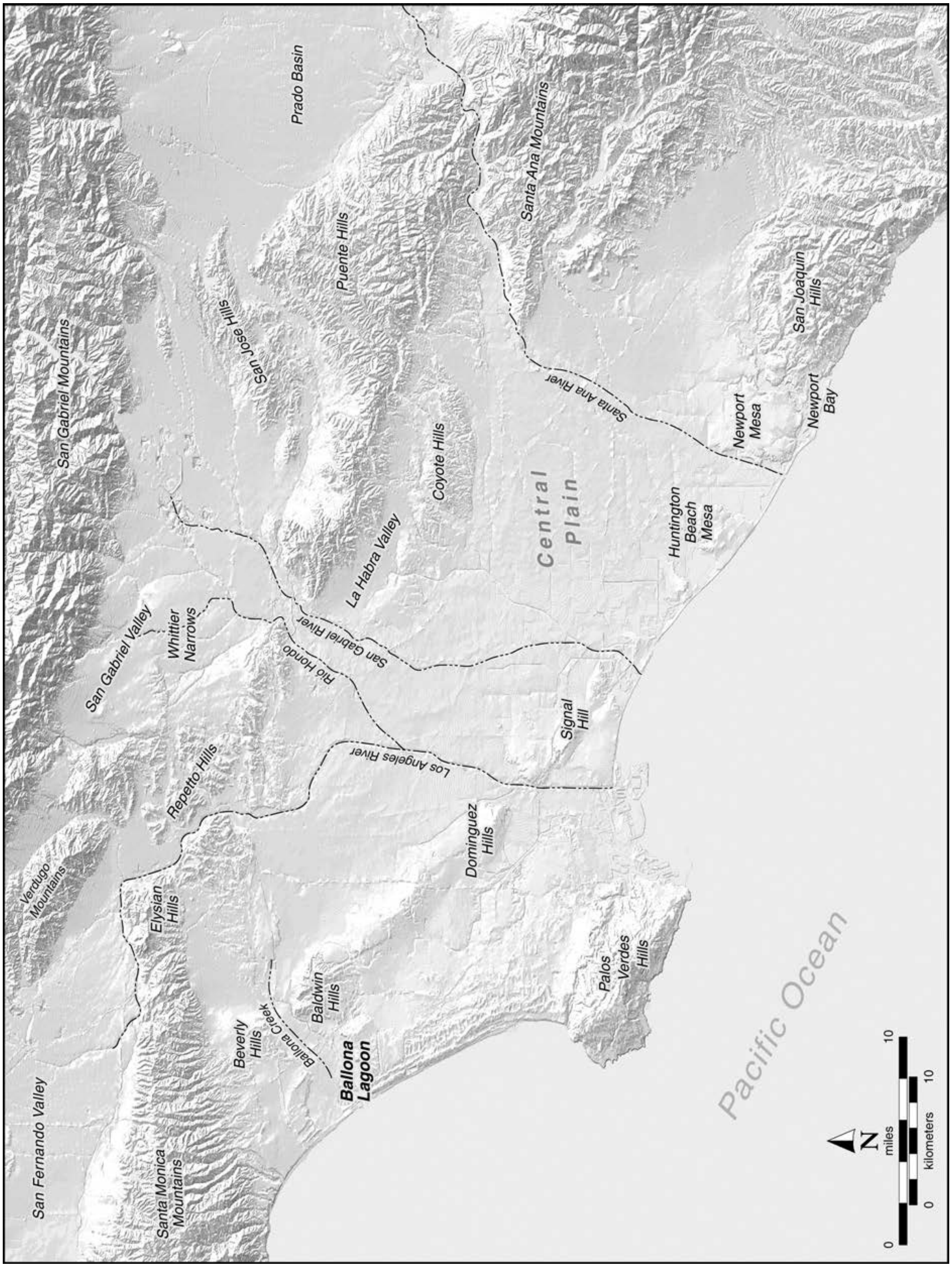


Figure 5. Physiographic map of the Los Angeles Basin and surrounding mountains.

restaurant ware and other restaurant-related debris suggest that the hog farm contracted with local municipalities and businesses to haul away their garbage to use as feed for the hogs. Between these various developments, government engineering projects rerouted or channelized Ballona and Centinela Creeks, which had fed the estuary, and constructed Marina del Rey in the 1960s (Davis 1998:4–5).

Modern Ecology of the Ballona

The sparse biological literature that predates the latest major development projects has described the Ballona as unique for its diversity of plant and animal species. Herpetologist von Bloeker (1942:29) stated that "few areas of comparable size in the immediate coastal region of California are hosts to such a great variety of life forms as have been found at El Segundo Sand Dunes." Ramirez (1981) echoed the view that, for its size, the Ballona salt marsh is diverse, though otherwise comparable to salt marshes elsewhere in southern California. In addition to the area's inherent interest in terms of species diversity, what makes the ecosystem especially interesting is the fact that it is one of the last estuarine environments in the Los Angeles area, the others having been completely developed well before. Unfortunately, the Ballona's wildlife was never comprehensively and scientifically documented before the Playa Vista development project was proposed and partially implemented (but see Davis 1998:6; Schreiber 1981).

The decline in Ballona species diversity within modern times is apparent with a quick perusal of the Friends of Ballona organization's Web site (http://www.ballonafriends.org), which provides lists of fish and birds native to the Ballona. The Web site lists 12 brackish and nearshore fish species found in the Ballona. In contrast, Sandefur and Colby (1992) identified approximately 65 species of fish from analysis of animal bones from the Late period Admiralty site (LAN-47). The birds either weathered modern development better than fish or were more comprehensively documented. The organization has compiled frequency listings for more than 150 avian species in the area. The Admiralty site faunal analysis listed only approximately 22 avian species (Sandefur and Colby 1992:305), although this should be read as human selection of certain species rather than a greater diversity of modern avifauna than in the prehistoric past. There do not appear to have been any scientific surveys of living fish or bird species in the Ballona region prior to the publication of the Biota of the Ballona report in 1981 (Ramirez 1981), even though von Bloeker (1942) as well as Schreiber (1981) carried out scientific surveys of the amphibian and reptile fauna. Von Bloeker's 1942 survey identified 3 species of amphibians and 16 species of reptiles. Demonstrating the value of early, pre-development scientific reports, von Bloeker's observations compare well with identifications of amphibian and reptile bones from the Admiralty site, where 3 species of amphibians and 19 species of reptiles were identified (Sandefur and Colby 1992:304). Interestingly, only 1 of the identified amphibian species occurred both in the archaeological assemblage and in the modern biological survey, whereas approximately half of the reptilian species occurred in both studies.

Modern animal and plant surveys are severely handicapped by the intense changes that the Ballona area has endured over the last 200 years. Landscape changes and the encroachment of urban Los Angeles have made many species locally extinct. At the same time, European settlers brought in a host of plants and animals not native to southern California, an ongoing process that alters the encountered fauna and flora and replaces native species. In addition to modern ecological surveys, both professional and amateur, we can add species lists generated by archaeological and geological investigations within the Ballona, which now has a more-than-30-year history of intensive survey and excavation (Altschul 1991; Altschul and Ciolek-Torrello 1997; Altschul et al. 1991; Altschul, Homburg, et al. 1992; Altschul et al. 2003; Altschul et al. 2005; Altschul et al. 2007; Douglass et al. 2005; Grenda et al. 1994; Van Horn 1983, 1984, 1987a, 1990; Van Horn and Murray 1984, 1985; Van Horn and White 1983, 1997a, 1997b, 1997c). Using archaeological reports for the purpose of generating a biodiversity profile for the Ballona region, however, does necessitate accepting the peculiar nature of this form of data. Archaeologically derived plant and animal lists are of a different nature from that of ecological surveys. In addition to the vagaries of preservation and archaeological sampling, these species lists are the products of human selection for food and other uses. The resources represented in the archaeological record are those that ancient populations exploited (i.e., they were specifically desired or wanted) and also intrusive plants and animals. Although the problem of human selection is, to an extent, overcome via the use of pollen coring, as has been done at various Ballona sites (cf. Davis 1994, 1998; Scott-Cummings 1992; Wigand 2015; see also Homburg et al. 2015), the pollen record introduces its own problems, most having to do with contamination. In other words, a direct analogy cannot be made between the modern and prehistoric ecologies of the Ballona. The habitat categories within the Ballona, however, would have largely remained the same in terms of character (but not location or size).

Definitions and Locations of Habitat Categories

For the purpose of this study, the biotic communities of the Ballona are grouped into seven categories: the Ballona wetlands (a category that includes both lagoon and freshwater marsh), freshwater riparian, Los Angeles upland and inland wetlands, Los Angeles Plain, sandy coast, rocky coast, and offshore. Although all of these categories were present during prehistory, modern development of west Los Angeles has altered the Ballona substantially over the past 100 years. As a result, some categories, such as the Ballona wetlands and the freshwater riparian, are very different from those in the past. In addition, the Ballona wetlands itself, as discussed in detail in Volume 1 of this series, was a fluid environment in the past and experienced major natural alterations from a freshwater lagoon and marsh to a saltwater marsh as the lagoon began to fill with silt.

These categories vary from those used in prior studies in the Ballona area. For example, Altschul et al. (1991) and Grenda et al. (1994:14–17) divided the Ballona into three primary types of habitats: estuarine, freshwater, and terrestrial, with subdivisions in each category. Drawing on several previous vegetational surveys, Altschul et al. (1991) and Grenda et al. (1994) recognized both freshwater- and salt-marsh econiches, as well as mudflats, salt flats, coastal dunes and scrub, agricultural areas and weedy fields, the prairie habitats of coyote brush and pampas grass, willow stands, and transitional areas of pickleweed and salt pans. Yet by the authors' own admission, the boundaries between plant communities no doubt shifted over time in response to increasing sedimentation within the wetlands. Therefore, some of the latter distinctions are difficult to maintain when presenting the biotic history of the landform over the last ca. 9,000 years. In addition, those divisions are based on vegetation alone, whereas a combined record of flora and fauna continuity and change over time is presented in this study.

Ballona Wetlands (Lagoon and Freshwater Marshes)

The marshes here comprise lands located near the shoreline and behind the sand dunes that were inundated by salt water and dominated by pickleweed (*Salicornia* sp.), as well as those lands flooded by freshwater. The latter were found at the mouth of Centinela Creek and, formerly, also at the mouth of the Ballona Creek/Los Angeles River, which was channelized beginning in the early twentieth century and now is forced to bypass the Ballona outlet and discharge directly into San Pedro Bay (Grenda et al. 1994:14–16). The Santa Monica (Ballona) and San Pedro outlets were equally used by the Los Angeles River, as indicated by satellite photographs that show great underwater deltas or plumes in both bays (see also Gumprecht 1999). In an estuarine environment, it is not easy to neatly separate saltwater and freshwater marshes. Their expanse and locations have changed over time as the Ballona landform evolved, as has been detailed in Volume 1 of this series. In addition, marshes may change their saline content seasonally in response to stream output, and tidal flow in and out of the marshes changes the salinity of the swamps on a daily basis. Also, estuarine salinity is as much a vertical phenomenon as it is a horizontal one: because salt water is heavier than freshwater, some parts of these marshes feature freshwater nearest the water surface but harbor one or more levels of saline water below.

Freshwater Riparian

The freshwater areas of the Ballona were normally defined by the banks of creeks, willow stands, and freshwater marshes. Because we have chosen not to differentiate between the two types of marshes in the present overview, the riparian environments instead consist only of the first two habitats. The creek banks are restricted today to Centinela Creek, because Ballona Creek is now completely encased within a concrete bed. The willow stands occur, or occurred until recent development, along Centinela Creek; skirt the base of the bluffs; and also stand just behind the coastal sand dunes (Gustafson 1981). Also included in this category is another type of heavily wooded area, the slopes of the bluffs.

Los Angeles Upland and Inland Wetlands

These wetlands include the inland wetlands (sloughs or *cienegas*) east of the Baldwin Hills and the upland wetlands (vernal pools) or coastal prairies on top of the Westchester Bluffs (Wigand 2005) immediately to the south of the PVAHP. Prehistorically and historically, the vernal pools extended from the Westchester Bluffs to where Los Angeles International Airport (LAX) stands today, and the inland wetlands extended from Beverley Hills in the north to Palos Verdes in the south (see Wigand 2005:Figure 12.9). Within the Ballona itself, these wetlands expanded as the lagoon shrank and the coastal wetlands filled in.

The upland vernal pools are separated from the inland wetlands, first because they appeared seasonally in spring, as the name "vernal" indicates, on the local plains and second because they are south of the PVAHP (whereas the sloughs and *cienegas* are to the east of the PVAHP). In historic and prehistoric times, vernal pools were relatively common features of the upland prairie areas above the Westchester Bluffs, but most have disappeared in modern times because of development and concomitant human-population water needs (Bauder et al. 1998; Wigand 2005). Seasonally present only, the freshwater pools had few dedicated inhabitants but, rather, attracted a diverse array of either migratory or permanent-resident animal species. Therefore, the pools, for the most part, featured greater concentrations of species rather than a higher diversity. The distinction is difficult to make archaeologically because it is one of numbers rather than kind. *Cienegas* and sloughs, although permanent, are essentially upland versions of the freshwater wetlands found in the Ballona itself; so, their species compositions are difficult to distinguish from Ballona marsh organisms, on the one hand, and Los Angeles plain inhabitants, on the other. These water features formerly dotted the upland landscape now occupied by greater west Los Angeles (Bauder and McMillan 1998).

Los Angeles Plain

Los Angeles Plain is a term used loosely in this study to refer to inland areas that essentially include what have historically been agricultural fields and the foothills of the San Gabriel Mountains to the east. These areas are often differentiated in ecological surveys (cf. Gustafson 1981). They are, however, combined in this study, because there is a great deal of overlap of species between fields and prairies, such that we cannot determine where the plants and animals were taken based on archaeological species occurrences.

Sandy Coast

The sand dunes and sandy shoreline (including underwater sandy substrate) of the Ballona were combined to form this category. Such habitats existed at the edge of the Ballona, where river sediments have been deposited over millennia and form a barrier against the Pacific Ocean. On the ocean side of the shore, beneath the water in Santa Monica Bay, there was extensive sandy-bottom habitat, with the exception of the outflow of Ballona Creek, which has been an elevated alluvial surface for quite some time. Within the Ballona Lagoon and those freshwater channels was a network of mudflats and mud bottoms, which are also included in this category. Many fish and shellfish inhabited both sand and mud sediments, whereas other aquatic species preferred rocky or reef habitats. Dunes, beach, and sandy and muddy bottoms hosted an impressive array of plant and animal life.

Rocky Coast

In the Ballona area, this category mainly includes reefs and rocky substrate found beneath Santa Monica Bay, because the coastline of the Ballona is entirely sandy, having been formed from freshwater-stream deposition. Nonetheless, there were "rocky" areas within the Ballona's terrestrial areas, too. During prehistory, prior to current development of the shoreline, there were likely scattered rocky outcrops along the shore south of the Ballona, toward the Palos Verdes Peninsula. Today, the closest rocky coast is located on the Palos Verdes Peninsula to the south (approximately 20 km) and in the Malibu area to the north (approximately 25 km).

Offshore

This econiche at present consists of, as its name indicates, those areas of salt water adjacent to the Ballona but west of the sandy shoreline and includes Santa Monica Bay as well as the nearshore portion of the Pacific Ocean itself. Until roughly 7,000 years ago, the ancient shoreline was much farther out than the modern shoreline because of lower sea levels. Santa Monica Bay now covers the submerged shore and other shallow areas, up to the point where it meets the higher landform of the Ballona. Many fish, shellfish, and marine-mammal species occupy both bay and nearshore waters and also range much farther out, even down to great depths, and in so doing make it difficult to determine whether they are endemic to shallow bay waters or more at-home in true ocean conditions. The Ballona ecological study (Schreiber 1981) did not attempt to survey marine organisms, perhaps for this very reason. Utilizing modern species distributions to compare with archaeological data is therefore essentially impossible, because one is left with either no information, as in the case of the Schreiber volume, or a maximalist catalog of all marine species recorded in southern California waters (e.g., Love 1996).

Theoretical Approach and Methods

In the last decade, archaeological investigations have been slowly moving away from the use of rigid hypothetico-deductive frameworks (Hodder 1991; Salmon 1993; Watson 1990). Recent research has been structured to link problems cogently with material correlates in the archaeological record. In doing so, researchers have accepted that there is a complex interplay of inductive and deductive steps filtered through the paradigmatic biases of the researchers. The PVAHP follows this trend by addressing research questions and correlating archaeological data within primary theoretical themes. The main research themes are chronology, technology, and human behavior as they pertain to site function, socio-ritual systems, social organization, settlement, and subsistence (research themes that relate directly to those posed in the original PVAHP Research Design [Altschul et al. 1991]). Although hunter-gatherer research in North America, and particularly in California, has been wrought with tensions between evolutionary and historical epistemologies (see, for example, Broughton and Bayham 2003; Jones et al. 2008; McGuire and Hildebrandt 2005), the PVAHP theoretical approach integrates behavioral ecology, cultural ecology, evolutionary theory, optimal foraging, and historical particularism to put our work into a larger theoretical context to enable better comparison to hunter-gatherer research in other parts of the world.

An important issue at hand for the PVAHP is chronological resolution. A rigorous dating program yielded 200 ^{14}C dates on shell and carbonized seeds from the PVAHP sites in addition to obsidian-hydration and archaeomagnetic data (see Volume 2 of this series for details). The results revealed that most of the occupation was concentrated between 5,000 and 200 years ago, with the earliest occupation in the Ballona area dating earlier than 8,000 years ago. In all PVAHP discussions of prehistoric adaptations in the Los Angeles Basin, a cultural chronology that distinguishes Millingstone, Intermediate, Late, Protohistoric, Mission, Rancho, and twentieth-century periods is used (Figure 6). In the PVAHP, LAN-54 and LAN-193 have Millingstone and Intermediate period deposits, and LAN-2768 primarily contains an Intermediate period occupation and a much-more-limited Protohistoric-Mission-Rancho period component. Occupation at LAN-62 appears to have begun sometime near the start of the Millingstone period (ca. 7000 B.P.), when the Ballona Lagoon would have been first established. Aboriginal occupation culminated at LAN-62 near the end of the Mission period in the early nineteenth century. The presence of a formal burial area at LAN-62 during the Late, Protohistoric, and Mission periods may indicate a village settlement nearby, but evidence of domestic activity dating to that time was sparse at the site. LAN-211 represents a domestic component that dates between the Intermediate and Mission periods and was very likely associated with LAN-62. Detailed discussions of chronological indicators and dating results are presented in Volume 2 of this series.

Archaeological research questions often shape data collection, sampling, and analysis, but additional research questions are raised equally often during the process. To accommodate such unforeseen situations, the PVAHP implemented a rigorous data-collection program in the field; this program was later tailored to research needs during sampling and analysis. Adequate sampling is often dependent on the research issues, which also guide the determination of the representativeness of a sample. Therefore, there was no standard sample size for each site or context. As a rule, unless field circumstances and conditions did not facilitate it, the contents of all features were collected. For detailed discussion of sample collection at each site, please refer to Volume 2 of this series.

Of particular relevance to this volume are the selected analytical excavation units (EUs) at each site. Control units (CUs) were selected at each site, and all data from these unit(s) were analyzed to provide measurable controls for densities of material culture, diversity and/or homogeneity of cultural deposits, and temporal changes in (and therefore intensity of) material culture. Selection of the control units was based on an understanding of the depositional history of each site, site structure, and postdepositional disturbance. Data presentation and discussion for each control unit typically uses cultural periods rather than levels or strata, thus allowing for intersite discussions. In addition to the control units, select features were analyzed, and their selection was based on presumed age, diversity of material culture, location within a site, and cultural integrity.

In some cases, blocks of excavation units, either by themselves or from within larger block excavations, were grouped together as feature blocks. Feature blocks incorporated groups of features that were clustered and perhaps contemporaneous.

All analytical contexts by site are presented in Appendixes A.1–A.6. Cultural material was recovered from the various analytical contexts and distinct stratigraphic levels when the sediment was screened through 1/8-inch and 1/16-inch screens (depending on the sample). In addition, point-provenienced artifacts and ecofacts were collected as items. Precise, three-dimensional provenience data were collected for these itemized objects, which typically included any artifact or ecofact that was large or unique enough to be collected individually. The level of effort at the five sites varied considerably according to the character of deposits and the potential impacts. Two sites, LAN-2768 and LAN-62, have spatially distinct areas designated as loci. These loci are largely heuristic devices that are useful management tools and do not reflect cultural boundaries. Similarly, the site boundaries are not distinct spatial definitions that delineate past behavioral locations. Given the length and intensity of repeated occupation in the Ballona over an 8,000-year period, site boundaries are used as guidelines to elucidate diachronic variations and preferences in settlement. Discussions of sites in the PVAHP publications will be presented in the order of the archaeological investigations conducted at each of the sites (LAN-193, LAN-2768, LAN-54, LAN-62, and LAN-211).

LAN-193 is situated at the base of the Ballona Escarpment, sandwiched between two large drainages south of Centinela Creek. Data recovery and subsequent monitoring at this site involved the excavation of 1-by-1-m excavation units (n = 119), mechanical trenches (n = 15), and features (Figures 7 and 8). Results of excavations at LAN-193 are presented in Chapter 5, Volume 2 of this series. Five 1-by-1-m control units (CUs 1, 11, 21, 34, and 117) at LAN-193 were selected for detailed analysis, along with nine features consisting of three burials (excavated subsequent to data recovery) and six nonburial features (see Appendix A.1). LAN-193 has Millingstone and Intermediate period deposits and an early-twentieth-century refuse dump.

LAN-2768 is located along the base of the Ballona Escarpment, within the upper reaches of the historical-period channel of Centinela Creek, in an area previously known as the Entertainment, Media, and Technology District (EMTD) and now known as the Campus. The Campus complex encompasses the eastern portion of the PVAHP project area. For management purposes, LAN-2768 was divided into four loci of investigation (Loci A–D); these loci were especially important in light of the large area of the site (Figure 9). Archaeological investigations at LAN-2768 included the excavation of 11 pothole trenches, 64 linear trenches, 93 excavation units (1 by 1 m), and 30 stripping units. In addition, 97 features were excavated in the four loci of LAN-2768 during the data recovery and monitoring excavations. Control units included 4 1-by-1-m control units (CUs 3, 8, 2/22, and 20/21) in Locus A; each of the 2 compound units (CUs 2/22 and 20/21) included upper and lower portions of 2 adjacent units combined into a single analytical unit (Figure 10). Three control units were selected in Locus B (CUs 502, 504, and 524). Of the 97 features, 19 excavated features were selected for analysis, including 3 burials and 16 nonburial features (Figure 11; see Appendix A.2). Features from data recovery contexts, rather than those identified during monitoring, were selected for analysis, because data recovery features were in stronger, more insightful contexts with better stratigraphic control. LAN-2768 comprises Intermediate period occupation deposits with a minor Protohistoric-Mission-Rancho period component.

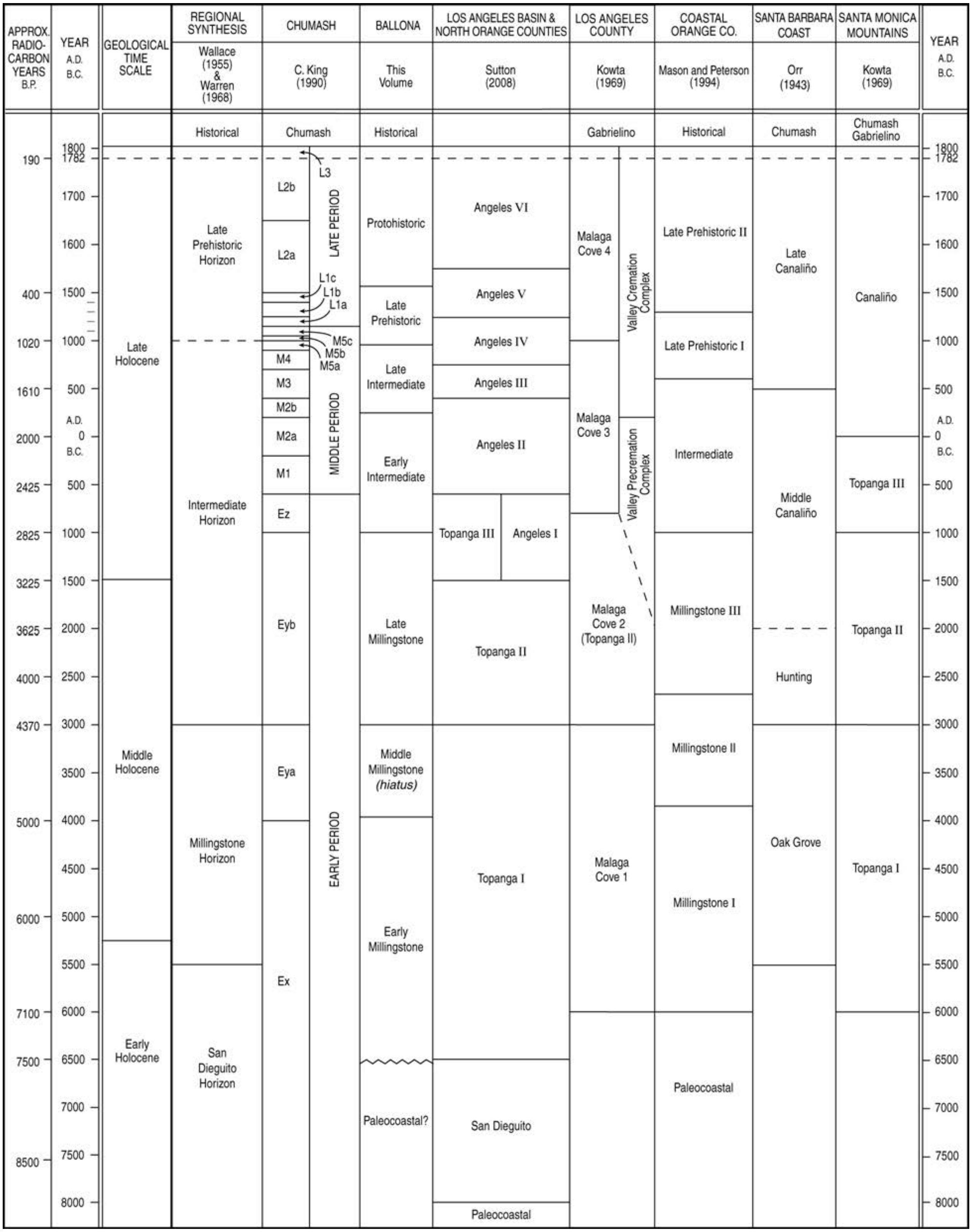


Figure 6. Chronology used in the PVAHP.

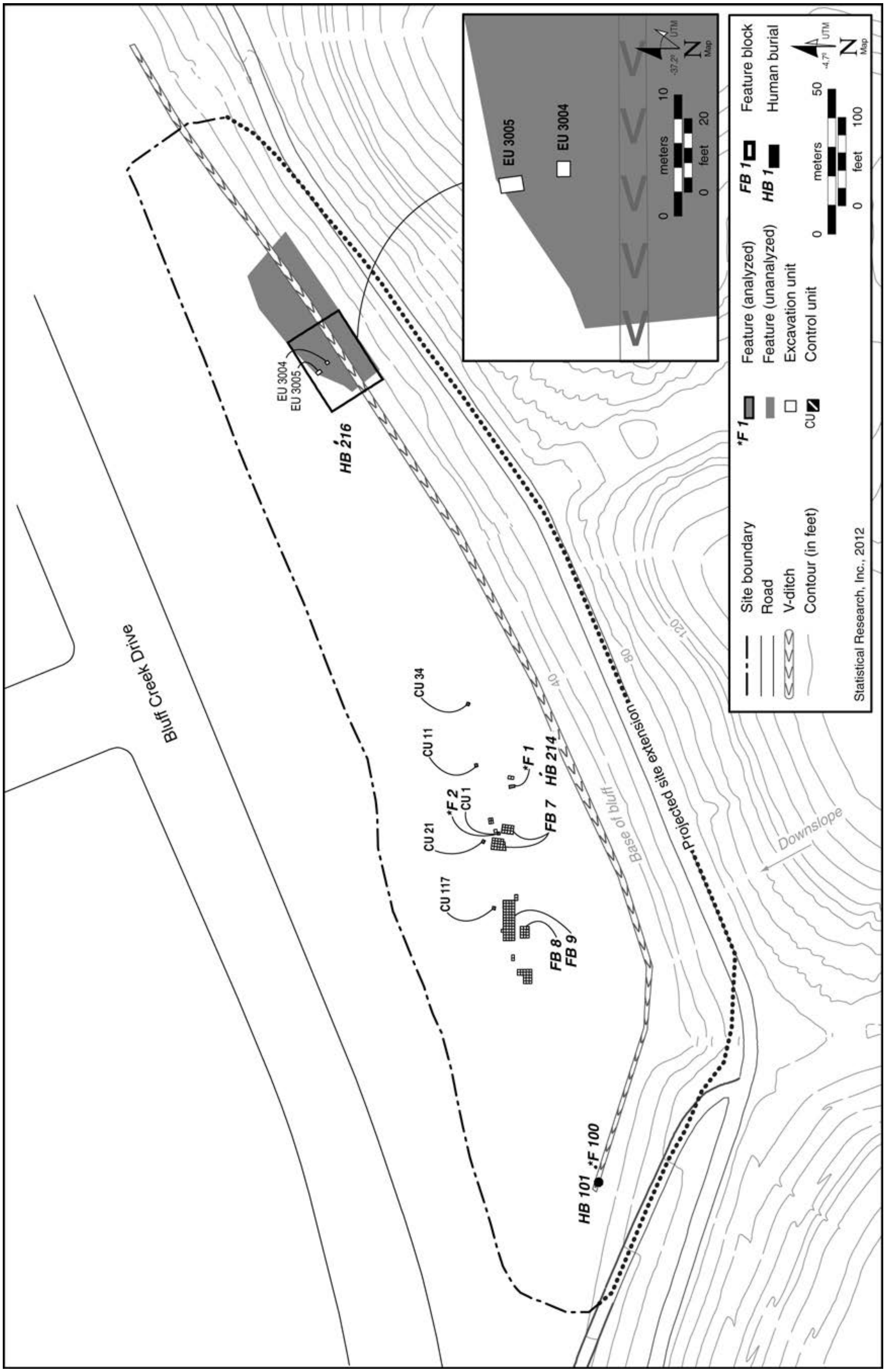


Figure 7. Map of LAN-193 showing analyzed proveniences.

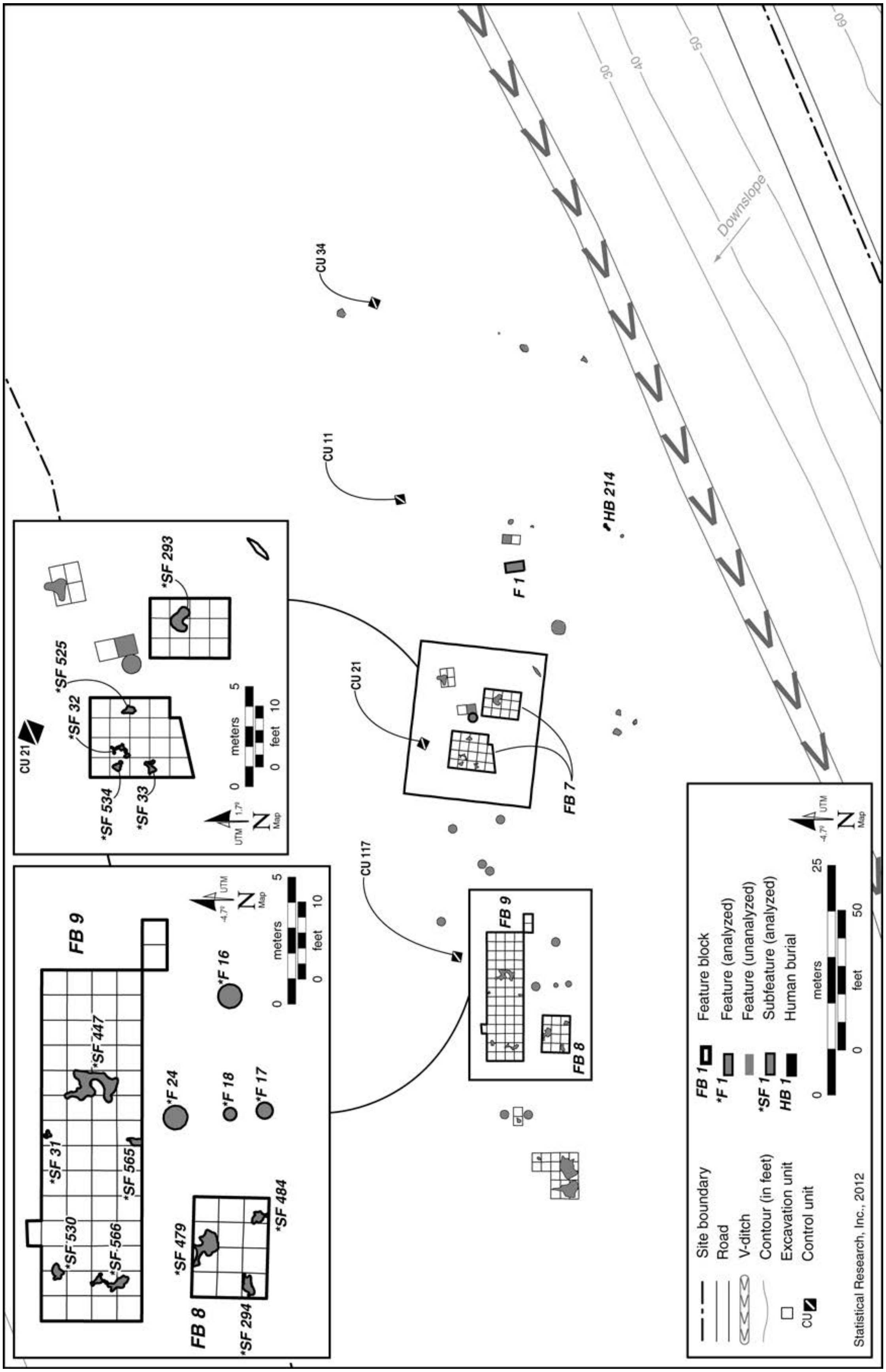


Figure 8. Feature excavations at LAN-193.

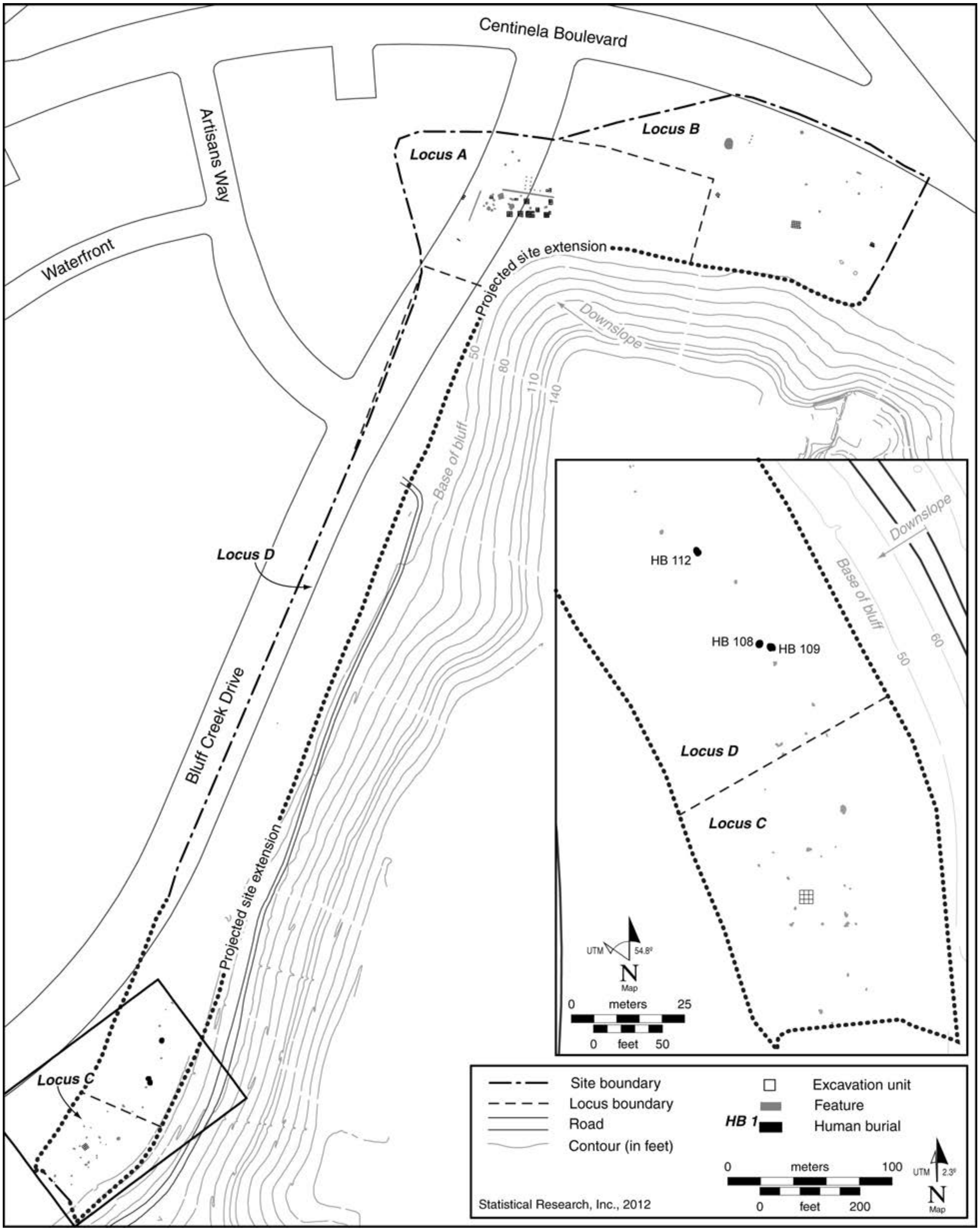


Figure 9. Map of LAN-2768 showing Loci C and D details.

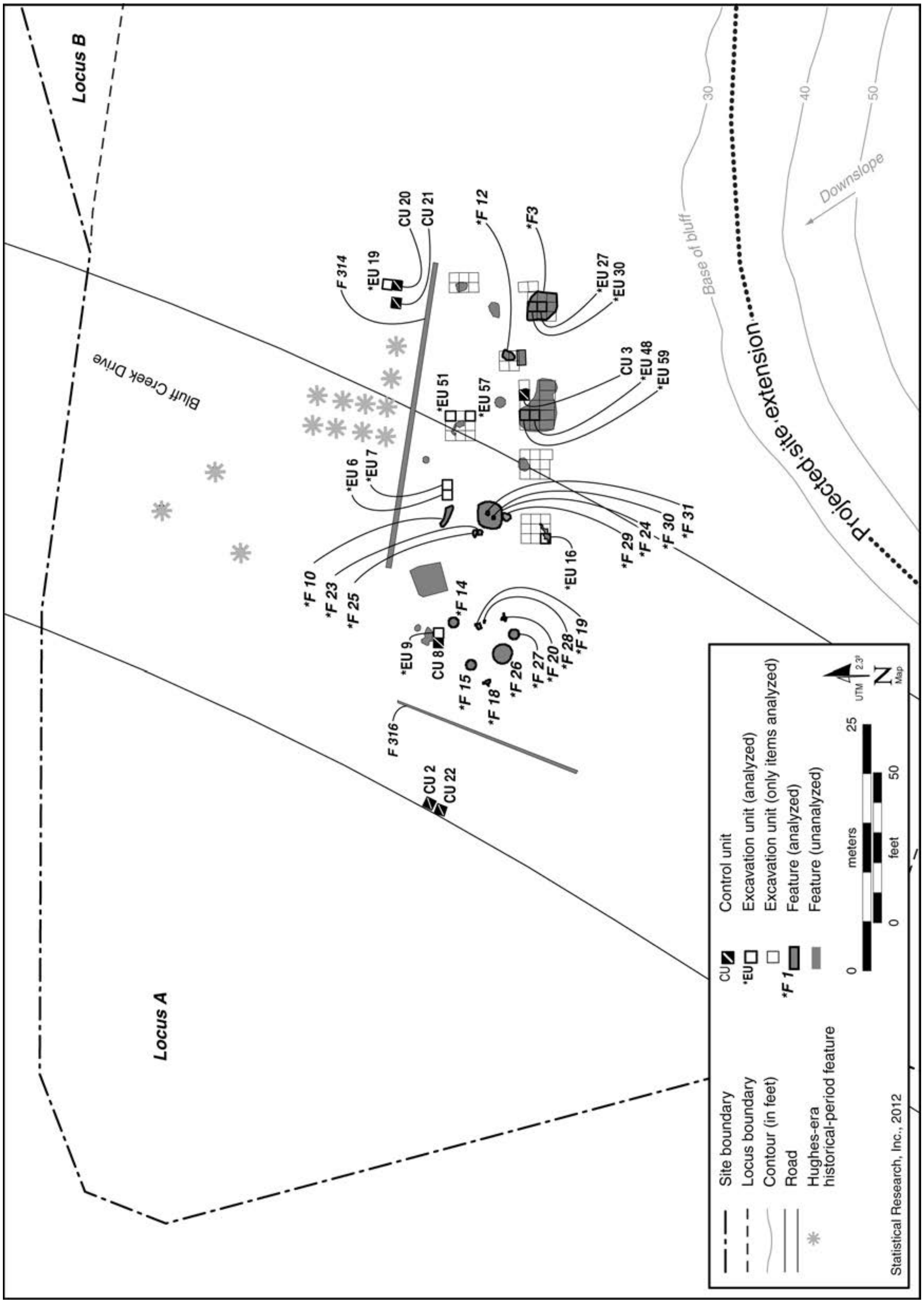


Figure 10. Analyzed contexts at Locus A, LAN-2768.

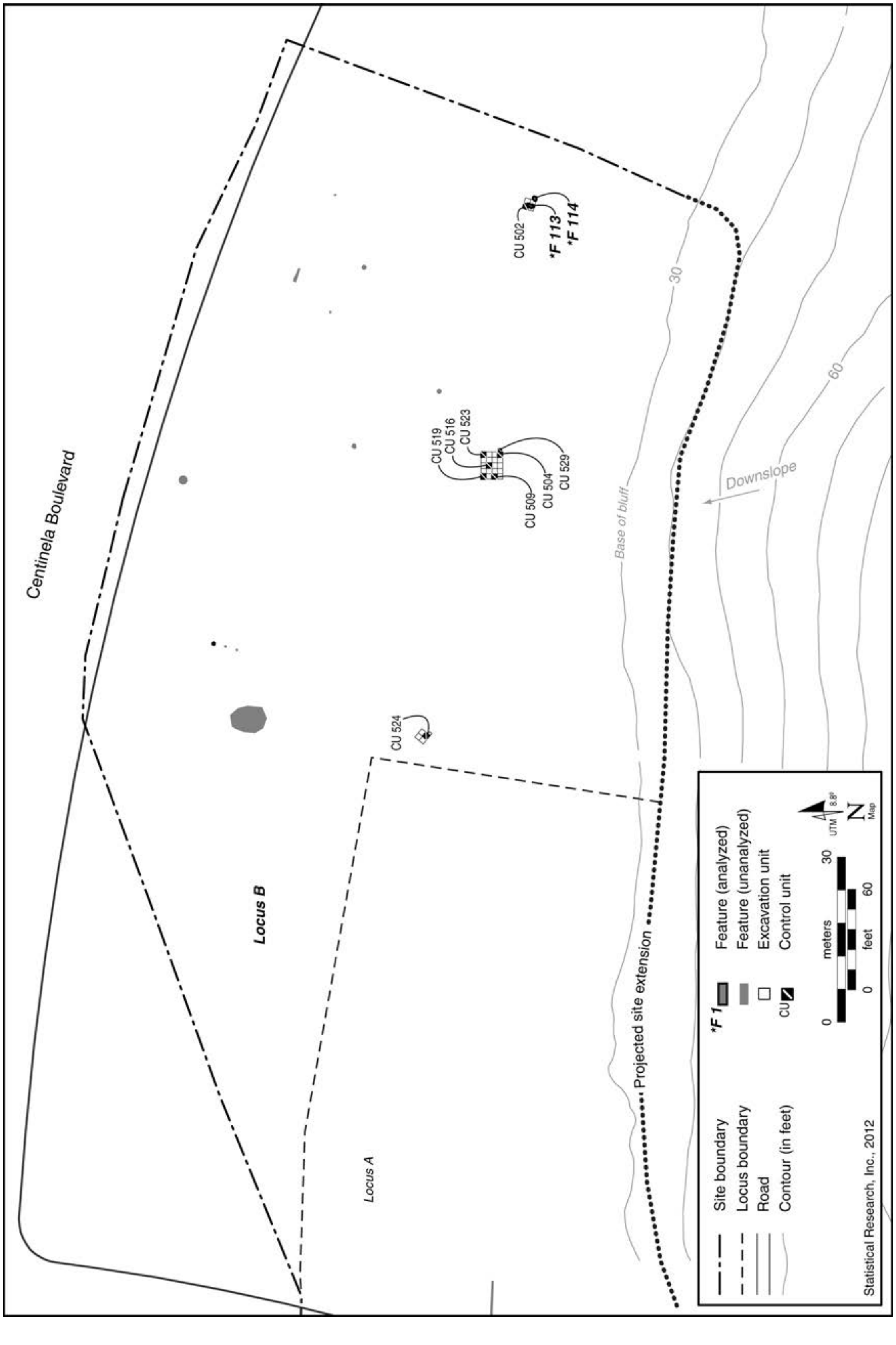


Figure 11. Analyzed contexts at Locus B, LAN-2768.

LAN-54 is located to the south and west of the intersection of the Marina Freeway (State Route 90) and Culver Boulevard and is the only prehistoric site within the PVAHP near the prechannelized location of Ballona Creek. Data recovery consisted of hand-excavations of control units, mechanical stripping of all intact site materials, and hand-excavation of identified features, including 3 human burials. LAN-54 is a multicomponent site with intact prehistoric components dating to the late Millingstone and early to middle Intermediate periods and a late-historical-period component. Data recovery at LAN-54 consisted of the excavation of 4 exploratory trenches, 10 blocks of excavation units (comprising 82 1-by-1 m units), 56 4-by-4-m stripping units, 8 column samples, and 37 features (including 3 burials) (see Appendix A.3). Four control units were selected (CUs 3, 11, 30, and 31), and 16 features were analyzed: 3 burials and 13 nonburial features (Figure 12).

LAN-62 is a large multicomponent site within the BLAD that was previously determined eligible for listing in the NRHP (Altschul 1991; Altschul et al. 1991). It rests on an alluvial-fan deposit at the base of the Ballona Escarpment, at the west end of the Playa Vista development. For management purposes, SRI divided LAN-62 into seven loci (Loci A–G). The prehistoric occupation at LAN-62 is significantly denser in the southern portion of the site (most of which is designated as Locus A), whereas the northern and eastern portions of the site are characterized by sparse cultural deposits (designated as Loci C–G); Locus B, along the base of the bluffs east of Locus A, is an area that was largely destroyed by historical-period activities. Data recovery was not conducted at Locus B, because it is a highly disturbed area, but construction of the Riparian Corridor in Locus B was monitored by archaeologists and Native Americans. The locus includes the former Fire Safety Training Area (FSTA), which was subjected to extensive use during the Hughes era. Very little intact soil remains; it appears that much of this area was excavated and redeposited or altogether removed for fill to be used elsewhere on the property. In the reporting of the data recovery, Loci A and G are combined, and Loci C and D are combined. There are no temporal distinctions between Loci A and G. Both Loci A and G have occupations ranging from the late Millingstone through the Protohistoric period. Locus A had a much denser concentration of cultural deposits and features than Locus G, and Locus A included a large burial ground. Locus G is located at the northern edge of the large alluvial fan upon which LAN-62 rests, where it joins the marsh. The archaeological signature within Locus G is less distinctive because of the commingling of the site and marsh deposits in this area. Loci E and F offered inconclusive or negative evidence of prehistoric occupation.

During the data recovery at LAN-62, Loci A and G, SRI excavated 56 mechanical trenches, 109 mechanical-stripping units, 677 excavation units, and 210 nonburial features and analyzed selected materials and contexts from 546 excavation units (81 percent of the total units) and 150 nonburial features (71 percent of the total nonburial features). In addition, 374 burial features were recovered from Locus A and analyzed (100 percent of the total burial features). During and immediately after the excavations, several spatially discrete analytical contexts were defined at LAN-62, including the burial area and Feature Blocks (FBs) 3, 4, and 7 (all of which are defined below) (Figures 13–16). The focus of the data recovery analysis was on the burial area and these three feature blocks. The burial area has the densest concentration of human burials in the Ballona. Select excavation units and nonburial features from the burial area were analyzed. See Appendix A.4 for analyzed contexts from LAN-62, Loci A and G. Feature blocks included a set of contiguous 1-by-1-m excavation units with a series of clustered features and feature fill. FB 3 is located immediately to the west of the burial area and is primarily composed of Protohistoric and Mission period deposits (Figure 17). FB 4 is defined by Intermediate period deposits (Figure 18), and FB 7, located to the northeast of FB 3, encompasses Millingstone period deposits (Figure 19). All itemized cultural materials from the excavation units and the features in the three feature blocks were analyzed. Itemized cultural materials are artifacts and ecofacts that were individually collected from a context and have three-dimensional provenience data. In addition, particular features from each feature block were selected for complete analysis (see Appendix A.5). Furthermore, several excavation units in FBs 4 and 7 were selected for analyses of particular material culture (lithics and/or vertebrates). In addition, 29 features and units located outside these particular contexts were also analyzed (Figure 20). The only exceptions to this sampling strategy were that shell and glass beads recovered from all excavation units and features were analyzed. Data recovery at Loci C and D of LAN-62 included excavation of 22 trenches, 39 1-by-1-m units, and 6 nonburial features. Seven control units (CUs 937/560, 534, 922, 970, 981, 998, and 1000) and 5 features were analyzed (Figures 21 and 22; see Appendix A.5).

LAN-211 is located on an alluvial fan at the base of the Ballona Escarpment, in Area D2 of the PVAHP project area, and is a contributing element to the BLAD. It is a multicomponent site with predominantly Intermediate (3000–1000 B.P.) and Mission (A.D. 1770–1830) period components. The data recovery program at LAN-211 included the excavation of 10 trenches, 370 1-by-1-m units, 3 burials, and 43 nonburial features (Figure 23). One of the primary contexts at LAN-211 is FB 1, which measured between 10 and 30 cm thick across an expansive area (153 m^2) and was characterized by a high density of cultural and organic remains. Because FB 1 yielded a very high quantity of material culture, it necessitated a sampling strategy that included a checkerboard grid over the entire feature block (Figure 24). Alternating units within FB 1 were selected for full analysis, and all itemized material culture from all the units was also selected for analysis. Analyzed contexts included 5 control units (CUs 119, 120, 274, 353, and 359), 15 features outside FB 1, 22 features inside FB 1, 117 excavation units in the FB 1 checkerboard and outside FB 1, and all items from excavation units within FB 1 (see Appendix A.6). The only exception to this sampling strategy was similar to the exception at LAN-62: all known shell and glass beads and worked-bone artifacts recovered from all excavation units and features were analyzed.

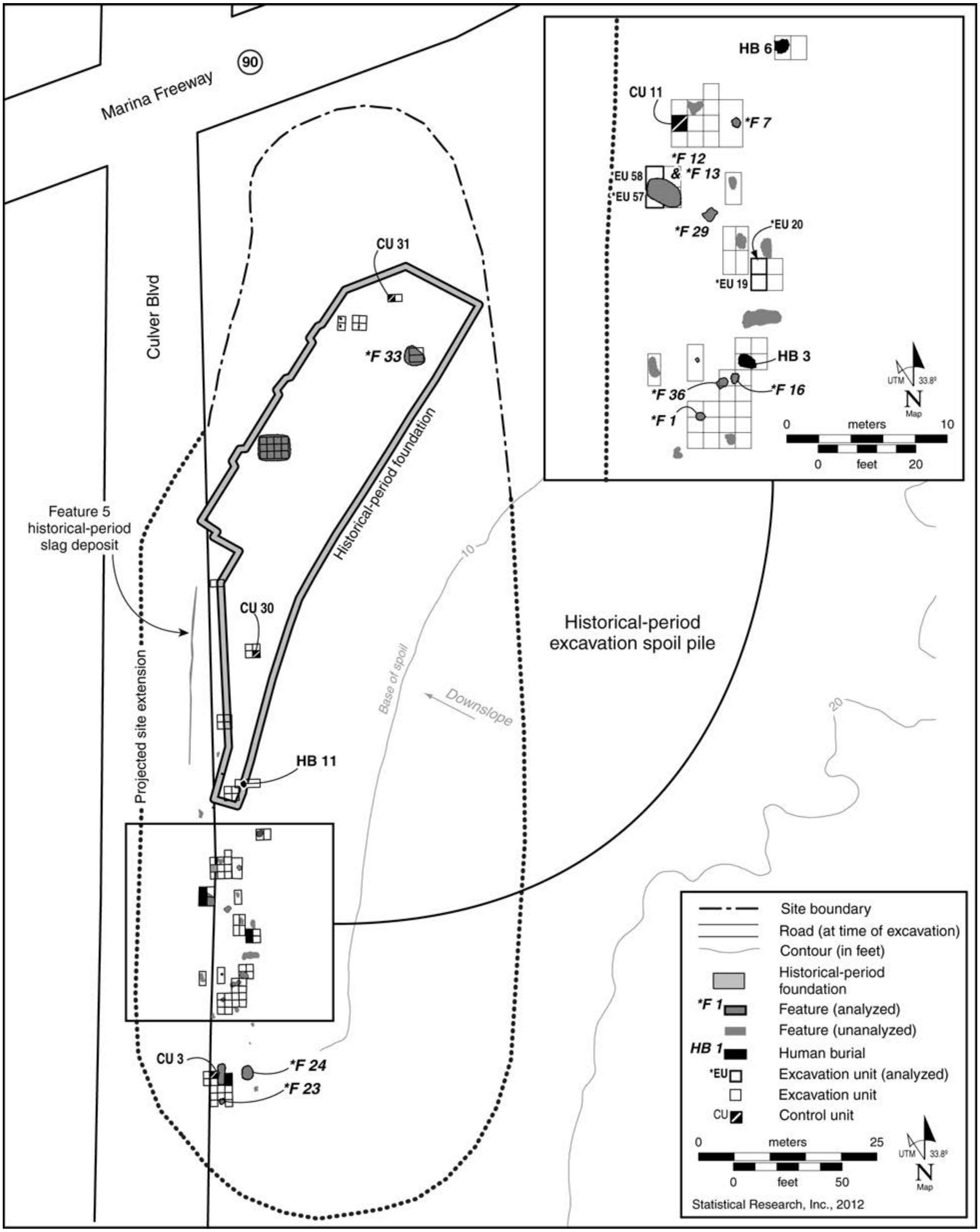


Figure 12. Analyzed contexts at LAN-54.

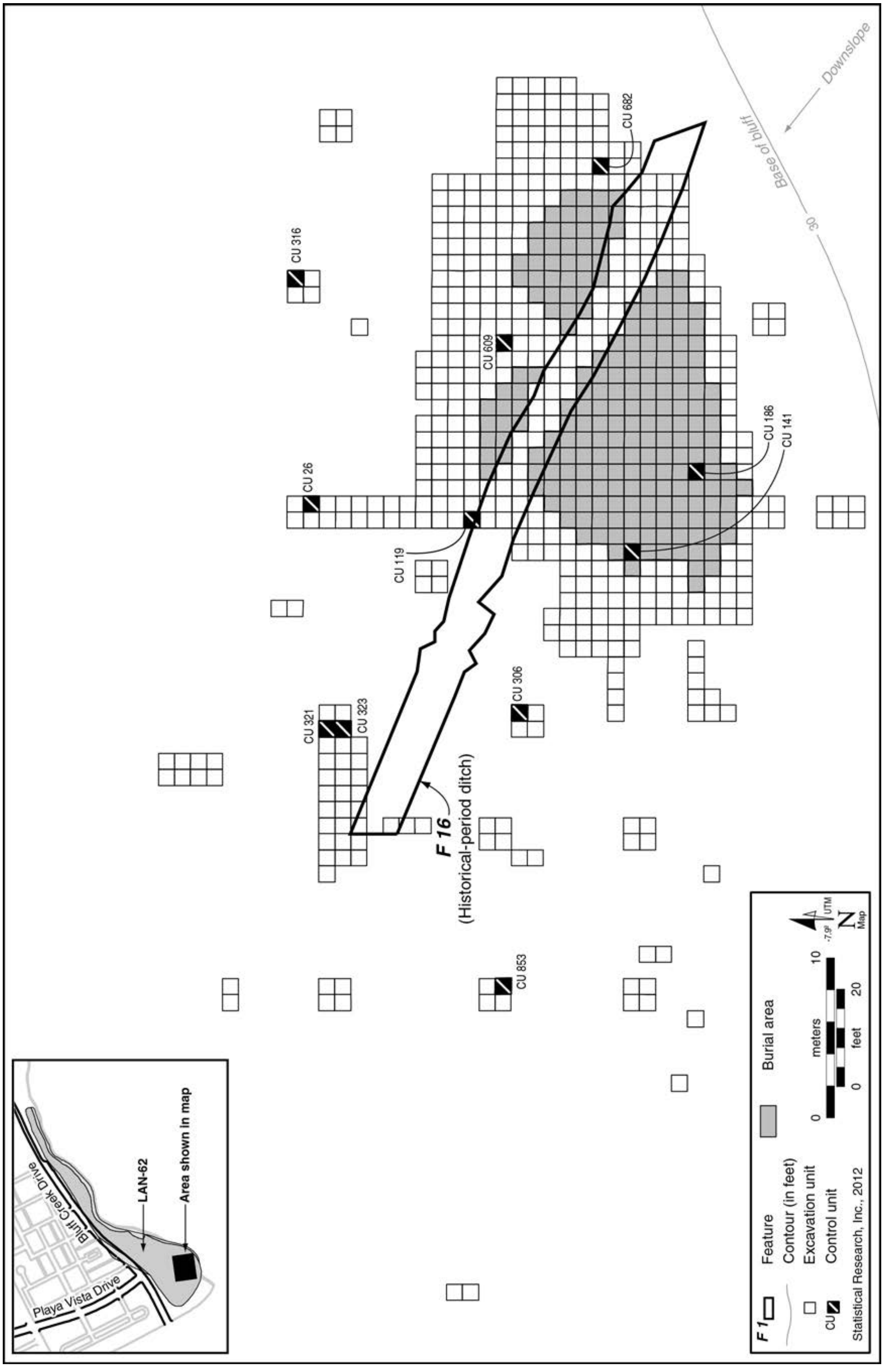


Figure 13. Locations of control units, the burial area, and Feature 16 at LAN-62, Locus A.

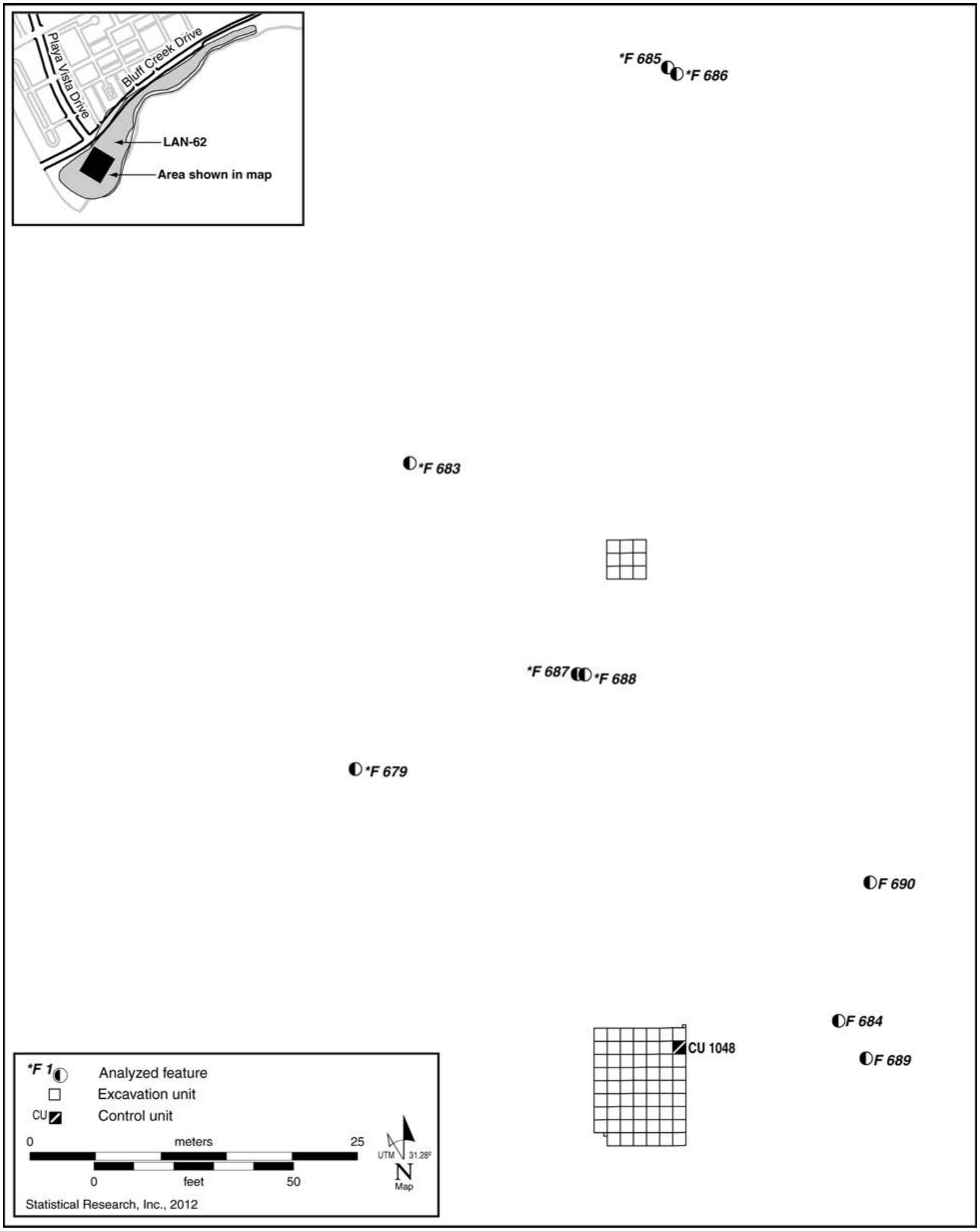


Figure 14. Locations of collection units and features at LAN-62, Locus G.

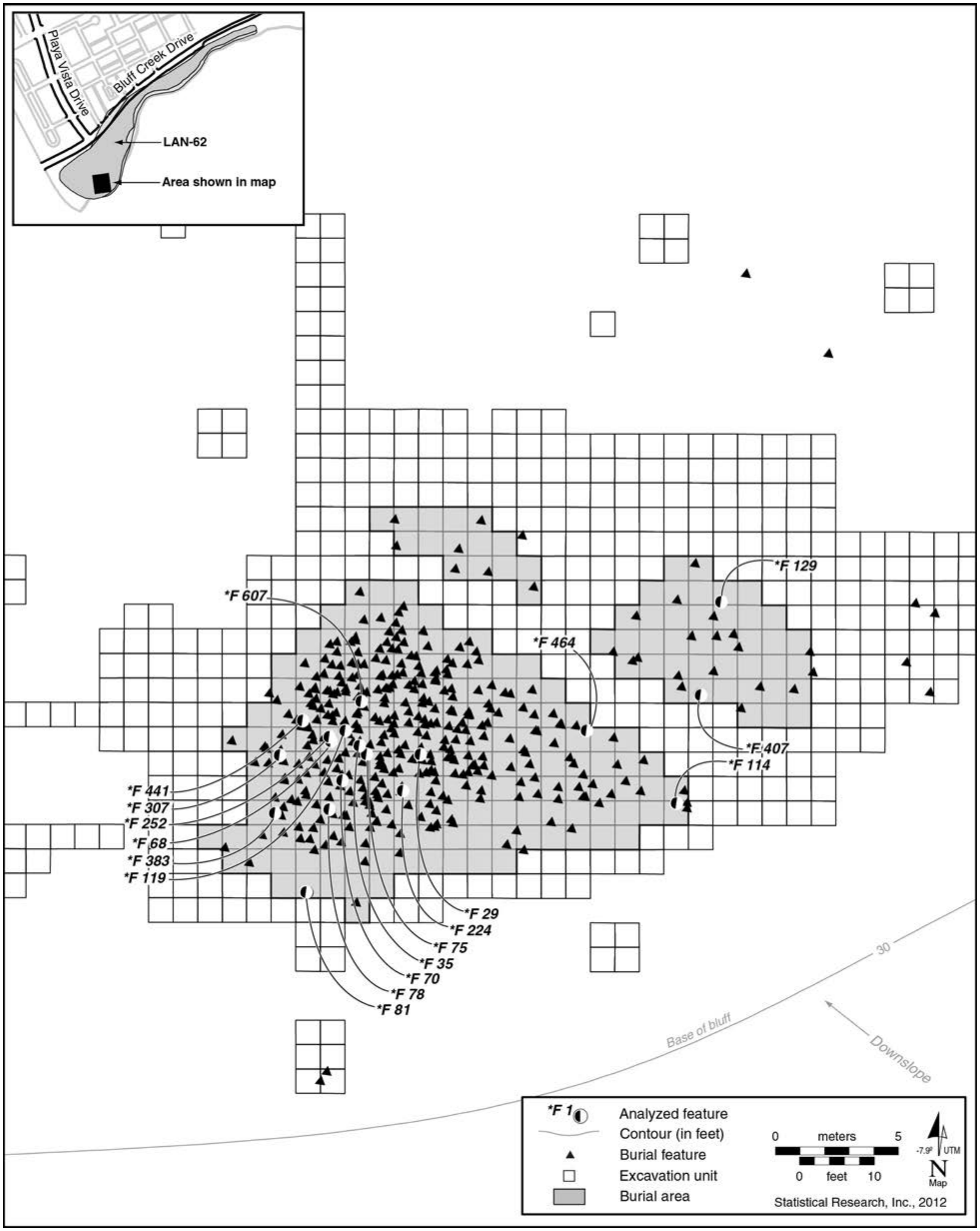


Figure 15. Burial area, with burial features and analyzed nonburial features, LAN-62, Locus A.

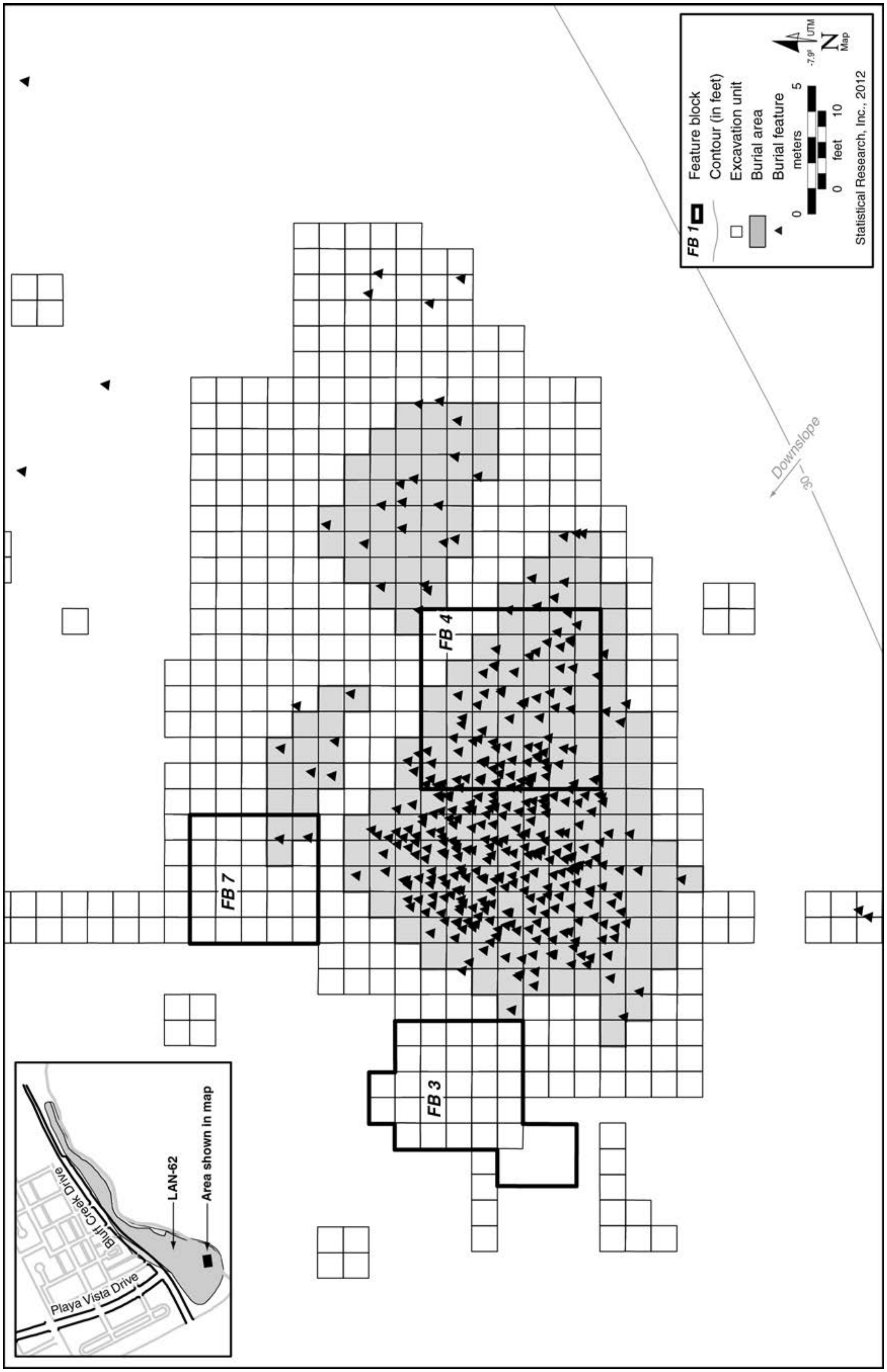


Figure 16. Spatial relationships between the feature blocks and the burial area at LAN-62, Locus A.

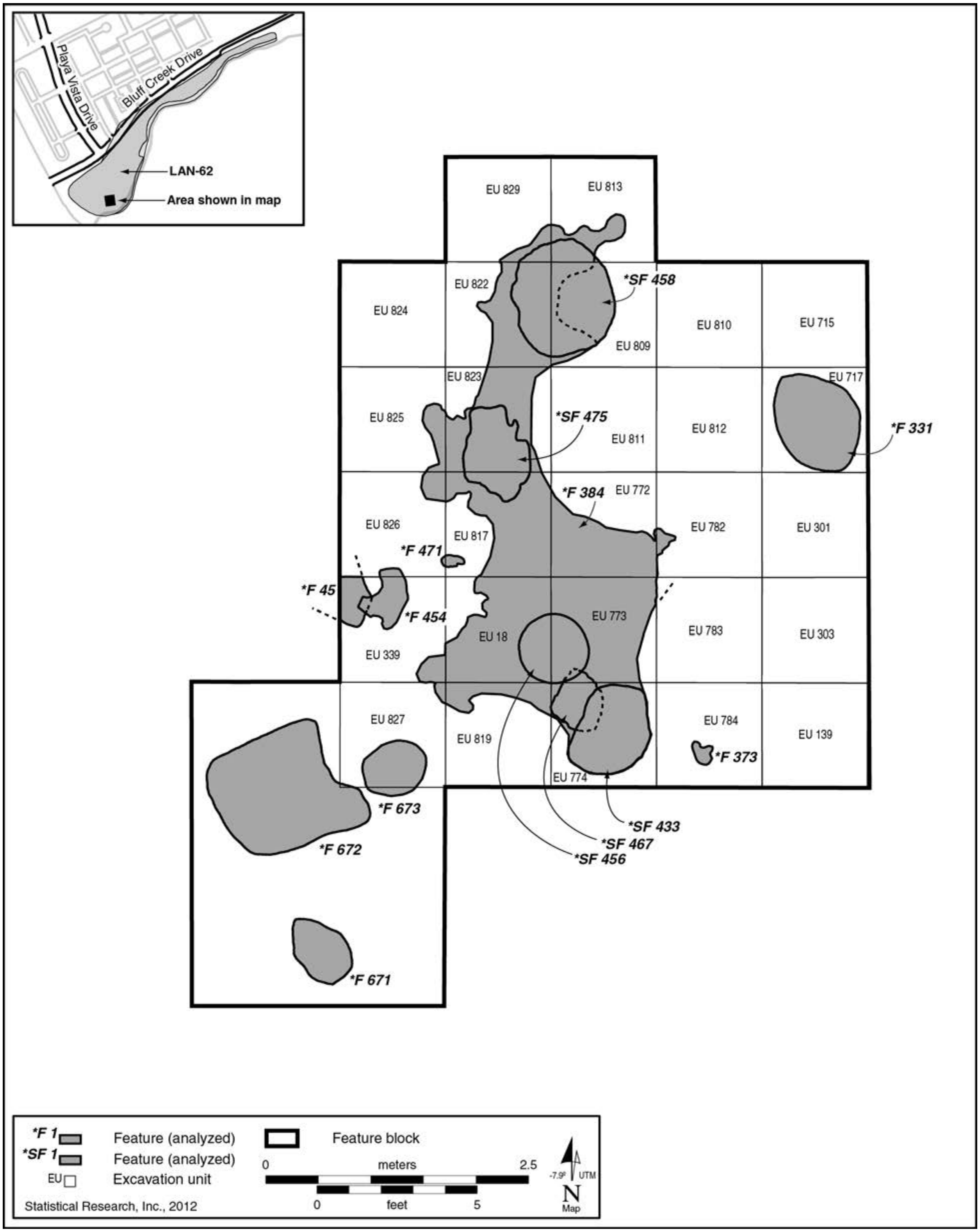


Figure 17. Analyzed features and excavation units in FB 3 at LAN-62, Locus A.

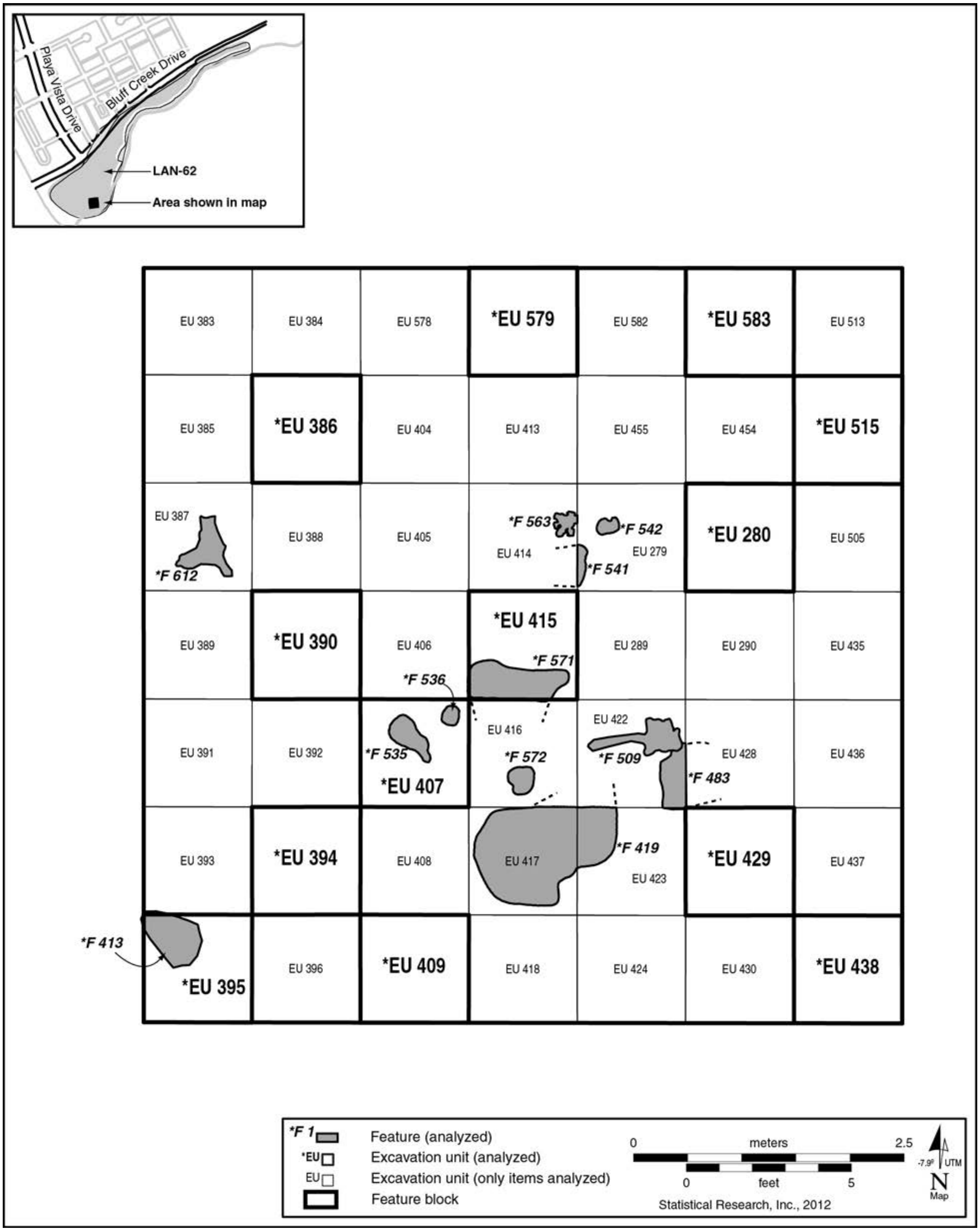


Figure 18. Analyzed features and excavation units in FB 4 at LAN-62, Locus A.

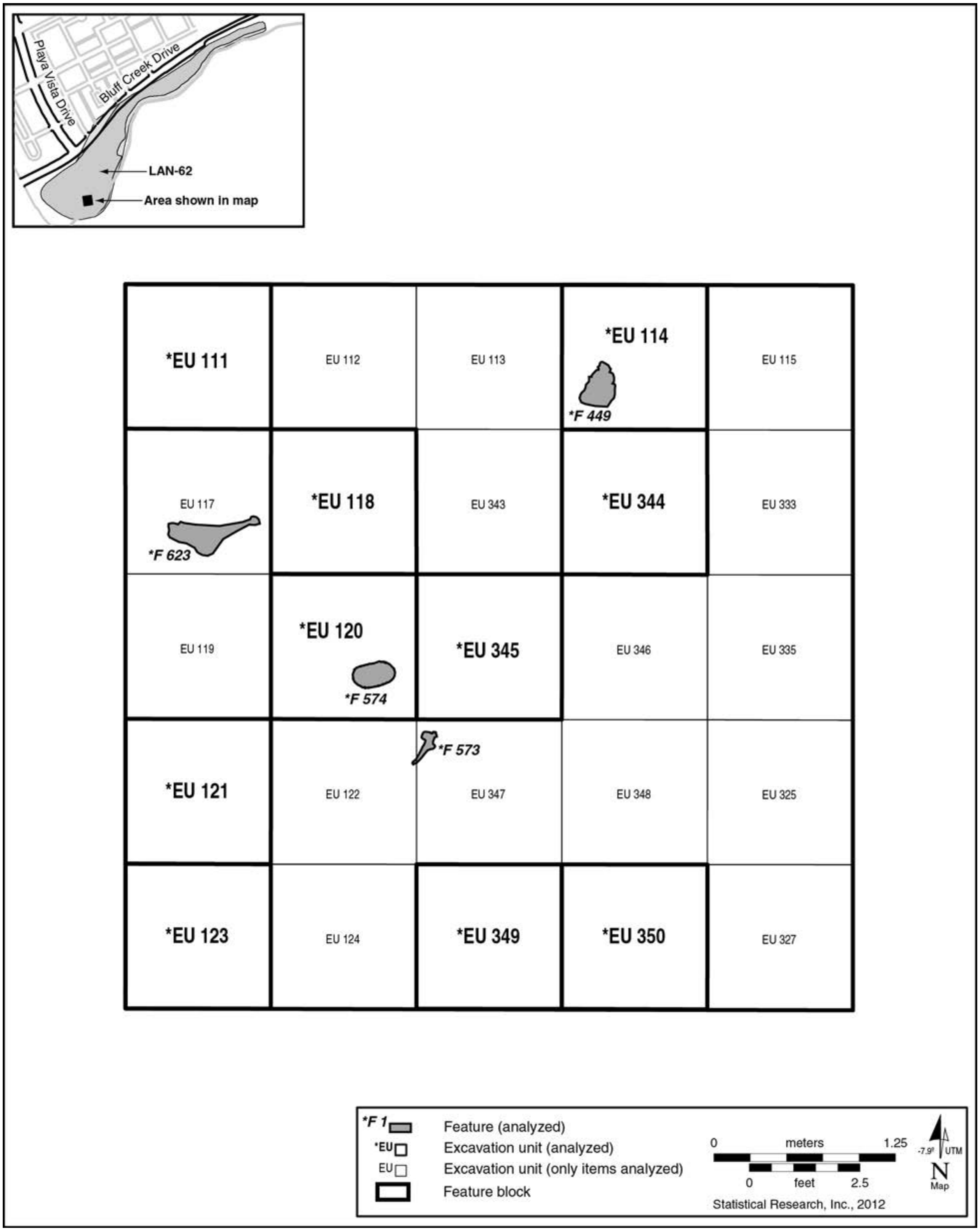


Figure 19. Analyzed features and excavation units in FB 7 at LAN-62, Locus A.

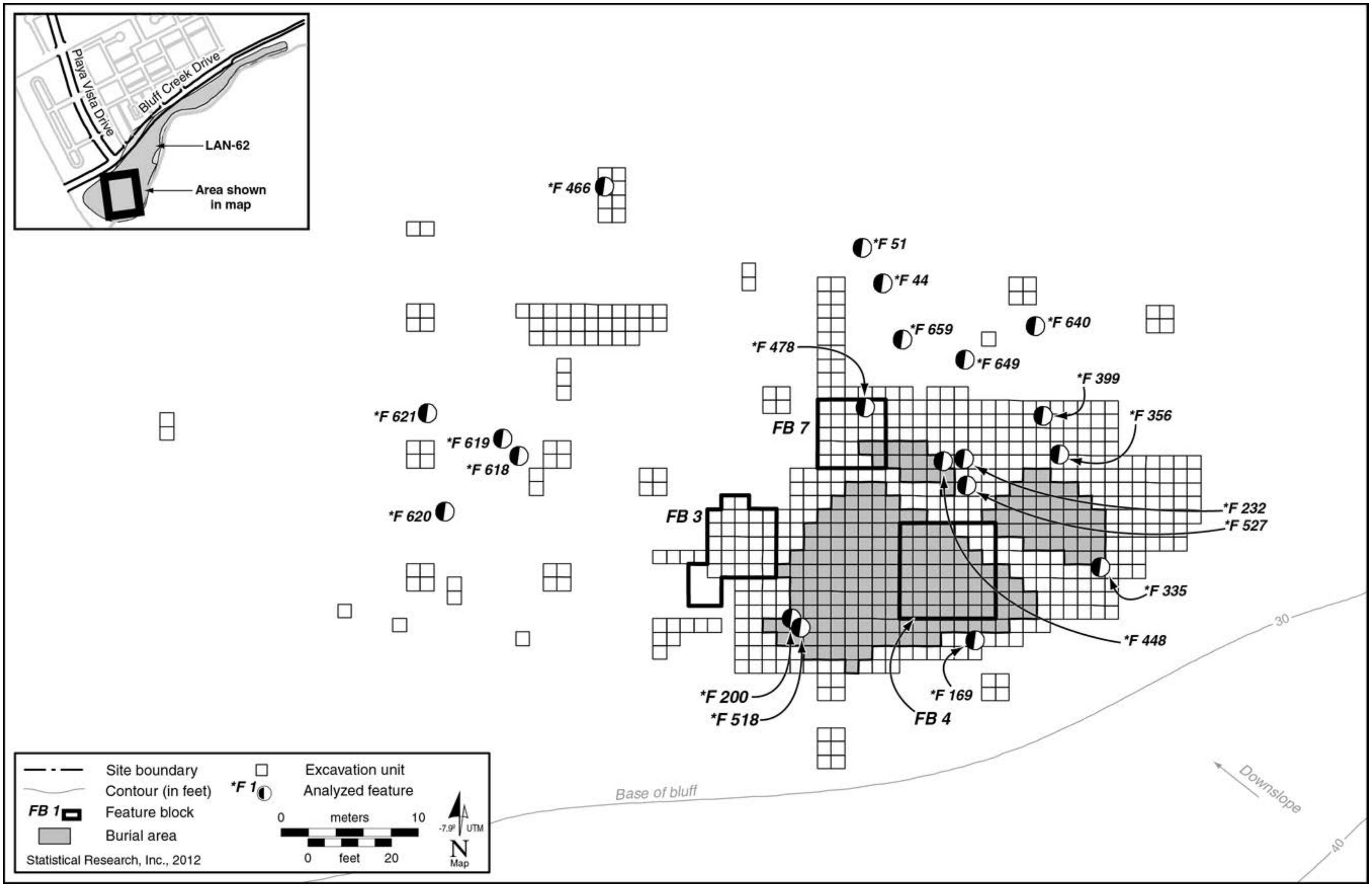


Figure 20. Analyzed features outside feature blocks and the burial area at LAN-62, Locus A.

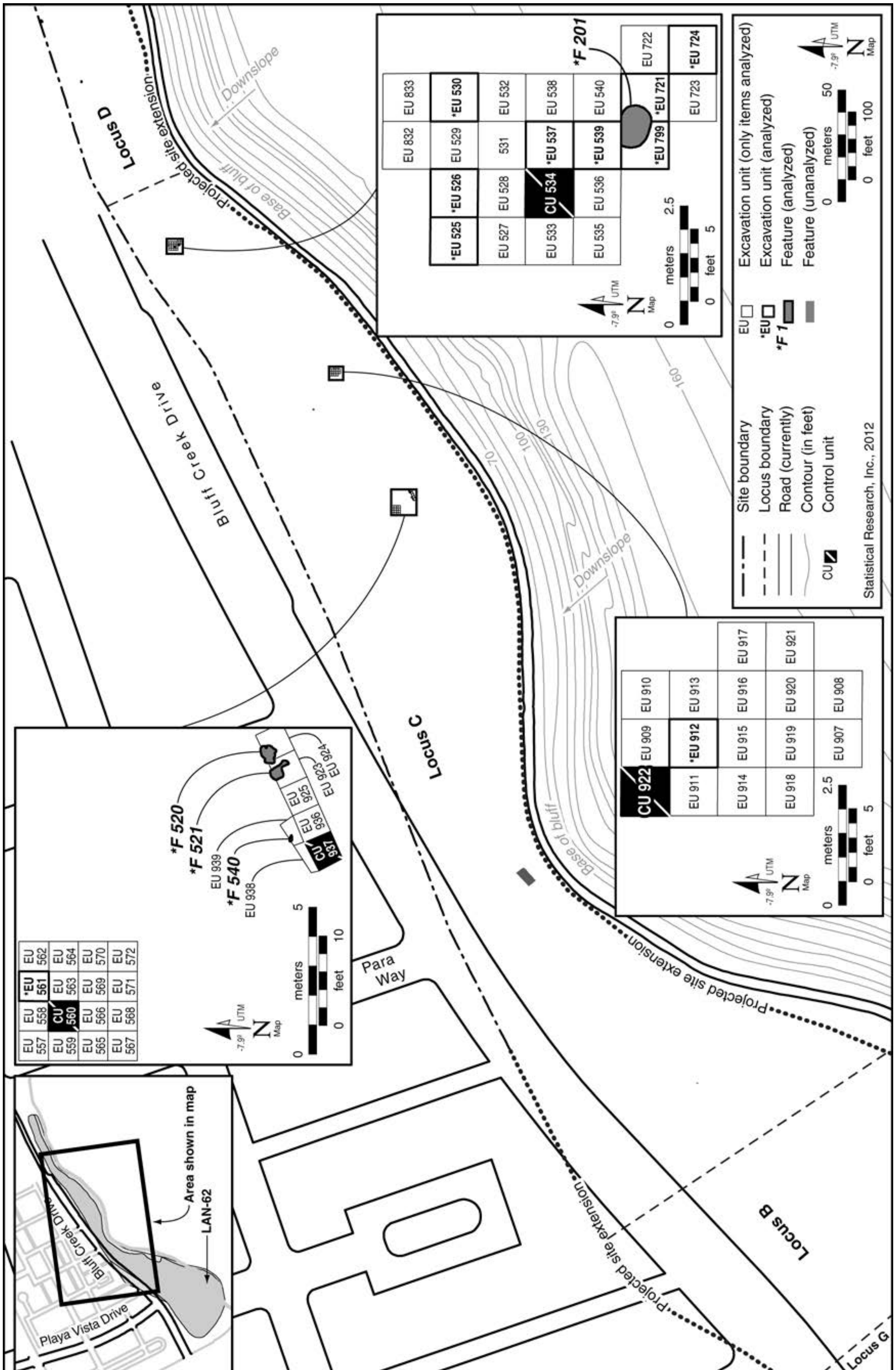


Figure 21. Control units, excavation units, and features at LAN-62, Locus C.

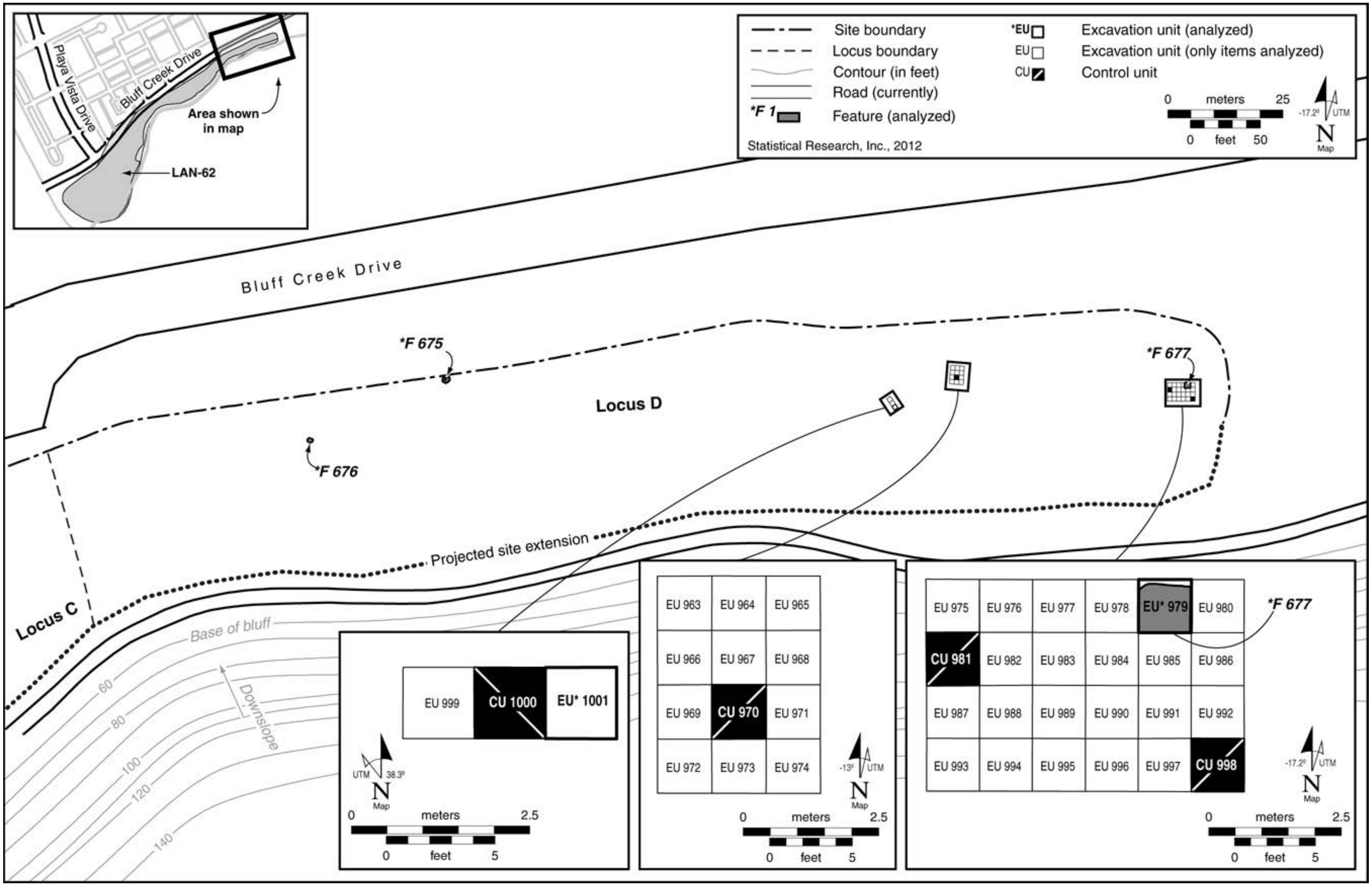


Figure 22. Control units, excavation units, and features at LAN-62, Locus D.

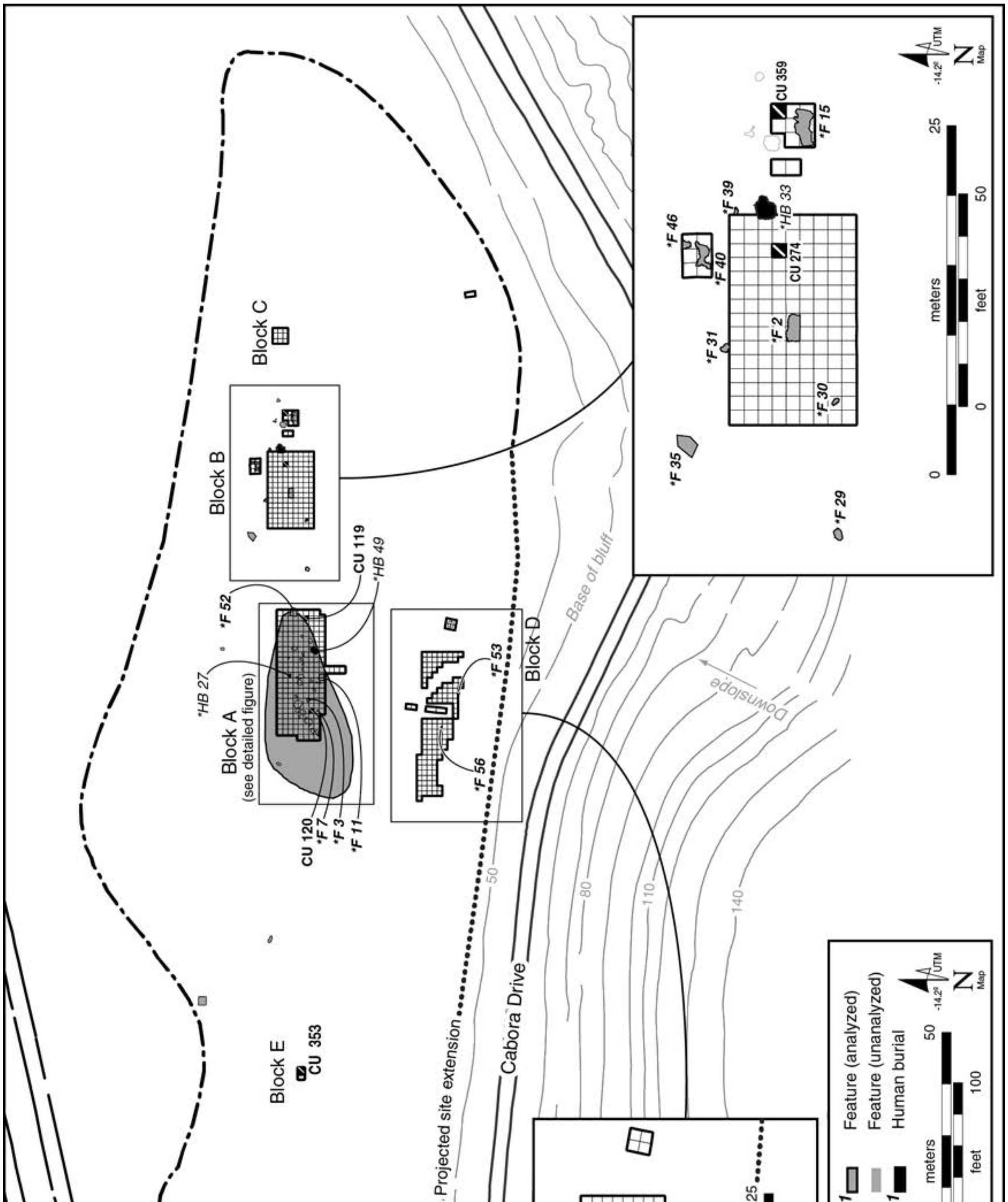


Figure 23. Map of LAN-211 showing analyzed contexts.

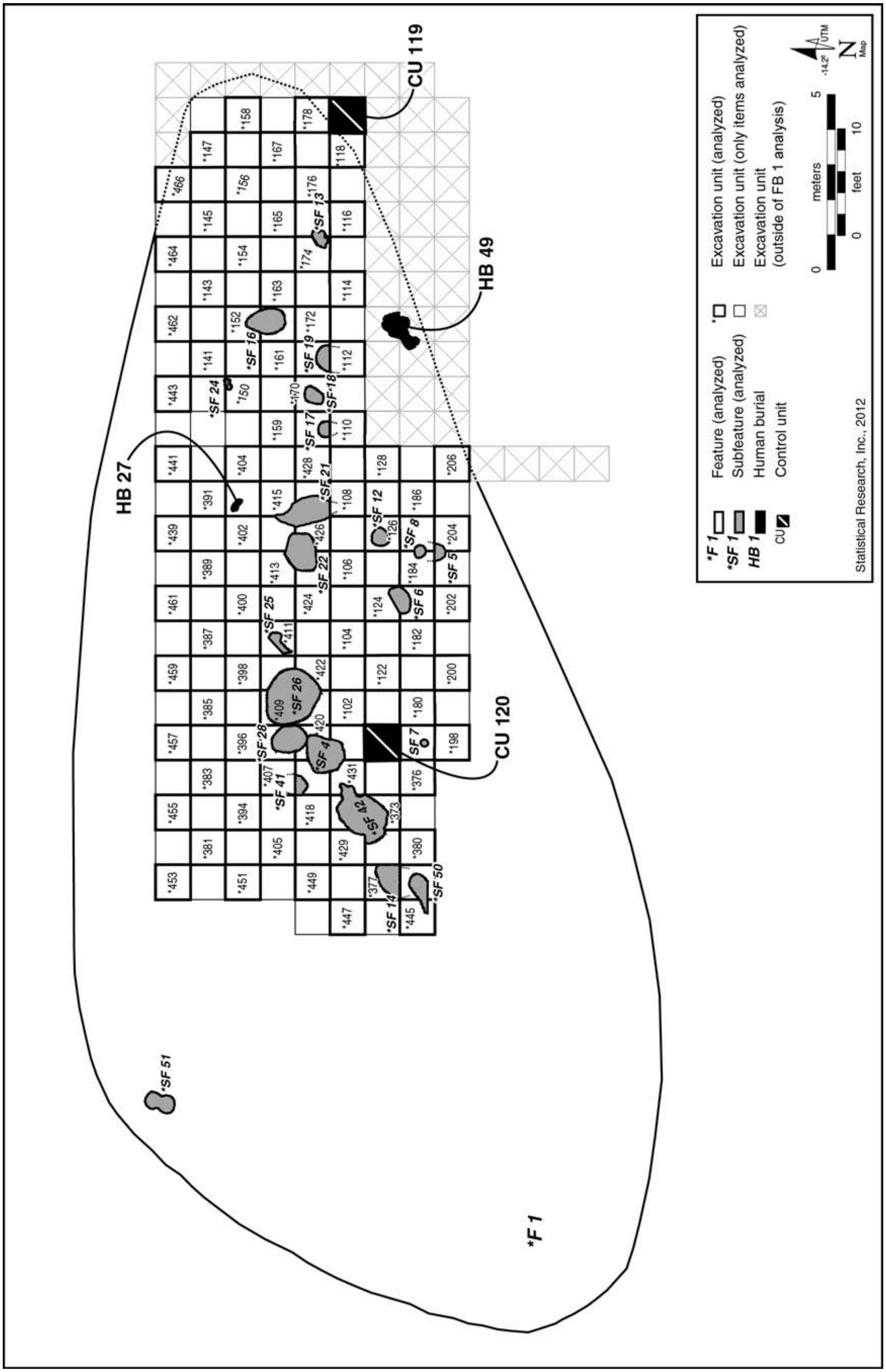


Figure 24. Excavation units and features inside FB 1 at LAN-211.

SRI implemented testing at two sites (also known as Runway sites) LAN-1932 and LAN-2676, and data recovery program only at LAN-2676. Archaeological testing at these sites suggested that they were intact sites with high potential to contribute significantly to the project's research questions (Altschul et al. 1998). Initial data recovery excavations, however, revealed that they were redeposited archaeological sediments. Further excavation was halted, and only small collections were recovered.

LAN-1932 is located along the Area D1/D2 boundary in the Playa Vista project area, slightly northeast of Locus D of LAN-62, northwest of LAN-211, and about 150 m northeast of the Ballona Escarpment. LAN-2676 is situated at the end of the old Hughes runway, near the intersection of Jefferson and Lincoln Boulevards and north of LAN-62, Locus G. Because of a lack of cultural integrity of deposits at these two sites, intensive analysis was not conducted. Our research goal for these sites was to determine how they might relate to the intact sites and from which sites they may have derived.

Contents of Volume 3

This PVAHP volume has two sections and 15 chapters. Section 1, comprising 7 chapters, presents the material-culture analyses, including flaked stone, worked shell, worked bone, basketry, glass beads, aboriginal ceramics, and European artifacts from the Mission and Historical periods. Chapter 2 (Lithic Artifacts, by Polly A. Peterson, Seetha N. Reddy, Kathleen L. Hull, Amanda C. Cannon, and Mark Q. Sutton) presents data on flaked, ground, and battered stone artifacts. Analysis and interpretations of worked shell from the PVAHP, including shell beads and other worked shell, are discussed in Chapter 3 (by Amanda C. Cannon). Worked-bone analysis is presented in Chapter 4 (by Janet L. Griffitts, Tina M. Fulton, and Justin E. Lev-Tov). In Chapter 5, Judith K. Polanich discusses the rich worked textiles and basketry remains recovered from the burial ground at LAN-62. Glass beads from Protohistoric and Mission period contexts are discussed in Chapter 6 (by Lester A. Ross, Scott H. Kremkau, Amanda C. Cannon, and John G. Douglass), and the small collection of aboriginal ceramics is summarized in Chapter 7 (by Christopher P. Garraty). The last chapter of Section 1 (by Karen K. Swope and John G. Douglass) discusses historical-period artifacts from the Mission and Historical period contexts. Some of these artifacts are Mission period from aboriginal contexts; others from more recent, early-twentieth-century contexts.

Section 2 of Volume 3 of this series is focused on subsistence and settlement and comprises six chapters. Chapter 9 (by Peter E. Wigand) presents the pollen data and interpretations of samples taken from archaeological contexts in the PVAHP and discusses both the paleoenvironment and human behavior related to plant use. Discussion of vertebrate remains from the five PVAHP sites is presented in Chapter 10 (by Justin E. Lev-Tov, Sarah Van Galder, and David Maxwell). In Chapter 11, Justin Lev-Tov presents data and discussion of aboriginal butchery practices based on a study of vertebrate remains from the Mission period contexts. An analysis of vertebrate fauna from early-twentieth-century deposits and their ethnic, economic, and industrial implications are presented in Chapter 12 (by Justin E. Lev-Tov and John D. Goodman II). Invertebrate remains are discussed in Chapter 13 (by Justin E. Lev-Tov, Sarah Van Galder, and Seetha N. Reddy). In Chapter 14, the study of carbonized seeds is discussed (by Seetha N. Reddy), along with a study of charcoal from LAN-62 (by John M. Marston). The final chapter in the volume, Chapter 15 (by Seetha N. Reddy and John G. Douglass), summarizes the main trends in the material-culture and paleodiet data and offers insight into significant contributions of the PVAHP to southern California archaeology.

Finally, it should be noted that artifacts from the PVAHP, with the exception of those from burial and burial-related contexts, have been curated at the Maxwell Museum at the University of California, Los Angeles (UCLA).

Lithic Artifacts

Polly A. Peterson, Seetha N. Reddy, Kathleen L. Hull, Amanda C. Cannon, and Mark Q. Sutton

Introduction

This chapter presents the results of the analysis of lithic artifacts recovered from the five sites in the PVAHP and the two Runway sites. The by-products of stone-tool manufacturing are some of the most ubiquitous remains in the archaeological record (Andrefsky 2009). This is definitely the case for the PVAHP, which yielded more than 60,000 lithic artifacts, including more than 50,000 artifacts from selected contexts that were analyzed (Table 1). These artifacts are the product of a complicated process involving the acquisition of raw materials, the production and use of tools, and the subsequent discard of expended tools. Stone artifacts were also used in a multitude of subsistence-related activities; in food processing; in the manufacture of wood, bone, and shell implements and ornaments; in ritual activities; and as items of personal adornment. Stone tools, therefore, provide a direct link to understanding how past people coped with the uncertainties of living.

The major goals of the study included elucidation of lithic technology, artifact function, artifact use history, long-term temporal change, and site function. Technological analysis was conducted to discern specific modes of lithic-material procurement and strategies for the manufacture of stone artifacts: How were lithic-procurement and -production activities integrated within settlement and subsistence systems? Was there potential participation in interregional exchange, and were there manufacturing preferences that might relate to cultural identity? Artifact function was delineated by detailed analysis of aspects of artifact morphology and use surfaces. Analysis of such data for a site, as a whole, as well as for selected features or areas in a site, can reveal the types and range of activities undertaken, providing insight into site structure and function (Hull 2005), can identify temporally diagnostic artifacts, and can address site chronology. Finally, detailed analysis considered additional artifact attributes that reveal artifact life history (see Schiffer et al. 2001).

This chapter first presents an overview of the lithic landscape of the Ballona and the larger region, identifying the availability, distribution, and qualities of the lithic resources potentially used by the Ballona inhabitants. Previous lithic studies in the Ballona are summarized to provide background and context to the reader. Then, brief summaries of analytical methods and terminology are presented, followed by detailed discussions of the lithic collections, presented by site (LAN-193, LAN-2768, LAN-54, LAN-62, and LAN-211). The interpretations are presented in the final section, addressing lithic technology, procurement, and exchange and site and feature function. Additional information on lithic analysis is provided in Appendixes B.1–B.78.

Lithic Landscape

The techniques for manufacture and the array of stone tools produced by the inhabitants of the Ballona were diverse. Individual tools might have served as projectile points, cutting or scraping implements, hammers, choppers, milling tools, or vessels. Others might have functioned in more than one capacity concurrently or in sequence over the lifetime of the tool. Given the diverse functions to which stone tools were applied and the three primary methods of shaping such objects (i.e., flaking, grinding, and battering), it is not surprising that material selection figured prominently in the process of stone-tool production and use. For example, only certain materials are suitable for flaking, and the durability or sharpness of particular materials may favor use of one type of implement rather than another. Conversely, although material selection was not arbitrary, it was constrained by availability, and therefore, artifact production and morphology were adapted to the local lithic environment (see Skinner et al. 1989).

Geological data suggest that the "lithic landscape" of the Ballona was diverse and readily available to the inhabitants of the Ballona, either directly or through fluvial transport from the mountains surrounding the Los Angeles Basin. Significantly, such diversity is not simply attributable to the "local" bedrock geology but also to the transport of diverse materials into the area by both natural and cultural means. A variety of sedimentary, igneous, and metamorphic deposits in and

Table 1. Summary of Lithic Artifacts Recovered from Analyzed Contexts, PVAHP

Site	Flaked Stone	Ground/Battered Stone	Unshaped Stone	Total	Percent
LAN-193	10,776	38	260	11,074	21.4
LAN-2768	3,631	22	1,045	4,698	9.1
LAN-54	363	9	504	876	1.7
LAN-62	9,811	798	3,297	13,906	26.8
LAN-211	19,772	402	1,095	21,269	41.0
Total	44,353	1,269	6,201	51,823	100.0

around the Los Angeles Basin were potentially accessible directly or through trade. Additionally, the hydrologic features of the basin—most importantly, the San Gabriel River and the Los Angeles River and its tributaries (Ballona and Centinela Creeks)—would have transported lithic materials from the surrounding Transverse Ranges to the Ballona area. Therefore, it was not sufficient merely to identify material preferences: it was also important to understand what materials were available in the local landscape, how cultural and natural transport might have affected material acquisition and production technology, and how both might have been integrated into the subsistence and settlement system. "Local delivery" of distant materials through natural means is significantly different from cultural acquisition, which carries further implications about mobility, territoriality, and group interactions.

Lithic Materials and Geological Distribution

The PVAHP sites are located in dune sand deposits, which border much of the coast from Centinela Creek to the Palos Verdes Hills (Jennings 1962). Thus, these sites are in a zone naturally lacking stone. Lithic deposits are also absent from the Pleistocene marine deposits that characterize the Baldwin Hills to the east and areas in Santa Monica and West Hollywood just south of the Malibu Coast Fault (Jennings 1962; Jennings and Strand 1969). Lithic materials were readily at hand, though, in much of the surrounding terrain of the Los Angeles Basin to the north and east, including the deposits along nearby Centinela and Ballona Creeks, as characterized by geologically recent alluvium consisting of clay, silt, sand, and gravel (Jennings 1962; Jennings and Strand 1969). In geological terms, these latter clasts encompass moderately to highly waterworn pebbles (between 4 and 64 mm in maximum dimension), cobbles (64–256 mm), and boulders (larger than 256 mm) with origins in the bedrock deposits of the Transverse Ranges surrounding the Los Angeles Basin. The headwaters of the Los Angeles River originate in the San Gabriel and Santa Susana Mountains, and the river flows southeast between the Santa Monica and Verdugo Mountains to the coast near the Ballona, transporting and depositing lithic materials along its course. Additionally, some pockets of Pleistocene nonmarine deposits in areas of the basin, such as downtown Los Angeles, also contain gravels or conglomerates that could have provided tool stone (Jennings 1962).

Because the clasts in the alluvial deposits in the immediate vicinity of the Ballona were far from their original source, they would have tended to be dominated by pebbles and cobbles. Cobbles gleaned from alluvial sources were suitable for the production of various lithic tools. Similarly, waterworn pebbles were employed for a range of tools. These relatively small and rounded clasts would have presented challenges for flaking; thus, the lack of acute angles for platforms and an absence of ridges to direct predictable flake removal would have influenced initial core-reduction strategies. For example, a pebble or cobble might have been split by freehand percussion or bipolar reduction to remove flakes from the interior, in contrast to initial core reduction by removing flakes from the entire natural, exterior surface. Moreover, such pebble or cobble reduction might have influenced the amount of dorsal cortex in the debitage. Conversely, pebbles and cobbles are more suitable for ground and battered stone technology. Water wear and water transport might have provided stone clasts of the roughly desired size and shape for tools, thereby minimizing production effort. As a result, we might anticipate little to no debris from the initial shaping of such implements, including initial flaking prior to shaping through pecking and grinding (Schneider 1993).

Chert, particularly Monterey chert, would have been carried to the Ballona in various forms, including waterworn pebbles reduced by bipolar percussion and tabular pieces with primary geologic cortex shaped into bifacial cores. These raw materials were most likely procured from the Santa Monica Mountains north of the Ballona or the Palos Verdes Hills to the south. The asphaltum from the La Brea Tar Pits was also very likely exploited by Ballona populations, and there were oil fields around the Ballona that could have provided additional sources of asphaltum.

Prospecting activities need not have been limited to alluvial deposits, and bedrock outcrops of sedimentary, igneous, or metamorphic stone were present in the general area around the PVAHP sites. The Transverse Ranges surrounding the Los Angeles Basin provide a diversity of material resources. To the north, the Santa Susana and Santa Monica Mountains are composed primarily of middle to late Miocene marine-sedimentary rocks, including sandstone, siltstone, conglomerate, and shale. Chert, sedimentary breccias, schist, and rare limestone are also associated with formations of this age in this area, and flow and pyroclastic Miocene volcanic rocks, such as breccias, tuff, andesite, and vesicular and porphyritic basalt, are also present.

By contrast, the San Gabriel Mountains to the northeast of the Los Angeles Basin are dominated by Mesozoic rhyolite and basalt as well as granitic rocks—including granite, granodiorite, quartz monozonite, and quartz diorite—and, to a lesser extent, gneiss. Older, Precambrian granitic rocks, including quartz-rich granite and gabbros, are also present in the northern portion of the San Gabriel Mountains. At the western end of the chain, pre-Cretaceous metasedimentary and metavolcanic rocks, such as graphite, biotite schist, quartzite, marble, serpentine, steatite, and rare limestone and dolomite, exist in the Pelona Schist. Similarly, the Verdugo Mountains, an offshoot range of the San Gabriel Mountains, are characterized by marble, quartzite, schist, gneiss, and granodiorite.

To the east of the PVAHP, in the Puente Hills, Miocene sandstone, conglomerate, siltstone, shale, and andesite tuff are present, and similar rocks are found extending to the south, at Newport Beach and beyond. To the southeast, the Santa Ana Mountains include Upper Jurassic marine-sedimentary and metasedimentary rocks as well as metavolcanic rocks of similar or somewhat earlier age. The latter include tuff, breccias, andesite agglomerates, and diabase, and the former include shale, slate, quartzite, greywacke, conglomerate, and limestone. The nearby Palos Verdes Hills are dominated by middle Miocene marine-sedimentary rocks, such as shale, chert, siltstone, sandstone, and conglomerate. Intrusive basalt and some metamorphic rocks, including schist and quartzite, are constituents of relatively minor formations also present in this area. The Del Rey Hills extend from the northernmost end of the Palos Verdes Hills to the southern edge of the Ballona, stand 125–150 feet above sea level, and are primarily composed of elongated slabs of chert and slate attesting to their marine origin (Van Horn 1987a:6).

The acquisition of nonlocal materials implies cultural exchange or group mobility through distant territories. Steatite was surely imported in finished form from the quarries on Santa Catalina Island (Heizer and Treganza 1944:302; Williams and Rosenthal 1993:27), located about 65 km (40 miles) across the channel from the Ballona. Quarry sites on Santa Catalina Island yielded miner's tools as well as all stages of steatite vessel production, from in situ blanks to preforms to debitage (Williams and Rosenthal 1993:27–29). Although another steatite source exists in Los Angeles County, near Palmdale (roughly 64 km [40 miles] away, in the San Gabriel Mountains), these highly schistose outcrops yield smaller, lenticular pieces of steatite unsuitable for production of large vessels but perhaps ideal for tablets and pendants (Rosenthal and Williams 1992:223, 225). Volcanics, such as tuff breccias, ash, and pumice, are also present, as is limestone, in the San Gabriel Mountains. Fused-shale sources are limited to Grimes Canyon (roughly 62.3 km [38.7 miles] distant) and Happy Camp Canyon in Ventura County and near Lompoc in Santa Barbara County (Figure 25) (Demcak 1981:26) (see Appendix B.1). Obsidian does not occur locally and was imported over great distances from the Coso volcanic field, Casa Diablo, and Mount Hicks sources (228.9–478.2 km, or 142.2–297.1 miles distant) in the Sierra Nevada to the northeast, as well as from Obsidian Butte (277.4 km, or 172.4 miles distant) to the southeast (see Figure 25), as known from geochemical trace-element analysis (see Appendix B.1). Additionally, obsidian from Mono Glass Mountain in the eastern Sierra Nevada has been recovered from the bluff-top site of LAN-63 (Hull 2005:8.54).

Analytical Methods and Terminology

The stone-artifact classification serves to identify different modes of manufacture, material preferences, and use histories. The first order within the classification addresses production, distinguishing three general technological classes: lithic items reduced by flaking, artifacts shaped by grinding and/or battering, and unshaped objects that have only been modified by use. Ground and battered items are considered together at this level because many such tools reflect shaping by both methods. For example, pecking might have been used to define the general shape of the tool, and grinding might have been used for final shaping or could have resulted from use. Unshaped objects reflect the expedient use of natural pebbles, cobbles, or tabular pieces, such as tarring pebbles or fire-affected rock (FAR) in thermal features. The details on the classification of flaked stone (including biface stages), ground stone, and unshaped stone are presented in Appendix B.2.

The second level in the classification that further addresses technology is artifact function. At this level, flaked stone items are divided into cores, debitage, and tools; debitage is unmodified debris resulting from flaked-stone-tool manufacture or use. Similarly, ground and/or battered stone implements are segregated into hafted and unhafted items; the latter class includes such items as milling equipment and pipes. Hafted ground or battered stone implements might include grooved axes, mauls, or other implements modified to attach a handle.

In the third order of distinction for classification and in lower orders, more-specific form and use details specify artifact function, stage in production, and use history. Flaked stone tools are further subdivided into bifacial and nonbifacial implements, reflecting the degree of investment in planning, design, and production for specific functions. At this level, a distinction also is made between hafted and unhafted bifaces; a hafted biface, such as a projectile point, exhibits modification on the proximal end for the purpose of attaching it to a handle or shaft. Likewise, in the nonbifacial group, flake tools are distinguished from core tools, as these two classes often represent disparate functions based on characteristics of use

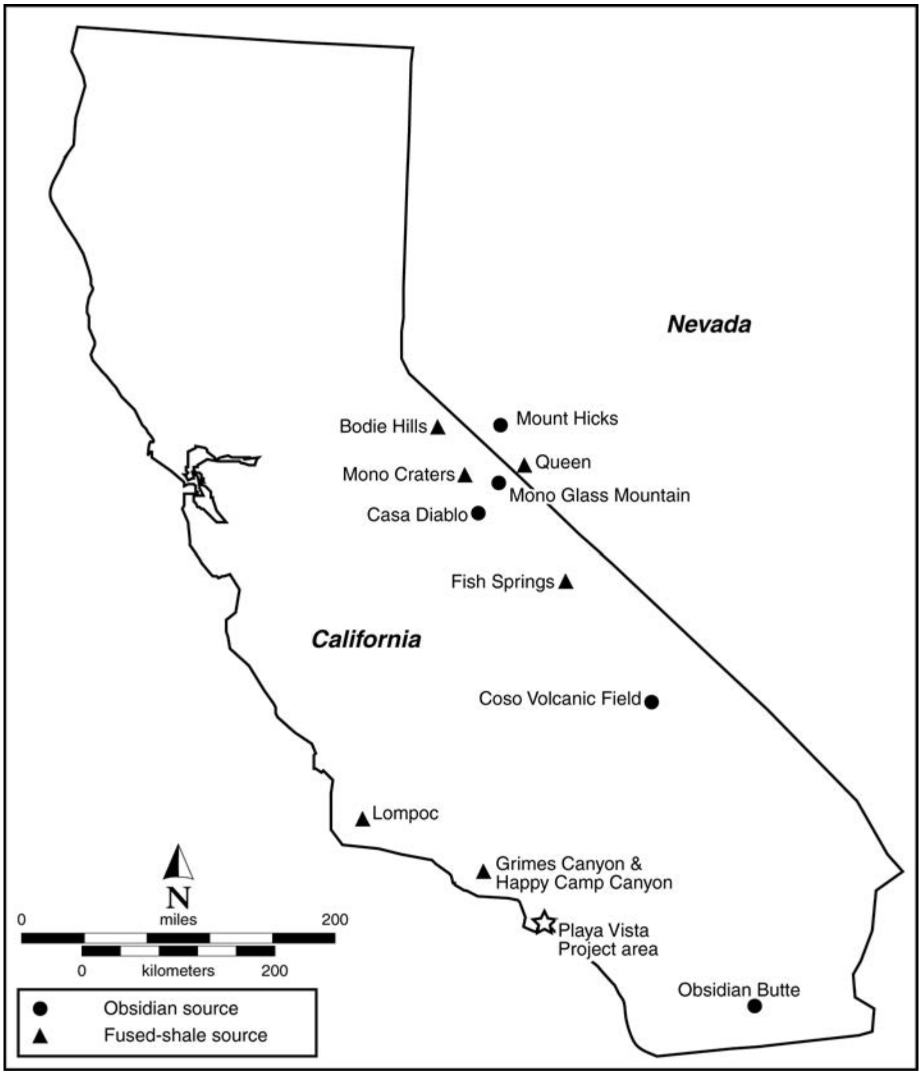


Figure 25. Map of the obsidian and fused-shale sources mentioned in the text.

edges, material qualities, or artifact size. A small flake scraper, for example, would have had a different function from that of a heavy chopping tool. In the class of unhafted ground and/or battered stone tools, implements used for grinding are distinguished from those used for pounding and from objects serving as vessels. Additionally, "other" unhafted artifacts are identified; this category encompasses objects lacking obvious utilitarian function, such as effigies.

Previous Lithic Studies in the Ballona

Substantial lithic collections were recovered during previous excavations in the Ballona (Van Horn 1987a; Van Horn and White 1997c). These early investigations provided a general picture of the artifacts and features present and an outline of the temporal components at each site. Such components were identified on the basis of lithic- and nonlithic-artifact collections, stratigraphy, and such chronological data as radiocarbon dates and obsidian-hydration results. Construction of a cultural chronology and, to a lesser extent, definition of site function appear to have been the major goals of earlier research.

Previous studies primarily described lithic artifacts, providing general morphological attributes and contributing to the definition of various functional categories or types of tools. In addition, a review of frequency, depth of recovery, and material type for most items in each of these categories is provided. Some fragmentary specimens were omitted from the analysis because of the reliance on morphology. Together, these data generally characterized the collections, defined components, and addressed site function. The reports presented only limited technological interpretations for selected artifact categories, such as cores and "potato" flakes (Van Horn 1987a:65–68, Figure 15). Behavioral interpretations beyond functional ascription—which was sometimes based on unspecified criteria—were rare. Still, these reports provided an important summary of the distribution and range of lithic artifacts at each site.

Other sites in the Ballona have also been excavated and their lithic collections documented (see Altschul, Homburg, et al. 1992; Altschul et al. 1999; Altschul et al. 2005; Grenda et al. 1994; Van Horn 1983, 1984; Van Horn and Murray 1984, 1985; Van Horn and White 1983). In some cases, discussions of the lithic artifacts were similar to those in early studies: primarily descriptive and only peripherally addressing technology or behavior. In other cases, the reports went beyond simple description and considered technology, exchange, and other research issues, and comparison of the lithic-analysis results for the current investigation with those of these other sites may add depth or context to our interpretations. Brief summaries of data from two groups of sites, the wetland sites and the bluff-top sites, are presented in Appendix B.3.

Projectile Point Typology

The classification of points is generally based on basic morphology: size is a primary criterion, and an important division between projectile point types is whether they were employed on spears (or lances), as darts, or as arrows. In California, complete points that weigh less than 3.5 grams are usually considered to be arrow points (Fenenga 1953), and larger specimens are considered to be either spear or dart points. The classificatory descriptions and criteria are presented in Table 2 and Figure 26. A large number (n = 282) of artifacts classified as projectile points was recovered from the five sites in the PVAHP and classified into various series and types (see Figure 26). The points include six dart-point series and three arrow-point series (Figures 27 and 28). The points were recovered from a wide range of contexts, including burials, excavation units, and nonburial features. As expected, most of the points were recovered from contexts dating to the Late and Protohistoric to Mission periods. Some points were recovered from contexts that indicate social conflict; for example, three points were recovered from a burial (Feature 305) at LAN-62 and had been embedded in the bones of an adult male.

The dating of projectile points is complicated. In general, spear points could date to any period, because spears were used throughout prehistory. Larger points are usually considered to have been used on darts in conjunction with the atlatl and are believed to date from the earliest times along the southern California coast until the introduction of the bow and arrow into the region about 1,500 years ago (Figure 29). Smaller projectile points used on arrows dominate projectile point assemblages dating to after that time. The PVAHP has implemented the tool typology illustrated in Figure 26.

Spear/Dart Points

Spear points are those thought to have been used on hand-held thrusting spears, weapons believed to have been employed as adjuncts to both atlatl and bow-and-arrow technology. Spear points tended to be large and long (there are no aerodynamic issues), but they were easily broken, and so their distal ends tended to be reworked, which resulted in a reduction in overall length and edge angle. The differentiation of points used on spears from those used on darts is sometimes difficult (therefore, they are included in a single category here).

Dart points are relatively large points thought to have been used with the atlatl, a weapons system generally predating the introduction of the bow and arrow. Most archaeologists believe that the different types of dart points can be used as time markers, and this practice is common (and followed herein). It has been argued, though, that dart points (e.g., Pinto and Elko series) have no real temporal significance (Flenniken and Wilke 1989; see also Schroth 1994), based on the fact that point types are identified by morphology and that it might be possible for a broken specimen of one "type" to be rejuvenated into another "type," thus confusing the temporal placement of such points. This led Flenniken and Wilke (1989; Wilke and Flenniken 1991) to propose that atlatl dart points should not be considered temporally sensitive within dart-point times. Although this position is not widely accepted (see Bettinger et al. 1991; O'Connell and Inoway 1994), it is clear that greater chronometric control is warranted. In total, nine spear/dart points were recovered from the PVAHP sites, including specimens classified as Silver Lake, Pinto, large side-notched, Humboldt, large contracting-stem, and Elko series.

Silver Lake

Silver Lake points are relatively small, stemmed, shouldered points presumably employed on thrusting spears (see Figure 27d). Silver Lake points are within the Great Basin Stemmed series generally associated with the Lake Mojave complex in the Mojave Desert (see Amsden 1937; Campbell et al. 1937) and the San Dieguito complex in southern California (see Rogers 1966; Warren 1967). Most researchers believe that the San Dieguito complex originated ca. 10,000 B.P. in the interior regions to the east (e.g., Lake Mojave in the Mojave Desert) and moved to the coast as the interior became drier (Kowta 1969:68; Warren et al. 1961:28; Warren and Pavesic 1963:420; see also Osborne 1958:48).

The earliest-dated evidence of San Dieguito on the southern California coast is in San Diego County, at the Harris site (SDI-149) (Warren 1966, 1967; Warren and True 1961) and the Agua Hedionda site (SDI-210) (Moriarty 1967; see also Erlandson et al. 2007:Table 4.1). Other San Dieguito components are known in the Los Angeles Basin and include Malaga Cove (LAN-138) (Walker 1937, 1951; Wallace 1984, 1985,

Table 2. Playa Projectile Point Series and Descriptions, by Category

Series and Type	Description	Metrics	Metrics Reference
	Spear/Dart		
Stemmed			
Silver Lake	relatively short stems, pronounced shoulders		Amsden 1937:84
Humboldt			
Concave base	lanceolate, unnotched, concave based, variable size	weight ≥1.5 g length ≥40 mm thickness ≥4.0 mm basal width/maximum width >0.90 basal indentation ratio <0.98	Thomas 1981:17
Pinto			
Unclassified	large, thick, shouldered, indented base	length ≥40 mm thickness ≥6.4 mm basal indentation ratio <0.98	Vaughan and Warren 1987:Table 1
Elko			
Corner-notched	large, thin, triangular, unindented base, notched corners	basal width >10.0 mm basal indentation ratio >0.93	Thomas 1981:20–21
Eared	large, thin, triangular, indented base, notched corners	basal width >10.0 mm basal indentation ratio ≤0.93	Thomas 1981:21
Large side-notched	large, with side notches	weight ≥1.5 g proximal shoulder angle >150°	Thomas 1981:18–19
Contracting-stem	large, with contracting stem	weight ≥1.0 g proximal shoulder angle ≤100° basal indentation ratio >0.97	Thomas 1981:23
	Arrow		
Marymount			
	small, shoulders (or tangs), commonly made of fused shale	weight ≤3.5 g length ≤40 mm	Van Horn 1990:29
Cottonwood			
Leaf-shaped	small, unnotched, rounded convex base	weight ≤1.5 g length ≥30 mm	Thomas 1981:16
Triangular straight base	small, unnotched	weight ≤1.5 g length ≥30 mm basal width/maximum width > 0.90	Thomas 1981:15–16
Triangular concave base	small, unnotched, shallow or deep indentation	weight ≤1.5 g length ≥30 mm basal width/maximum width > 0.90	Thomas 1981:15–16; Waugh 1988
Desert Side-notched			
	small, side notched, straight or concave base	weight ≤1.5 g basal width/maximum width >0.90	Thomas 1981:18

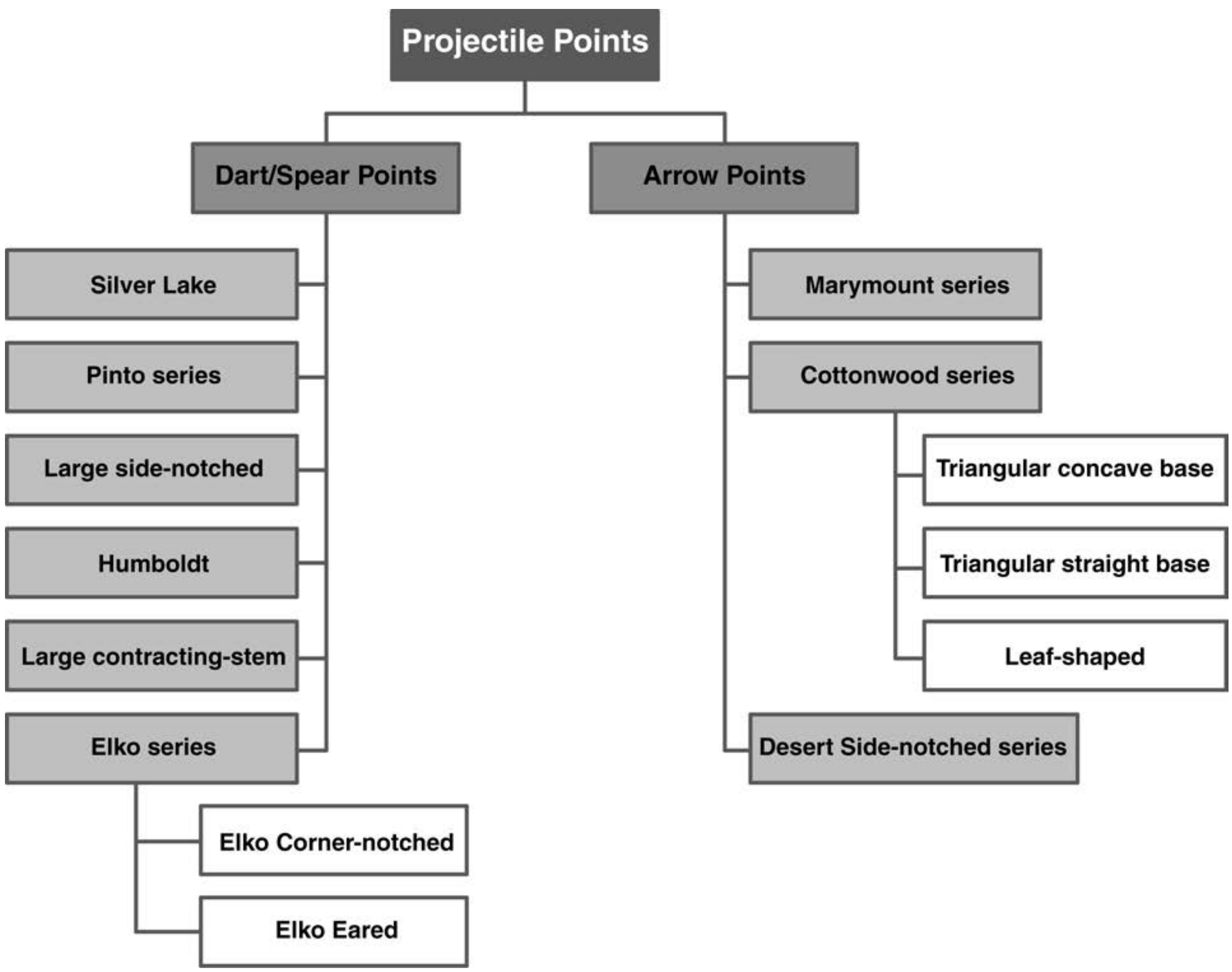


Figure 26. Projectile point typology for the PVAHP.

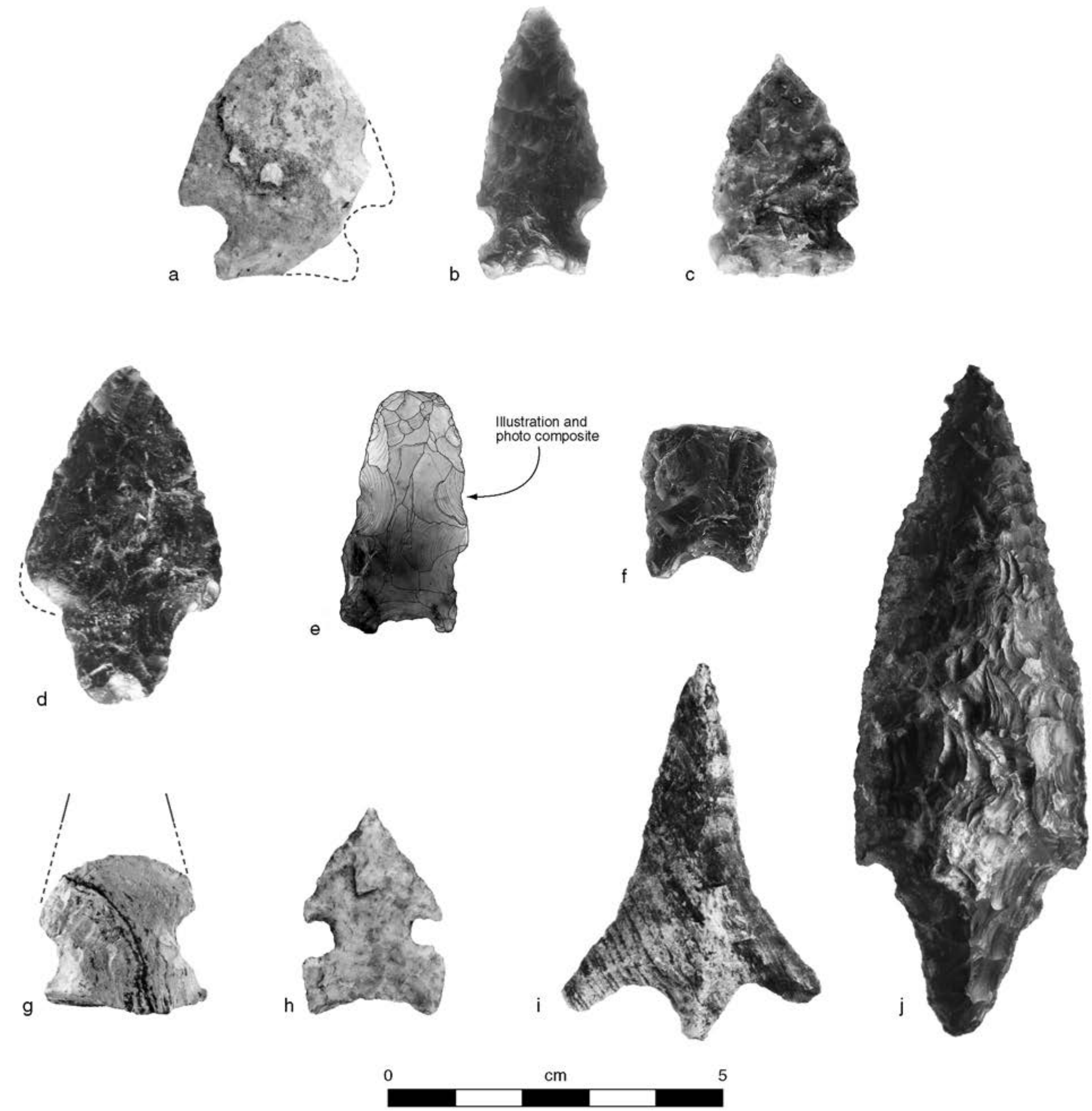
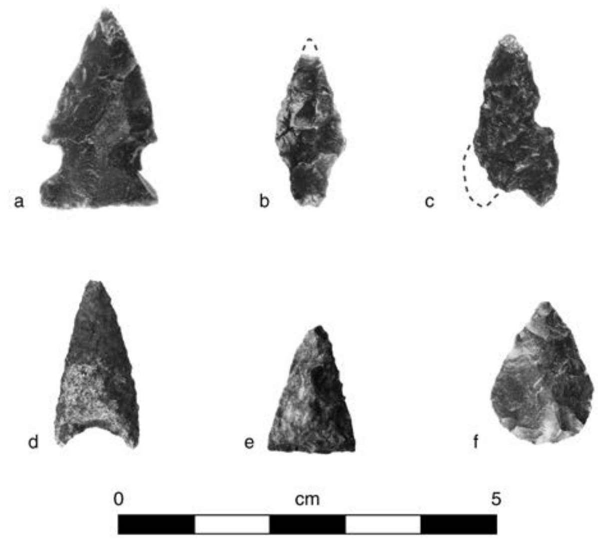


Figure 27. Dart/spear points recovered from the PVAHP: (*a*) Elko point, LAN-62, CU 321, Level 88; (*b*) Elko point, LAN-62, EU 180, Level 52; (*c*) Elko point, LAN-62, EU 324, Level 86; (*d*) Silver Lake point, LAN-62, burial Feature 461; (*e*) Pinto point, LAN-62, EU 937, Level 75; (*f*) Humboldt point, LAN-2768, Unit 33, Level 2; (*g*) large side-notched point, LAN-62, CU 111, Level 77; (*h*) large side-notched point, LAN-62, burial Feature 141; (*i*) contracting-stem point, LAN-62, burial Feature 38; (*j*) contracting-stem point, LAN-62, burial Feature 96.

Figure 28. Arrow points recovered from the PVAHP: (*a*) Marymount side notched, LAN-62, CU 1048, Level 96; (*b*) Marymount stemmed, LAN-62, EU 179, Level 49; (*c*) Desert side notched, LAN-211, EU 466, Level 65; (*d*) Cottonwood Triangular Concave Base, LAN-62, burial Feature 261; (*e*) Cottonwood Triangular Straight Base, LAN-62, burial Feature 274; (*f*) Leaf shaped Cottonwood Triangular, LAN-62, EU 450, Level 44.



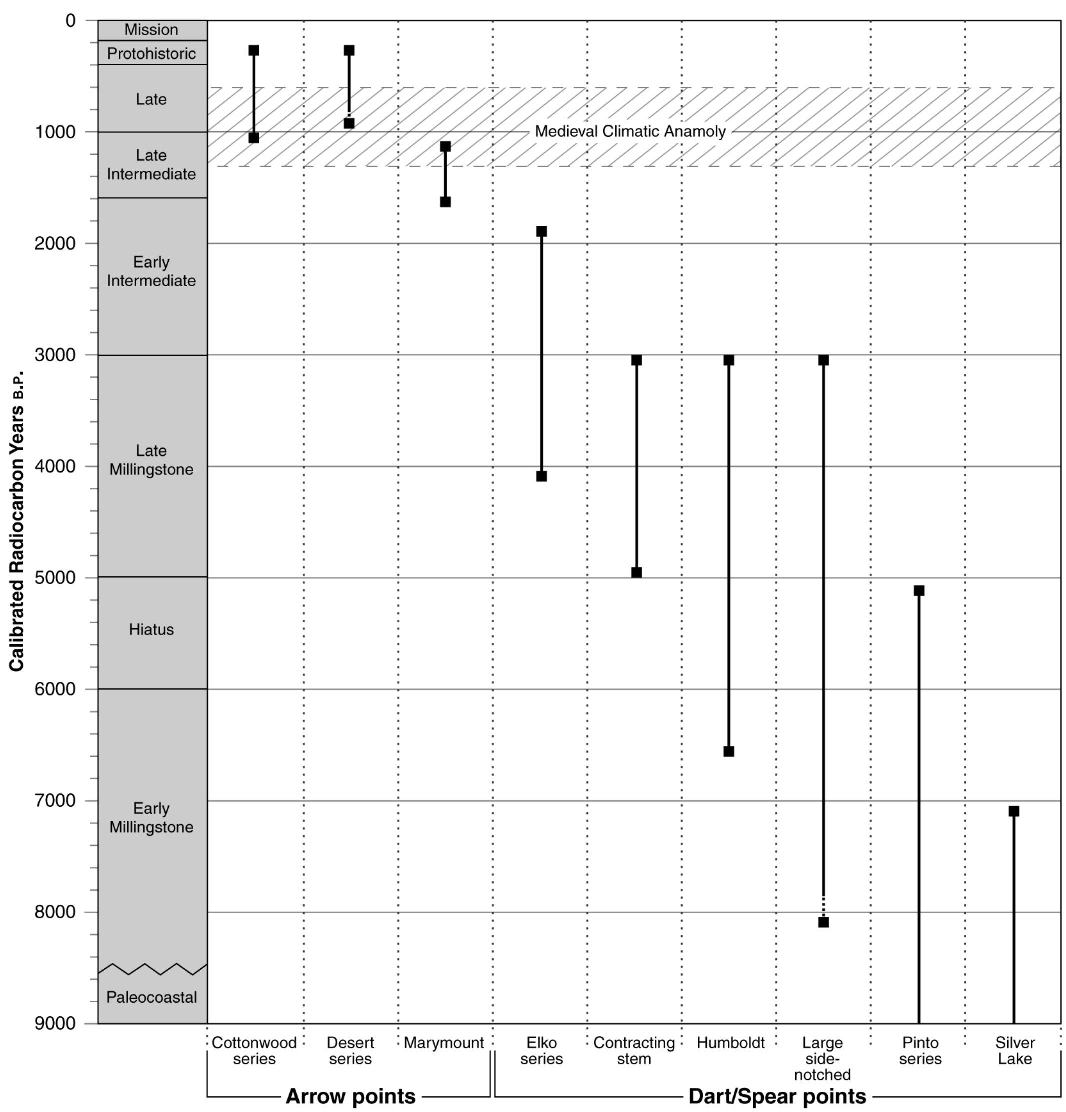


Figure 29. Arrow points and chronotypology.

1986; see also Moratto 1984:132; True 1987) and the Irvine site (ORA-64) (Drover et al. 1983; Macko 1998; see also Erlandson et al. 2005; Erlandson et al. 2007:Table 4.1, 60).

San Dieguito–like materials (e.g., stemmed points and crescents) were reported from several sites in the Ballona Creek area (LAN-61 [Lambert 1983:8, Figure 2; Van Horn and Murray 1985] and LAN-63 [Lambert 1983:8, Figure 5]), but the nature of these surface collections and the lack of dating prevent a good association with the San Dieguito complex. One Silver Lake point was reported from ORA-660 (Koerper et al. 1994:85), two were reported from ORA-667 (Koerper et al. 1994:94), and one other was reported from LAN-63 (Lambert 1983:8, Figure 5d).

Initially, the San Dieguito assemblage was characterized by an absence of milling tools (Warren 1967), but more recently, Warren et al. (2008) included milling tools in a Transitional Period II (San Dieguito–La Jolla), bringing the debate regarding San Dieguito (Paleoindian period) and La Jolla (Archaic period) to a new juncture. Now, the debate centers on whether there is a transition between San Dieguito and La Jolla and, if so, whether it is related to population replacement, acculturation, or transformation (Gallegos 1987; Grenda 1997; Warren 1987; Warren et al. 2008).

A single fragment of a Silver Lake point made of obsidian was recovered from LAN-62 (see Figure 27d) and was associated with burial Feature 461. The presence of this point type may add some support to the idea that there was a San Dieguito component in the Ballona area. The implications of this find and its interpretive value are discussed at the end of the chapter.

Humboldt Series

Humboldt series points, first defined by Heizer and Clewlow (1968), are relatively long and robust points, generally with a deep concave base (see Figure 27f). Humboldt series points have a long temporal span in the Great Basin, and presumably in coastal southern California, beginning by at least 5000 B.P. (Heizer and Hester 1978:2–3; Thomas 1981:36–37) and perhaps even persisting into post-contact times (Thomas 1981:37; see also Bettinger 1978; Green 1975). It is possible that these are not projectile points at all but, instead, knives. Similar specimens, apparently knives, are known from ethnographic collections (cf. Fowler and Matley 1979:Figure 56), and they may have functioned as knives in antiquity, as well. Alternatively, they may have been used on thrusting spears.

Humboldt points have been identified in Orange County in contexts dated between 6324 and 3580 B.P. (Koerper et al. 1994:98). Three specimens were reported from the Landing Hill sites (ORA-262 and ORA-263) (Cleland et al. 2007:193) in contexts dating between ca. 5500 and 3000 B.P. (Cleland et al. 2007:329). Together, these dates suggest that Humboldt series points may be limited to middle Holocene contexts along the southern California coast. One fragment of a Humboldt Concave base point or blade was recovered from LAN-2768, CU 33, Level 2, during stripping.

Pinto Series

Pinto series projectile points are relatively large, thick, shouldered points with indented bases (see Figure 27e). They were first defined at the Pinto Basin site (Campbell and Campbell 1935; see also Rogers 1939) and were later recovered at the Stahl site (Harrington 1957), both in the Mojave Desert. Vaughan and Warren (1987) suggested that Pinto points probably constitute a series with several types and further suggested that the Pinto points from the Mojave Desert were morphologically and technologically different from those identified from other parts of the Great Basin.

Pinto series points are generally thought to date to the Pinto complex, ca. 9,000–5,000 years ago (Heizer and Hester 1978; Sutton et al. 2007; Warren 1984). A major problem in delineating the Pinto complex in the Mojave Desert is the continuing disagreement regarding the formal definition and dating of Pinto series points (see Schroth 1994; Thomas 1981; Vaughan and Warren 1987; Warren 1980). Both the Pinto Basin and Stahl sites were reinvestigated (Schroth 1994) in an effort to resolve some of the problems surrounding the classification of Pinto points. Schroth (1994:374–375) concluded that Pinto points should not be used as an "index fossil" for anything other than marking dart-point times (ca. 10,000–2000 B.P.). Most researchers, though, continue to use Pinto points as an index fossil for the Pinto complex in the Mojave Desert (see Sutton et al. 2007:238).

In the Los Angeles Basin, Pinto points are uncommon but are known from several sites in Orange County (Koerper and Drover 1983:14; Koerper et al. 1994:98; Macko 1998:103; Marshall 1979:Figure 2j). Pinto points are more common in early Millingstone period sites further inland (Horne and McDougall 2007; Kowta 1969:39; McDougall 2001), although a few are also known along the San Diego coast (e.g., at Whelan Lake [SDI-6010]) (Vanderpot et al. 1993). In the Ballona area, Pinto points have been identified on the bluff tops at LAN-61 (Lambert 1983:10, Figure 2; Van Horn and Murray 1985:96–97), LAN-63 (Lambert 1983:10, Figure 5), and LAN-64 (Lambert 1983:10, Figure 6). Lambert (1983:10) suggested that the Pinto points from these sites were made of stone obtained from the eastern deserts.

One Pinto point was recovered from Loci C and D (CU 937, Level 75) at LAN-62. The specimen is complete but not well flaked, suggesting that it is unfinished. Its "rough" morphology makes it impossible to classify further. The specimen was made of chalcedony from an unknown source. Such materials occur in the mountains and deserts to the northeast and east and in the nearby Palos Verdes Hills marine-sedimentary formation just a few miles to the south. Nonetheless, the presence of Pinto series points appears to indicate an early occupation at LAN-62 (see Figure 29).

Elko Series

Elko series points are large, thin, triangular points with notched corners (see Figure 27a–c). The Elko series was originally defined by Heizer and Baumhoff (1961; see also Heizer and Hester 1978:5–7; Thomas 1981:32–33), and specimens are commonly recovered at southern California sites, though rarely in large numbers (but see McDonald et al. 1987). Three types of Elko points are generally recognized: Elko Eared, Elko Corner-notched, and Elko Side-notched (but the merit of the last type was questioned by Thomas [1981:30]). A fourth type, Elko Contracting-stem, is usually included with large contracting-stem points (see below). Elko series points generally date to between 4000 and 1500 B.P. (cf. Bettinger and Taylor 1974; Heizer and Hester 1978).

Elko points are known from a number of sites in Orange County (Cleland et al. 2007:191, 193; Koerper and Drover 1983:10, 12; Koerper et al. 1994:Table 3). Elko points have also been identified in small numbers at LAN-61 (Lambert 1983:Figure 3).

Five examples of Elko series points were recovered, all from LAN-62. Two types are represented, including four Elko Corner-notched and one Elko Eared. The first corner-notched specimen, complete and made from chert, was recovered from CU 318, Level 63. The second corner-notched specimen, a fragment made from chert, came from CU 117, Level 79. The third corner-notched specimen was also a fragment made from chert, and it came from CU 321, Level 88. The fourth corner-notched specimen was found in CU 324, Level 86; it was complete and was made from chalcedony.

Large Side-Notched

Large side-notched points include a variety of large points with notches on the sides of the blade (see Figure 27g–h). The Northern Side-notched type is perhaps the most well-known; it was first identified by Gruhn (1961) in the northern Great Basin, is commonly considered to date from the early Holocene to perhaps as late as 3000 B.P. (Heizer and Hester 1978:13), and is a poor time marker. Thomas (1981:30) classified such points into a more general category of "large side-notched" and noted that they were very rare in the central Great Basin.

Relatively few large side-notched points are known in southern California (see Koerper and Drover 1983; Koerper et al. 1994; Macko 1998:103). In the Ballona area, large side-notched points have been identified at several sites, including LAN-61 (Lambert 1983:Figure 3; Van Horn and Murray 1985:99), LAN-63 (Lambert 1983:Figure 5; Van Horn 1987a:93, Figure 29), and LAN-64 (Van Horn 1987a:247).

Two large side-notched specimens were recovered from LAN-62. The first is a complete chert point and was recovered from a burial (Feature 141). The second is a fragmentary chert point found in CU 111, Level 77. These specimens were initially classified as different types (Northern Side-notched and Fish Slough Side-notched, respectively), but we hesitate to use those designations to describe them, so as to avoid any assumption of cultural contact with the northern Great Basin. However, it now seems apparent that an interaction sphere (the Western Nexus) (see Sutton and Koerper 2009) existed between the southern California coast and the northwestern Great Basin during the middle Holocene, making it possible that such contact did occur.

Contracting-Stem Points

Contracting-stem points are relatively large points (see Figure 27i). A variety of contracting-stem points is known from coastal southern California. Contracting-stem points are often classified within the Gypsum series (following Heizer and Hester [1978:13], but see Thomas [1981:35]), as Elko Contracting-stem, or as Vandenberg Contracting Stem (see also Justice 2002:241–275). The Gypsum and Elko series generally date to between 4000 and 1800 B.P. in the Mojave Desert (Sutton et al. 2007:241), and other contracting-stem forms (e.g., Vandenberg) generally date to the same time. Along the coast, large contracting-stem points are considered by some (e.g., Harrison 1964; Moratto 1984:137–138) as markers of the Hunting culture or Campbell tradition. Thus, such points could date from late Millingstone to early Intermediate period times.

A number of contracting-stem points (often called Gypsum) have been identified in Orange County (Koerper et al. 1994:Table 3; Macko 1998:103), but this type of point is not common. One Vandenberg Contracting Stem point was found at Landing Hill (Cleland et al. 2007:193). Other contracting-stem points (called Gypsum) have been identified on the Ballona bluff tops at LAN-61 (Lambert 1983:Figure 2; Van Horn and Murray 1985:95–96), LAN-63 (Lambert 1983:Figure 5; Van Horn 1987a:96–97, Figure 31), and LAN-64 (Lambert 1983:Figure 6; Van Horn 1987a:247, Figure 92).

Four contracting-stem points were recovered from LAN-62. The first example is a very large, complete chert point discovered in association with burial Feature 96. This specimen is morphologically similar to one reported from LAN-63 (Lambert 1983:Figure 5p). The second contracting-stem point is a fragmentary chert point found in EU 162, Level 52. The third specimen was found in EU 425, Level 58, was incomplete, and was made from chert. The fourth contracting-stem specimen was a large, complete chert point discovered in association with burial Feature 38. This example has large, flaring "ears" and could be classified as a Vandenberg Contracting Stem point. Two additional contracting-stem points were found at LAN-2768. The first was found in EU 50, Level 2, during stripping; it is fragmentary and was made from chert. Asphaltum was noted on the base of this specimen, demonstrating that it had been hafted. The second specimen was also found during stripping, in EU 52, Level 2.

The distribution and association of spear/dart points in the PVAHP and their recovery from burial contexts will be discussed at the end of the chapter. Their recovery from Protohistoric to Mission period burials suggests that they may have been scavenged from earlier sites, perhaps the neighboring bluff-top sites. Alternatively, the dart points could be indicators of earlier components at the PVAHP sites and are in secondary contexts in the burial midden.

Arrow Points

Small projectile points weighing less than 3.5 grams (Fenenga 1953) are generally classified as arrow points and are believed to reflect use of the bow and arrow. It seems unlikely that the bow and arrow abruptly replaced the atlatl; the two weapons systems probably coexisted for some time (Yohe 1998:49). The bow and arrow diffused into the Mojave Desert from the north in about 1500 B.P. (Yohe 1998:27). The arrow points of that time in the Mojave Desert are of the Rose Spring series.

It is assumed that the bow and arrow diffused into coastal southern California from the Mojave Desert at about the same time (but see Koerper, Schroth, et al. 1996). Assuming that the bow and arrow came from the Mojave Desert and that Rose Spring series points were the earliest arrow tips, it seems logical to suggest that Rose Spring points should have accompanied the bow and arrow into coastal southern California. However, very few Rose Spring series points have been identified in coastal southern California (but see Koerper, Schroth, et al. 1996), suggesting that some other point type was employed on the coast or that the bow and arrow entered the coastal areas later. Koerper, Schroth, et al. (1996) proposed that the earliest arrow points in coastal areas might simply be smaller versions of the atlatl points in use prior to the introduction of the bow and arrow. Perhaps a coastal variant of the Rose Spring series was the earliest arrow point. Marymount points (Van Horn 1990) appear to be the best candidates for this transition.

Note that Koerper, Schroth, et al. (1996) regarded the appearance of Cottonwood points in coastal southern California as an indication of the introduction of the bow and arrow This seems unlikely, because Cottonwood points date to after ca. 1000 B.P., probably too late to mark the initial entrance of the bow and arrow. Sutton (2009:53) has suggested that Cottonwood points could mark the appearance of the bow and arrow in interior southern California.

Marymount Series

The Marymount point series was defined by Van Horn (1990; Freeman and Van Horn 1987a, 1987b) as arrow points "distinctive by form and material" (Van Horn 1990:29). Marymount points are small (less than 40 mm) and light (generally under 3.5 g), have shoulders or tangs, and are made of fused shale (see Figure 28a–b). Van Horn (1990:33), using data from a number of sites in southern California, dated the occurrence of Marymount points to "principally between A.D. 400–500 and 1000–1100" (ca. 1600–900 B.P.). The overall dating and description of Marymount points (all those illustrated by Van Horn [1990:Figures 1 and 2]) are very similar to those of specimens of the Rose Spring series, as recognized by Van Horn (1990:33), who suggested that "Marymount points should probably be regarded as a regional variant of a more widespread arrowhead type." Thus, Marymount points should be considered a southern California coastal variant of Rose Spring (Van Horn 1990:35). Van Horn (1990:29, 32–33) reported examples of Marymount points from a number of sites in southern California (see also Koerper, Schroth, et al. 1996).

Unlike their Rose Spring counterparts, Van Horn (1990:29) noted that Marymount points were "usually manufactured from fused shale" from the Grimes Canyon formation. Several examples of Marymount points from PVAHP sites were made from Monterey chert, perhaps from a nearby source at San Pedro/Palos Verdes Hills, further expanding the materials used for this type.

A few examples of Marymount points made of obsidian (assumed by Van Horn to be from the Coso volcanic field) were noted, as well as one from chert. Note that Marymount points were made primarily from raw materials available in coastal areas and Rose Spring points were made of inland-area raw materials. Citing the presence of obsidian specimens (combined with an absence of obsidian cores and debitage) at the Hughes (LAN-59) and Marymount (LAN-61A) sites, Van Horn (1990:34) suggested that obsidian Marymount points were traded into coastal areas in finished form, perhaps already hafted onto arrows. This suggestion is contradictory to the idea that Marymount points are of coastal origin (but the contradiction might be resolved through formal sourcing of the obsidian).

It seems likely that the appearance of Marymount points in coastal southern California marks the diffusion of the bow and arrow into the region about 1,500 years ago. If so, Marymount points would be marker artifacts for the inception of the late Intermediate period. Some scholars (e.g., Koerper et al. 2002:63–64) have suggested that the arrival of bow-and-arrow technology may reflect the Takic arrival into southern California, mirroring an argument by Van Horn (1990:35), who suggested a connection between Marymount points and Takic groups. It seems much more likely that Takic groups were already present when the bow and arrow diffused into the region (Sutton 2009), though, making Marymount points a temporal, but not an ethnic, indicator.

The distribution of the Marymount series appears to be fairly restricted to the Los Angeles coastal area (see Koerper, Newman, et al. 1996). If Marymount points reflect the entrance of the bow and arrow into the region and their distribution is limited, it is possible that the distribution of the bow and arrow was limited, at least until the widespread appearance of Cottonwood series arrow points in coastal areas in about 1000 B.P. Indeed, Sutton (2009:53) suggested that the bow and arrow did not diffuse into areas east of Los Angeles until 1,000 years ago.

It is also possible that Marymount points represent a technology specific to a new or different subsistence practice. It may be that Marymount points (as arrow points) mark a change in subsistence practices, perhaps an increased use of terrestrial resources (e.g., artiodactyls). Conversely, they could reflect an increase in the exploitation of aquatic resources (e.g., fish and sea mammals). Finally, the replacement of Marymount points by Cottonwood points could reflect a similar situation. In total, seven Marymount points were recovered from analyzed contexts in the PVAHP.

Cottonwood Series

The Cottonwood series consists of small, thin, unnotched points that are generally triangular or lanceolate (see Figure 28d–f). The series was first formally defined by Lanning (1963:252–253; see also Heizer and Hester 1978:11; Riddell 1951:17; Riddell and Riddell 1956:30; Thomas 1981:16–17), who identified two major types: Cottonwood Leaf-shaped and Cottonwood Triangular. Lanning (1963:252; see also Riddell 1951:Figure 1; Waugh 1988) further divided the triangular type into three major base forms: straight, concave, and convex. The convex classification seems to have been rarely employed by archaeologists, and it seems that such forms have usually been assigned within the leaf-shaped type. A third Cottonwood type, Cottonwood Bipointed, was proposed by Heizer and Clewlow (1968:64; see also Lanning 1963:253), but the examples provided (Heizer and Clewlow 1968:Figure 7i–m) could easily be classified as Cottonwood Leaf-shaped. Cottonwood series points generally date to after 1000 B.P. in southern California (Koerper, Schroth, et al. 1996) and mark the beginning of the Late period (ca. 1000–150 B.P.). Lanning (1963:276) observed that the Cottonwood types from the northwestern Mojave Desert were "both nearly identical to common south coast types, though the coastal specimens are of chert rather than obsidian." In order to distinguish coastal from desert contexts, Marshall (1979:24; see also Koerper and Drover 1983:16; Koerper, Schroth, et al. 1996) proposed that the label "Coastal Cottonwood" be used for coastal specimens.

Heizer and Hester (1978:11) noted that Cottonwood points tended to co-occur with Desert Side-notched points in the Great Basin, but the two series have an uneven distribution in the Mojave Desert and in southern California. Desert Side-notched points are present in quantity in the southern Sierra Nevada and in the Mojave Desert north of the Mojave River but are rare in the western Mojave Desert and south of the Mojave River (Sutton 1988, 1989). Cottonwood types are the dominant, and sometimes the exclusive, points found along and to the south of the Mojave River. This pattern appears to extend well south into coastal southern California, where Cottonwood types dominate and Desert Side-notched forms are rare (Koerper, Schroth, et al. 1996). Interestingly, the geographic extent of the dominance of Cottonwood types appears to correspond with ethnographic Takic territory (see also Sutton 1989, 2009).

The Cottonwood types may vary sequentially in time. The leaf-shaped type, Lanning (1963:276) argued, was earlier than the triangular type and ranged from "very small arrow points to large dart points," the smallest of the type dating to the Protohistoric and Historical periods. Koerper, Schroth, et al. (1996) later made the same argument for coastal southern California. Lanning (1963:276) suggested that the triangular type, "especially the concave-base variety, is limited to protohistoric and historical-period times on the south coast" of California. Based on triangular examples from northern San Diego County, Waugh (1988:112) proposed that the "deep" concave-base variant dated to later than the other triangular forms. In summarizing a sequence of Coastal Cottonwood types, then, the leaf-shaped type would have originated first, followed by contemporaneous straight-base and shallow-concave-base forms and then, lastly, by deep-concave-base forms. Each of the types and varieties would have persisted until contact.

Cottonwood points of various types have been found in large numbers from late contexts in southern California (Koerper and Drover 1983; Koerper, Newman, et al. 1996). However, Cottonwood types were rare at LAN-61 (Lambert 1983:12; Van Horn and Murray 1985:100), LAN-63 (Van Horn 1987a:92), and LAN-64 (Van Horn 1987a:246), most likely because these sites primarily date to the Intermediate period and thus predate the use of these points.

The Cottonwood Leaf-Shaped Type

The Cottonwood Leaf-shaped type consists of small, thin, unnotched points with convex sides and rounded, convex proximal ends (Lanning 1963:253; Thomas 1981:16) (see Figure 28f). As noted above, it seems that the leaf-shaped type may be earlier than the triangular type, perhaps earlier than once believed. Because Rose Spring or Marymount series points seem conspicuously absent from the Orange County region, Koerper, Schroth, et al. (1996) suggested that the earliest arrow points in coastal areas of southern California may have been smaller copies of dart points. If the earliest Cottonwood type was leaf-shaped and was fashioned after a leaf-shaped dart point, it may be that some of the "large" leaf-shaped bifaces now classified as arrow points (see Justice 2002:Figure 33) were actually dart points. In fact, Lanning (1963:276) thought that some of the larger leaf-shaped forms at the Rose Spring site were dart points. Perhaps large leaf-shaped dart points preceded Marymount (cf. Rose Spring) arrow points in coastal southern California (see Van Horn 1990:35). Thus, it seems possible that the earliest forms of Cottonwood arrow points along the southern California coast were smaller versions of an existing large leaf-shaped dart point (see Koerper, Schroth, et al. 1996).

Justice (2002:363–366) proposed the existence of a "Malaga Cove Leaf" point with a rather extensive distribution across much of southern and central California (Justice 2002:Map 41). Many of the examples offered by Justice (2002:Figure 33) appeared to be neither Cottonwood Leaf-shaped arrow points nor leaf-shaped dart points (see discussion above). We believe that any such large examples from the Ballona area should be classified as bifaces.

Van Horn and Murray (1985:94–95, Figure 34) identified a large number of "small leaf-shaped points with tangless convex bases" (some of which were serrated) from their excavations at LAN-61—points they classified as "Canaliño" (Freeman and Van Horn 1987a, 1987b; see also Van Horn 1987a:88–91, 245–246, Figures 25 and 26; Van Horn and Murray 1985:94). Many of these points were small enough to be arrow points (i.e., less than 3.5 g) (see Fenenga 1953), and a number of others were larger and were called dart points (Van Horn and Murray 1985:94). Justice's (2002:375–376) description of Canaliño points as concave base confuses the issue still further.

The designation of "Canaliño" has been used to describe the prehistoric Chumash culture after about 4000 B.P. (e.g., Moratto 1984:139); so, Canaliño points have been specifically linked with Chumash groups. In fact, Van Horn and Murray (1985:94) noted that another name for Canaliño points was "Chumash" points. "Canaliño" is no longer employed as a term to describe the Late period Chumash (see Gamble and Russell 2002; Glassow et al. 2007), and although the term could still be used as a classification for small leaf-shaped points, we prefer not to use it, because it could still be seen by some as an ethnic assignment.

The smaller points identified as Canaliño by Van Horn and Murray (1985) and Van Horn (1987a) fall very comfortably within the Cottonwood Leaf-shaped type. However, the original definition of the Cottonwood Leaf-shaped type (Lanning 1963:253, 276) included some larger specimens that are probably dart points, and some of the Canaliño points identified by Van Horn and Murray (1985:94) fall into the dart-point category. Having one type that can be either a dart point or an arrow point is confusing. Thus, in this report, the smaller leaf-shaped arrow points are classified as Cottonwood Leaf-shaped, and the larger specimens are classified as bifaces. Other researchers have avoided this problem by calling all of their leaf-shaped specimens "unclassified leaf-shaped" (e.g., Cleland et al. 2007:Figure 13.17). The PVAHP yielded 46 leaf-shaped Cottonwood Triangular points, the majority of which were recovered from LAN-62 (Figure 30). Variation and similarity in these points recovered from the project are discussed at the end of the chapter.

As an aside, a small number of the Cottonwood Leaf-shaped points were strikingly similar to one another: "teardrop-shaped" and very similar in size. Unfortunately, this pattern was not noted until the latter stages of the lithic analysis and so cannot be properly quantified or explored (because many of the specimens were from mortuary contexts and have now been reinterred). Nevertheless, we offer a few very preliminary observations below for future research. Other examples of "teardrop" points from Orange County were illustrated by Koerper and Drover (1983:15–16, Figure 8m; see also Justice 2002:Figure 33.3).

The uniformity of these points from the PVAHP sites suggests some sort of specific production technique or narrow mental template. Some of the points appeared to have been made from flakes derived from small pebbles. It is possible, then, that these points are the result of a specific pebble-reduction sequence that generated uniformly shaped points.

Figure 30. Leaf-shaped Cottonwood Triangular points recovered from the PVAHP.

Another possibility is that their shape was intended to fulfill a specific function. Of interest is the fact that a number of these specimens were found to have had a single, small pressure flake removed from near the tip. Many of these specimens were discovered in association with burials, leading to the suggestion that they may have been ritually "killed" (by the flake removal) and used specifically in mortuary ceremonies (see also Whittaker 1987).

A third possibility is that these points were intended for a specialized economic function—for example, fishing. It is possible that protein-residue analysis could be employed to test this proposition with future collections of points.

The Cottonwood Triangular Type

Lanning (1963:252) identified three basic varieties of Cottonwood Triangular: straight base, concave base, and convex base (Figures 31 and 32). Most researchers would now classify most Cottonwood points with convex bases as Cottonwood Leaf-shaped (see above). Cottonwood Triangular points are described as triangular, straight sided (often asymmetrical), relatively thin, and relatively long (Lanning 1963:252; Thomas 1981:16) (see Figures 31 and 32). The triangular type is generally viewed as dating later than the leaf-shaped type and dates to after about 700 years ago (Thomas 1981:15). However, Koerper, Schroth, et al. (1996) suggested that Coastal Cottonwood points were as early as 1350 B.P., providing a convenient indicator of the end of the Intermediate period and the beginning of the Late period.

Based on an analysis of a number of Cottonwood Triangular specimens from northern San Diego County, Waugh (1988:105) proposed three variants of the type: straight base, broad base, and deep base. These three variants correlate to straight, shallow concave, and deep concave, essentially identifying two forms of the concave-base variety. Waugh (1988:112) further suggested that the concave-base forms were earlier than the straight-base form; Koerper, Schroth, et al. (1996) did not verify this conclusion upon examination of data from the Newport Bay area.

The PVAHP yielded a total of 218 Cottonwood Triangular points: 119 with concave bases, 94 with straight bases, and 5 with indeterminate bases (see Figures 31 and 32). Some of the deep-base Cottonwood specimens have longer "tangs" on one side, which may have been purposeful. It could have been an ethnic marker or simply a result of a common breakage pattern and subsequent reworking. One example (Burial 587) from LAN-62 exhibited preserved wood on its proximal end, evidently the remnants of the shaft upon which it had been hafted. Variation and similarity in these Cottonwood Triangular straight- and concave-base points recovered during the project are discussed at the end of the chapter.

The Desert Side-Notched Series

Desert Side-notched points are small and triangular and have notches on their sides (see Figure 28c). They were first identified by Baumhoff and Byrne (1959) and are common in late contexts across much of the Great Basin and southern California (Baumhoff and Byrne 1959:38; Heizer and Hester 1978:10–11). This type is known to occur across much of North America under a variety of other names (see Kehoe 1966; Lyneis 1982). In western North America, Desert Side-notched points are often associated with Numic groups in the Great Basin (Harrington 1933:126, 1937:87, Figure 2a; Malouf 1968; Steward 1933:18, Figure 7; Swanson 1962:157; see also Bettinger and Baumhoff 1982:495), with Apachean groups in the Southwest, and with Yuman groups in southern California (True 1966, 1980) but not with Takic groups in southern California (Sutton 1989, 2009; True 1966, 1980). If this general association is correct, one would

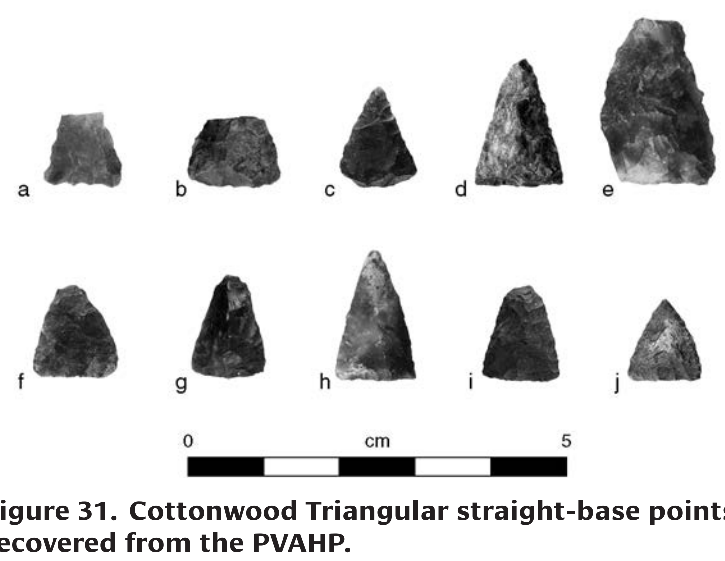


Figure 31. Cottonwood Triangular straight-base points recovered from the PVAHP.

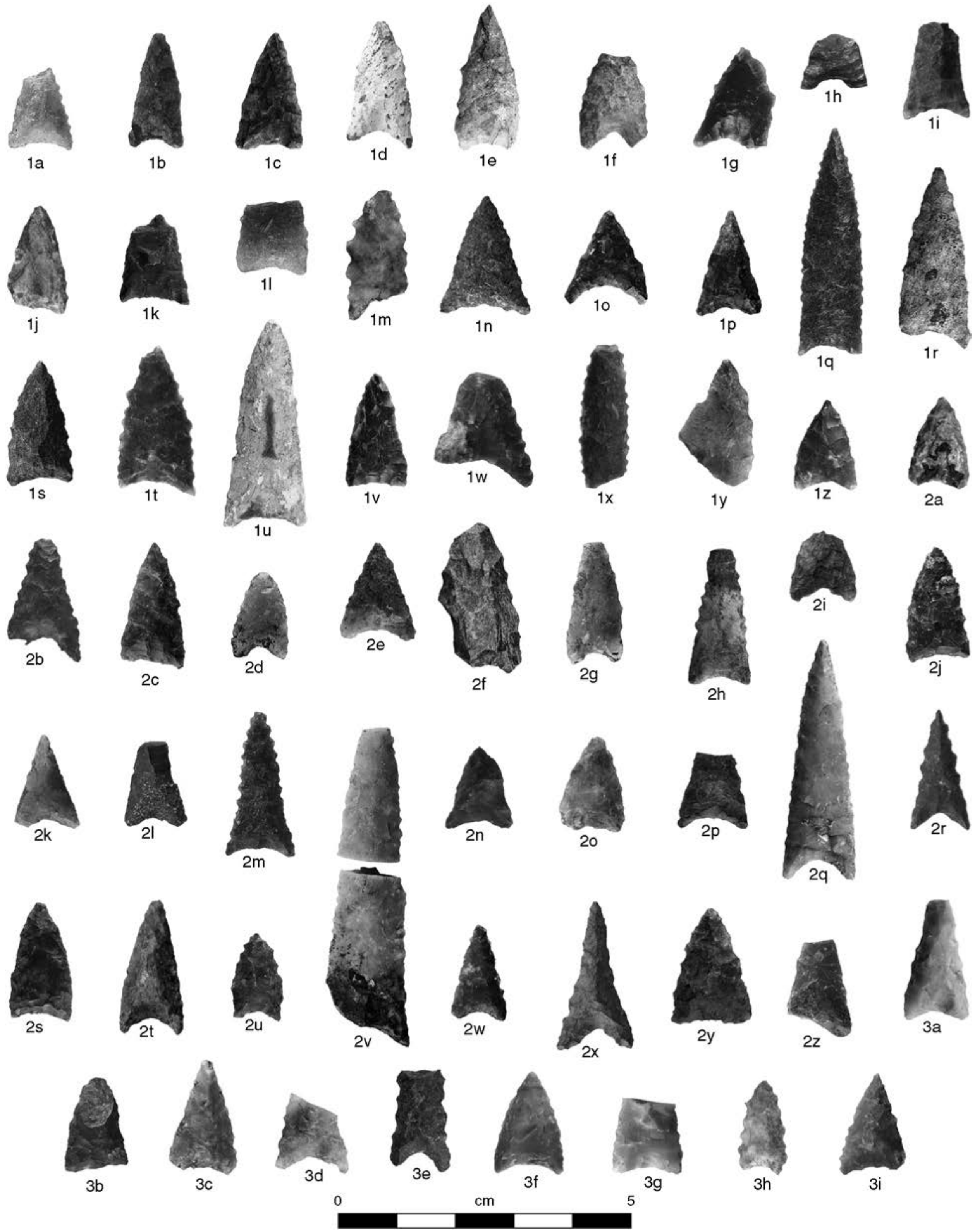


Figure 32. Cottonwood Triangular concave-base points recovered from the PVAHP.

expect to see very few Desert Side-notched points in the Los Angeles Basin, and indeed, few Desert Side-notched points are known from that region (Koerper, Schroth, et al. 1996), and very few were recovered from the Ballona.

South of the Los Angeles/Orange County region, where Cottonwood types dominate, small side-notched points (cf. Desert Side-notched) do commonly occur and were used, along with other traits, by True (1966:280) as a marker to separate the Takic Luiseño from the Yuman Ipai (Diegueño). True (1966:280; see also Koerper, Schroth, et al. 1996) noted that side-notched projectile points "turned out to be practically nonexistent in the Shoshonean 'Luiseño' components and were significantly diagnostic in the Yuman 'Diegueño' components." This is essentially the same pattern observed in other Takic areas (see Keller and McCarthy 1989). However, small side-notched projectile points have since been recovered from sites within ethnographic Luiseño territory at Camp Pendleton (Byrd 1998; Reddy 1997a, 2000a), suggesting that this idea should be reexamined.

Only three examples of Desert Side-notched points were identified at PVAHP sites, two from LAN-62 and one from LAN-211. The first specimen from LAN-62 was fragmentary and made from chert and was recovered from EU 153, Level 56. The second example, found in EU 1048, Level 96, was complete and was made from fused shale. The single Desert Side-notched specimen from LAN-211 was a fragmentary specimen of chert recovered from EU 466, Level 65.

The projectile points recovered during the PVAHP project span the entire cultural sequence from post-8000 B.P. through the Mission period. The recovery of particular points and other lithic artifacts from various sites will be discussed below, and a synthesis of their recovery and its implications will be presented later in the chapter.

Lithic Artifacts from LAN-193

Analysis of lithic artifacts recovered from LAN-193 involved the study of more than 11,000 artifacts recovered from three distinct contexts: control units, burial features, and nonburial features (Tables 3–5).

Sampling Strategy

Detailed technological analysis was conducted on more than 11,000 stone artifacts, including 2,861 artifacts from four control units, 108 artifacts from three burial features, and 8,105 artifacts from two nonburial features (see Tables 3–5). The lithic artifacts analyzed include 10,776 flaked stones, 38 ground stones, and 260 unshaped stones.

Control Units

The four control units span the long axis of the site and are spaced approximately 20 m apart. CU 34 is located on the eastern end, followed by CUs 11, 21, and 117 to the west. In total, 2,861 lithic artifacts were recovered from these four units (see Tables 3–5). The four control units are used as temporal and spatial controls to interpret human behavior as it pertains to lithic-tool production, discard, and use at LAN-193 during the late Millingstone, early Intermediate, and Intermediate periods (Table 6). Note that the Intermediate period includes dates that cut across the early and late Intermediate periods. Detailed discussion of the distribution of artifacts in each control unit is presented in Appendix B.4, and data are presented in Appendixes B.5–B.8.

Spatially, CU 21 has the highest density of lithic artifacts (738 artifacts per cubic meter), followed by CU 117 (538 artifacts per cubic meter), CU 11 (381 artifacts per cubic meter), and CU 34 (130 artifacts per cubic meter); therefore, the eastern end of the long axis across the site has a lower lithic-artifact density than the western end.

Based primarily on the frequencies and densities of artifacts recovered from these temporally distinct strata, the early Intermediate period occupation at the site appears to have been the most prevalent (see Table 6). The Millingstone period deposits predominantly yielded debitage, and a wider range of artifacts was recovered from the early Intermediate and Intermediate period deposits. In addition, relatively higher numbers of FAR pieces, fragments of fire-affected ground stone, and tarring pebbles and a larger amount of asphaltum in the early Intermediate period deposits suggest that activities involving fire were prevalent at the site and were perhaps related to food preparation and/or tool maintenance.

Burial Features at LAN-193

Three burials were discovered at LAN-193. In total, 108 lithic artifacts were recovered from all three burials, but the great majority of these artifacts were recovered from burial Feature 101 in burial fill (Table 7). Two projectile points were recovered from burial Feature 101: a chert Cottonwood Triangular concave base and a Marymount dart point. The chert Marymount dart point has asphaltum and evidence of hafting. Burial Feature 101 also contained a portion of a granite basin metate that had seen heavy use and resharpening followed by continued use. The recovery of 16 pieces of FAR from this burial feature is also distinctive.

Nonburial Features

Lithic artifacts from two nonburial features were analyzed. Feature 1 was an isolated rock cluster that yielded 128 lithic artifacts, including cores, debitage, a biface, edge-modified

Table 3. Summary of Flaked Stone Artifacts Recovered from LAN-193

Context	Flaked Stone								Total Lithic Artifacts
	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Chopper	Core Hammerstone	Total	
CU 11	2	733	—	1	4	—	—	740	767
CU 21	3	1,242	—	1	5	—	—	1,251	1,255
CU 34	—	236	—	—	2	—	—	238	247
CU 117	—	575	—	1	—	—	—	576	592
Subtotal	5	2,786	—	3	11	—	—	2,805	2,861
Burial Feature 101	1	83	2	—	—	—	—	86	105
Burial Feature 214	—	2	—	—	—	—	—	2	2
Burial Feature 216	—	1	—	—	—	—	—	1	1
Subtotal	1	86	2	—	—	—	—	89	108
Nonburial Feature 1	1	87	—	1	2	—	—	91	128
Nonburial FB 9	23	7,749	—	4	13	1	1	7791	7,977
Subtotal	24	7,836	—	5	15	1	1	7882	8,105
Total	30	10,708	2	8	26	1	1	10,776	11,074

Table 4. Summary of Ground Stone Artifacts Recovered from LAN-193

Context	Ground/Battered Stone									Total Lithic Artifacts
	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Metate	Indeterminate Ground Stone	Mano	Metate	Pestle	Bead	Total	
CU 11	—	—	—	—	—	—	—	—	—	767
CU 21	—	—	—	—	—	—	—	1	1	1,255
CU 34	—	—	1	—	—	—	—	—	1	247
CU 117	1	—	—	—	—	—	—	—	1	592
Subtotal	1	—	1	—	—	—	—	1	3	2,861
Burial Feature 101	1	—	—	—	—	1	—	—	2	105
Burial Feature 214	—	—	—	—	—	—	—	—	—	2
Burial Feature 216	—	—	—	—	—	—	—	—	—	1
Subtotal	1	—	—	—	—	1	—	—	2	108
Nonburial Feature 1	—	—	—	—	—	1	—	—	1	128
Nonburial FB 9	20	2	1	1	6	1	1	—	32	7,977
Subtotal	20	2	1	1	6	2	1	—	33	8,105
Total	22	2	2	1	6	3	1	1	38	11,074

Table 5. Summary of Unshaped-Stone Artifacts Recovered from LAN-193

Context	Unshaped Stone							Total Lithic Artifacts
	FAR	Cobble Hammerstone	Tarring Pebble	Manuport	Asphaltum	Ocher	Total	
CU 11	17	1	—	7	—	2	27	767
CU 21	3	—	—	—	—	—	3	1,255
CU 34	3	—	1	1	3	—	8	247
CU 117	4	—	—	—	11	—	15	592
Subtotal	27	1	1	8	14	2	53	2,861
Burial Feature 101	16	—	—	1	—	—	17	105
Burial Feature 214	—	—	—	—	—	—	—	2
Burial Feature 216	—	—	—	—	—	—	—	1
Subtotal	16	—	—	1	—	—	17	108
Nonburial Feature 1	36	—	—	—	—	—	36	128
Nonburial FB 9	140	—	5	5	—	4	154	7,977
Subtotal	176	—	5	5	—	4	190	8,105
Total	219	1	6	14	14	6	260	11,074

Table 6. Summary of Lithic Artifacts Recovered from Control Units at LAN-193, by Cultural Stratum

Cultural Stratum	Flaked Stone				Ground/Battered Stone		Unshaped Stone						Total
	Core	Debitage	Biface	Edge-Modified Piece	Bead	Fire-Altered Metate	FAR	Tarring Pebble	Cobble Hammerstone	Manuport	Asphaltum	Ocher	
Fill	—	130	1	—	—	—	—	—	—	—	1	—	132
Intermediate period	1	630	—	3	1	—	2	—	—	—	—	—	637
Early Intermediate period	4	1,519	2	6	—	2	23	1	1	7	13	2	1,580
Late Millingstone period	—	507	—	2	—	—	2	—	—	1	—	—	512
Total	5	2,786	3	11	1	2	27	1	1	8	14	2	2,861

Table 7. Lithic Artifacts Recovered from Burial Features at LAN-193

Feature No.	Projectile Point	Core	Debitage	Fire-Altered Ground Stone	Metate	FAR	Manuport	Total
101	2	1	83	1	1	16	1	105
214	—	—	2	—	—	—	—	2
216	—	—	1	—	—	—	—	1
Total	2	1	86	1	1	16	1	108

pieces, a metate, and an unshaped stone. The biface, made of andesite, is a Stage 2 fragment. Feature 9 is a large, composite cultural-activity area with several subfeatures and excavation units that dated to the early Intermediate period (see Volume 2 of this series for details of Feature 9). It is also referred to as FB 9. Lithic artifacts were recovered from five subfeatures and from particular levels of 56 excavation units (Tables 8 and 9). The majority of the artifacts were recovered from the FB 9 levels of the excavation units (96.5 percent). Lithic artifacts accounted for 83.9 percent of the artifacts from subfeatures in FB 9, and Subfeatures 447, 566, 530, 31, and 565 yielded significantly lower frequencies.

Lithic artifacts recovered from Feature 9 primarily include flaked stone (cores, debitage, a biface, and edge-modified pieces) and low frequencies of unshaped stone. The biface is a Stage 5 chert fragment. The five subfeatures yielded debitage and a range of fire-affected and -altered artifacts (see Tables 8 and 9). The primary difference between the lithic collections from Feature 9 and those from its subfeatures is that the subfeatures had a higher percentage of artifacts that are fire-affected than did Feature 9.

The lithic artifacts from the excavation units in Feature 9 yielded a total of 7,699 artifacts, including flaked stone in higher frequencies than those of the ground/battered stone or unshaped-stone categories. The three bifaces were recovered from Level 2 of EUs 78, 100, and 101 and included a Stage 2 chert biface fragment, a Stage 5 obsidian biface fragment, and a Stage 5 chalcedony biface fragment, respectively. The collection is significantly more diverse than those of the subfeatures. The recovery of a range of ground stone tools and also ground stone that appears to have been exposed to fire suggests that food processing and/or preparation were among the activities at this locale. A complete granite basin metate was recovered from Feature 9, EU 83 (Figure 33).

Discussion of Lithic Artifacts from LAN-193

The lithic-artifact collection from LAN-193 includes flaked stone (97.3 percent), ground and/or battered stone (0.3 percent), and unshaped stone (2.3 percent). Detailed discussion of these artifact categories is presented in Appendixes B.9–B.11. Only two artifacts that are temporally diagnostic were recovered from the analytical contexts at LAN-193, two projectile points from burial Feature 101: a Cottonwood Triangular concave-base point and a Marymount dart point. Cottonwood Triangular points (concave and straight base) date from the Late period to the Historical period (Justice 2002:368–372; Lanning 1963:252–253; Thomas 1981:15–16). Marymount dart points appeared along the southern California coast during the Intermediate period (Justice 2002:364; Van Horn 1987a:91–92, Figure 27, 1990:33). Radiocarbon dates obtained from Features 7 and 9 and CU 21 at LAN-193 place occupation in the late Millingstone and Intermediate periods. The recovery of the Cottonwood Triangular concave base from burial Feature 101 is likely indicative of postdepositional intrusion.

The majority of the artifacts were recovered from the early Intermediate period deposits (88.4 percent), followed by Intermediate period, late Millingstone period, and fill deposits (Table 10). However, the density of lithic artifacts was higher in the Intermediate (both early and late) period deposits than in the other deposits. Higher densities indicate greater intensity of production, use, and discard, and higher numbers suggest a higher number of incidents of use. At LAN-193, the early Intermediate and Intermediate period populations used lithic artifacts more intensively and more frequently than did the late Millingstone period occupants.

As discussed above, obsidian chemically sourced to the Coso volcanic field was recovered from LAN-193. Coso obsidian was imported to the site as finished tools from the late Millingstone period through the Intermediate period. Of the 14 Coso obsidian flakes, 3 were from contexts dating to the late Millingstone period, 9 were from contexts spanning the early Intermediate period, and 2 dated to the Intermediate period.

The increase in artifact diversity is also reflected in the variety of artifact types at LAN-193, which increased from the late Millingstone period to the early Intermediate and Intermediate periods. This increase is noted in FB 9, which dates to the early Intermediate period. In total, 7,977 lithic artifacts representing 72 percent of the artifacts from LAN-193 were recovered from FB 9 (see Tables 8 and 9). Furthermore, the density and diversity of artifacts recovered from FB 9 suggest a habitation midden with distinct subfeatures that may have been hearth cleanouts.

The characteristics of the early Intermediate period artifact collection at LAN-193 (high debitage frequencies representing all stages of reduction, with core reduction the dominant technique) suggest that lithic-tool production was the primary activity. However, note that finished obsidian tools were also brought to the site. Other activities, possibly related to food

Table 8. Flaked Stone Artifacts Recovered from FB 9 Subfeatures (Early Intermediate Period), LAN-193

Context	Feature Type	Flaked Stone							Total	Density (n/m³)
		Core	Debitage	Biface	Edge-Modified Piece	Chopper	Core Hammerstone	Total		
Control units		19	7,531	3	12	1	1	7,567	7,699	
Features										
Feature 9	activity area	4	200	1	1	—	—	206	233	9.66
Feature 31	rock clusters	—	2	—	—	—	—	2	5	500.00
Feature 447	rock clusters	—	5	—	—	—	—	5	19	52.78
Feature 530	rock clusters	—	—	—	—	—	—	—	6	300.00
Feature 565	rock clusters	—	3	—	—	—	—	3	4	133.33
Feature 566	rock clusters	—	8	—	—	—	—	8	11	84.62
Subtotal		4	218	1	1	—	—	224	278	11.28
Total		23	7,749	4	13	1	1	7,791	7,977	

Table 9. Ground Stone and Unshaped-Stone Artifacts Recovered from FB 9 Subfeatures (Early Intermediate Period), LAN-193

Context	Feature Type	Ground/Battered Stone							Unshaped Stone				Total	Density (n/m³)
		Fire-Altered Ground Stone	Fire-Altered Mano	Mano	Metate	Pestle	Fire-Altered Metate	Indeterminate Ground Stone	FAR	Tarring Pebble	Manuport	Ocher		
Excavation units		10	1	5	1	—	1	1	100	4	5	4	7,699	
Features														
Feature 9	activity area	3	—	1	—	—	—	—	22	1	—	—	233	9.66
Feature 31	rock clusters	—	—	—	—	—	—	—	3	—	—	—	5	500.00
Feature 447	rock clusters	5	1	—	—	1	—	—	7	—	—	—	19	52.78
Feature 530	rock clusters	1	—	—	—	—	—	—	5	—	—	—	6	300.00
Feature 565	rock clusters	1	—	—	—	—	—	—	—	—	—	—	4	133.33
Feature 566	rock clusters	—	—	—	—	—	—	—	3	—	—	—	11	84.62
Subtotal		10	1	1	—	1	—	—	40	1	—	—	278	11.28
Total		20	2	6	1	1	1	1	140	5	5	4	7,977	

Figure 33. Basin metate from LAN-193, nonburial Feature 9.

Table 10. Lithic Artifacts from LAN-193, by Context

Artifact Category, by Type	Mixed/Fill	Intermediate Period	Early Intermediate Period	Late Millingstone Period	Total
Flaked stone					
Core	—	1	29	—	30
Debitage	133	630	9,438	507	10,708
Biface	1	—	7	—	8
Edge-modified piece	—	3	21	2	26
Chopper	—	—	1	—	1
Core hammerstone	—	—	1	—	1
Ground/battered stone					
Fire-altered ground stone	—	—	22	—	22
Fire-altered mano	—	—	2	—	2
Fire-altered metate	—	—	2	—	2
Indeterminate ground stone	—	—	1	—	1
Mano	—	—	6	—	6
Metate	—	—	3	—	3
Pestle	—	—	1	—	1
Bead	—	1	—	—	1
Unshaped stone					
FAR	—	2	215	2	219
Cobble hammerstone	—	—	1	—	1
Tarring pebble	—	—	6	—	6
Manuport	—	—	13	1	14
Asphaltum	1	—	13	—	14
Ocher	—	—	6	—	6
Total	135	637	9,788	512	11,072
Percent of total	1.2	5.8	88.4	4.6	100.0
Volume (m^3)	1.53	0.7	26.7	2.5	29.9
Density (n/m^3)	88	910	367	339	370.8

Note: Only contexts with strong chronostratigraphic data are included in this table.

preparation, were also relatively important in this locale, based on the recovery of FAR and fire-altered ground stone (n = 245; 2.5 pieces of FAR per cubic meter). The FAR and fire-altered ground stone were not restricted to midden deposits (control units and excavation units) but were recovered from features, too; for example, burial Feature 101 yielded 16 pieces of FAR and 1 piece of fire-altered ground stone.

Lithic Artifacts from LAN-2768

Analysis of lithic artifacts recovered from LAN-2768 involved the study of more than 4,500 artifacts recovered from four loci: Loci A, B, C, and D (Table 11). Note that these loci do not necessarily reflect behavioral or temporal distinctions; rather, they are spatial delineations for management purposes.

Sampling Strategy

Most of the artifacts were from Locus A (87.2 percent); Locus B (12.4 percent) yielded much lower frequencies, and Loci C (0.1 percent) and D (0.3 percent) yielded very low frequencies. Overall, flaked stone accounted for the majority of the lithic-artifact collection, with ground and/or battered stone in very low frequencies. Unshaped stone was found in moderate to low frequencies. Of note is that fire-altered ground stone and FAR account for 12 percent of the collection. The discussion of the LAN-2768 lithic artifacts will be presented by locus.

Locus A

Robert G. Elston conducted an initial analysis of 358 stone artifacts from LAN-2768, Locus A (see Appendix B.12), that supplement the artifacts from Locus A described below. Subsequently, distinct contexts were selected for analysis from

Table 11. Analyzed Lithic Artifacts, LAN-2768, by Locus

Locus	Flaked Stone	Flaked Stone (%)	Ground/ Battered Stone	Ground/ Battered Stone (%)	Unshaped Stone	Unshaped Stone (%)	Total
A	3,368	71.70	17	0.4	714	14.9	4,099
B	252	5.40	5	0.1	327	6.8	584
C	2	0.04	—	0.0	1	0.0	3
D	9	0.20	—	0.0	3	0.1	12
Total	3,631	77.30	22	0.5	1,045	22.2	4,698

Locus A, yielding 4,099 lithic artifacts from 4 control units and 14 nonburial features (Tables 12–14). The lithic artifacts analyzed from Locus A included flaked stone, ground stone, and unshaped stone. The control units yielded 81.2 percent of the Locus A lithic-artifact collection, and the nonburial features yielded 18.8 percent.

Control Units

More than 3,000 lithic artifacts were recovered from the four control units (see Tables 12–14), including primarily flaked stone (cores, debitage, a projectile point, edge-modified pieces, and a core hammerstone), a single ground stone mano, and several unshaped stones. The four control units are located along the central axis of Locus A, with CU 2/22 on the western end, CU 8 to the east, CU 3 on the southeastern edge, and CU 20/21 to the north of CU 3.

The four control units will be used as temporal and spatial controls to interpret human behavior as it pertains to lithic-tool production, discard, and use at LAN-2768, Locus A, during the early Intermediate period and also the different occupational episodes within the early Intermediate period (see Table 14). Detailed discussion of the distribution of artifacts in each control unit is presented in Appendix B.13, and data are presented in Appendixes B.14–B.19.

Episodes 2 and 3 are represented in all four control units, and Episode 1 is present only in CU 8. Episode 4 is not present in CU 3 (but occurs in CU 2/22, CU 8, and CU 20/21). When individual control units are compared, the Episode 3 deposits in CU 2/22, CU 3, and CU 8 have significantly more-intensive occupations (higher artifact densities); Episodes 2 and 3 are similar in CU 20/21. Overall, Episode 3 has the highest density of lithic artifacts, followed closely by Episode 1 (present only in CU 8), and Episodes 2, 2/3, and 4 show lower densities. Also, note that the presence of FAR in all the control units is consistent with the thermal damage (crazing and pot lids) also evident on many of the pieces of debitage.

Spatially, CU 8 has the highest density of lithic artifacts; much lower densities were documented at CUs 2/22, 3, and 20/21. The core of the lithic production and disposal appears to be associated with the early Intermediate period Episode 3 deposits located along the western end of the long axis of Locus A.

Nonburial Features

In total, 772 lithic artifacts were analyzed from 14 nonburial features: 6 artifact concentrations, a hearth, 4 rock clusters, a structure, and 2 pits (Table 15). All 14 nonburial features dated to the early Intermediate period.

Artifact Concentrations

The 6 artifact concentrations yielded 213 lithic artifacts (27.6 percent of artifacts from the 14 nonburial features). The 6 features are located within close proximity to each other within the southwestern part of Locus A.

There are immense differences in artifact recovery among the six artifact concentrations. Features 26, 28, and 29 yielded significantly lower frequencies than the other three artifact concentrations. Feature 29 yielded only two pieces of FAR (nonlithic artifacts, such as bone and shell, were also recovered), and a single flake was recovered from Feature 28 (a few pieces of FAR were observed but not collected). Feature 26 had only three lithic artifacts (no faunal remains). By contrast, Features 3, 10, and 19 yielded relatively higher frequencies, and the most diverse lithic artifacts were recovered from Feature 3. Only debitage and FAR were recovered from Features 10 and 19. It appears that of the six features in this category, Feature 3 is different from the other five in terms of artifacts recovered.

Lithic-artifact densities differed among the features because the feature sizes were distinct (note that volumes for Features 26 and 28 were not available). Features 29 and 19 were small features (0.002 m^3 and 0.02 m^3, respectively). Feature 3 had a significantly higher volume (3.84 m^3), and the volume of Feature 10 was lower (0.4 m^3). All the artifact concentrations, with the exception of Feature 3, are locales of lithic production and discard. The FAR in these features could be related to lithic production. By contrast, Feature 3 had indicators of both lithic production and food preparation.

Hearth

Feature 12 is the single hearth feature that was analyzed at Locus A, and it is located immediately to the west of Feature 3 (artifact concentration). The lithic artifacts include debitage, a biface, a core hammerstone, fire-altered ground stone, a mano, and FAR. The biface is a Stage 5 chert fragment with one edge that appears to be notched and a bend break, most

Table 12. Summary of Flaked Stone Artifacts from Analyzed Contexts at LAN-2768, Locus A

Context	Flaked Stone							Total Lithic Artifacts
	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Core Hammerstone	Total	
CU 2/22	—	1,185	—	—	1	—	1,186	1,205
CU 3	3	578	—	—	2	1	584	630
CU 8	—	1,126	1	—	2	—	1,129	1,218
CU 20/21	2	248	—	—	2	—	252	274
Subtotal (CUs)	5	3,137	1	—	7	1	3,151	3,327
Nonburial Feature 3	3	12	—	—	—	—	15	107
Nonburial Feature 10	—	1	—	—	—	—	1	34
Nonburial Feature 12	—	6	—	1	—	2	9	162
Nonburial Feature 14	—	—	—	—	—	—	—	10
Nonburial Feature 18	3	59	—	—	—	1	63	82
Nonburial Feature 19	—	19	—	—	—	—	19	66
Nonburial Feature 20	—	—	—	—	—	—	—	8
Nonburial Feature 24	—	105	—	—	—	—	105	247
Nonburial Feature 25	—	—	—	—	—	—	—	1
Nonburial Feature 26	1	1	—	—	—	—	2	3
Nonburial Feature 28	—	1	—	—	—	—	1	1
Nonburial Feature 29	—	—	—	—	—	—	—	2
Nonburial Feature 30	—	—	—	—	—	—	—	1
Nonburial Feature 31	—	2	—	—	—	—	2	48
Subtotal (features)	7	206	—	1	—	3	217	772
Total	12	3,343	1	1	7	4	3,368	4,099

Table 13. Summary of Ground Stone and Unshaped-Stone Artifacts from Analyzed Contexts at LAN-2768, Locus A

Context	Ground/Battered Stone						Unshaped Stone				Total Lithic Artifacts
	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Pestle	Mano	Pestle	Total	FAR	Tarring Pebble	Manuport	Total	
CU 2/22	—	—	—	—	—	—	19	—	—	—	1,205
CU 3	—	—	—	—	—	—	46	—	—	—	630
CU 8	—	—	—	1	—	1	88	—	—	—	1,218
CU 20/21	—	—	—	—	—	—	21	1	—	1	274
Subtotal (CUs)	—	—	—	1	—	1	174	1	—	1	3,327
Nonburial Feature 3	2	3	1	1	1	8	83	—	1	1	107
Nonburial Feature 10	—	—	—	—	—	—	33	—	—	—	34
Nonburial Feature 12	6	—	—	1	—	7	146	—	—	—	162
Nonburial Feature 14	—	—	—	—	—	—	10	—	—	—	10
Nonburial Feature 18	—	—	—	—	—	—	19	—	—	—	82
Nonburial Feature 19	—	—	—	—	—	—	47	—	—	—	66
Nonburial Feature 20	—	—	—	—	—	—	8	—	—	—	8
Nonburial Feature 24	—	—	—	—	—	—	142	—	—	—	247
Nonburial Feature 25	—	—	—	—	—	—	1	—	—	—	1
Nonburial Feature 26	—	—	—	1	—	—	—	—	—	—	3
Nonburial Feature 28	—	—	—	—	—	—	—	—	—	—	1
Nonburial Feature 29	—	—	—	—	—	—	2	—	—	—	2
Nonburial Feature 30	—	—	—	—	—	—	1	—	—	—	1
Nonburial Feature 31	—	—	—	—	—	—	46	—	—	—	48
Subtotal (features)	8	3	1	3	1	16	538	—	1	1	772
Total	8	3	1	4	1	17	712	1	1	2	4,099

Table 14. Summary of Lithic Artifacts Recovered from Control Units at LAN-2768, Locus A (Early Intermediate Period)

Occupation Episode	Flaked Stone				Ground/Battered Stone	Unshaped Stone		Total	Density (n/m³)
	Core	Debitage	Projectile Point	Edge-Modified Piece	Mano	FAR	Tarring Pebble		
1	—	141	—	—	—	4	—	145	690.5
2	—	173	—	—	—	13	—	186	320.7
2/3	—	41	—	—	—		—	41	410.0
3	2	2,305	1	4	1	133	1	2,447	767.1
4	—	258	—	—	—	23	—	281	312.2
Total	2	2,918	1	4	1	173	1	3,100	622.5

Note: Table does not include artifacts from control-unit levels that do not have chronostratigraphic data.

Table 15. Summary of Flaked Stone and Ground Stone Artifacts from Nonburial Features at LAN-2768, Locus A (All Early Intermediate Period), by Feature Type

Feature No.	Flaked Stone				Ground/Battered Stone					Total Lithic Artifacts	Density (n/m³)
	Core	Debitage	Biface	Core Hammerstone	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Pestle	Mano	Pestle		
Artifact Concentrations											
3	3	12	—	—	2	3	1	1	1	107	27.9
10	—	1	—	—	—	—	—	—	—	34	85.0
19	—	19	—	—	—	—	—	—	—	66	3,300.0
26	1	1	—	—	—	—	—	1	—	3	
28	—	1	—	—	—	—	—	—	—	1	
29	—	—	—	—	—	—	—	—	—	2	1,000.0
Subtotal[a]	4	34	—	—	2	3	1	2	1	213	49.0
Hearth											
12	—	6	1	2	6	—	—	1	—	162	810.0
Subtotal[a]	—	6	1	2	6	—	—	1	—	162	810.0

continued on next page

Feature No.	Flaked Stone				Ground/Battered Stone					Total Lithic Artifacts	Density (n/m³)
	Core	Debitage	Biface	Core Hammerstone	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Pestle	Mano	Pestle		
Rock Clusters											
14	—	—	—	—	—	—	—	—	—	10	
18	3	59	—	1	—	—	—	—	—	82	8,200.0
20	—	—	—	—	—	—	—	—	—	8	800.0
25	—	—	—	—	—	—	—	—	—	1	100.0
Subtotal[a]	3	59	—	—	—	—	—	—	—	101	3,033.3
Structure											
24	—	105	—	—	—	—	—	—	—	247	247.0
Subtotal[a]	—	105	—	—	—	—	—	—	—	247	247.0
Pits											
30	—	—	—	—	—	—	—	—	—	1	50.0
31	—	2	—	—	—	—	—	—	—	48	1,200.0
Subtotal[a]	—	2	—	—	—	—	—	—	—	49	816.7
Total	7	206	1	3	8	3	1	3	1	772	135.4

[a] Note that the density calculations only include artifacts from features with volume data.

likely a manufacturing error. With a lithic-artifact density of 810 artifacts per cubic meter, Feature 12 had a moderate artifact density, relative to the other feature groups.

Rock Clusters

Four rock clusters yielded 101 lithic artifacts, primarily including debitage (58.4 percent) and FAR (37.6 percent); cores (3 percent) and a single core hammerstone (1 percent) accounted for significantly lower frequencies.

Spatially, the four rock clusters are located in close proximity to the artifact concentrations and the hearth. Feature 14 is immediately to the north of Feature 19 (artifact concentration), and Features 18 and 20 are immediately to the northwest and east of Feature 26 (artifact concentration), respectively. Feature 25 is immediately to the northwest of Feature 24 (artifact concentration).

Artifact density within the four rock clusters was distinct; Feature 18 had the highest density (8,200 artifacts per cubic meter). Overall, the artifact density of the rock clusters was higher than that of the other feature types.

Structure

Feature 24, defined as a structure, is located immediately to the north of Feature 29 (artifact concentration) and was composed exclusively of debitage (42.5 percent) and FAR (57.5 percent). Note that many pieces of FAR were not collected in the field. Refer to Volume 2 of this series for details on this feature. Artifact density in Feature 24 was moderate (247 artifacts per cubic meter), relative to that of the other feature types.

Pits

Two pit features yielded 47 lithic artifacts. The pit features are located within Feature 24 and are contemporaneous with it. They yielded debitage and FAR exclusively, and Feature 31 had a high artifact density: 1,200 artifacts per cubic meter.

Summary of Nonburial Features

Of the four feature types at LAN-2768, Locus A, the rock clusters had the highest artifact density, followed by pits and hearths, and the artifact concentrations had the lowest density (Table 16; see Table 15). Particular features within each feature category had higher densities. For example, three features with the highest densities include Feature 18 (rock cluster), Feature 19 (artifact concentration), and Feature 31 (pit).

The greatest artifact diversity was noted among the artifact concentrations, followed by the hearth and rock clusters, and the structure and the pits had similar low diversities. Feature 3 (artifact concentration) had the highest diversity of lithic artifacts, which suggests a greater range of activities at this particular locale, a generalized activity locale.

Locus B

Locus B at LAN-2768 is located to the east of Locus A, and excavations yielded 584 lithic artifacts, including flaked stone (43.2 percent), ground stone (0.8 percent), and unshaped stone (56 percent) (Table 17).

The artifacts were recovered from two distinct contexts: 565 artifacts from three control units and 19 artifacts from nonburial Features 113 and 114. Spatially, the three control units are spread from the east to the west; CU 502 is located at the eastern edge of the locus, CU 504 is in the south-central part of the locus, and CU 524 is on the western edge, near Locus A. The two features are located in the vicinity of CU 502, on the eastern edge of Locus B.

Control Units

In total, 565 lithic artifacts were recovered from three control units (see Table 17) and included a core, debitage, a projectile point, two pieces of fire-altered ground stone, a fire-altered mano, a fire-altered vessel, a bead, and an unshaped stone.

The three control units will be used as temporal and spatial controls to interpret human behavior as it pertains to lithic-tool production, discard, and use at LAN-2768, Locus B, during the late Intermediate, Intermediate, and early Intermediate/Millingstone periods (Table 18). The late Intermediate and Intermediate periods were represented in all three control units; the early Intermediate/Millingstone period was absent from CU 524. Detailed discussion of the distribution of artifacts in each control unit is presented in Appendix B.20, and data are presented in Appendixes B.21–B.24.

When individual control units are compared, the Intermediate period deposits have significantly more-intensive occupations (higher artifact densities). A similar pattern is evident when the three control units are combined; the Intermediate period has the highest density of lithic artifacts, followed by early Intermediate/Millingstone period deposits, and the late Intermediate period has the lowest density. Also, note that most of the FAR and fire-altered ground stone was recovered from the Intermediate period levels.

Spatially, CU 524 had the highest density of lithic artifacts (131.3 artifacts per cubic meter); lower densities were documented at CUs 504 (106 artifacts per cubic meter) and 502 (101.7 artifacts per cubic meter). The heart of the lithic production and disposal appears to have been associated with the Intermediate period deposits along the western end of Locus B.

Nonburial Features

Two nonburial features were analyzed and yielded 19 lithic artifacts, including debitage and FAR (Table 19). Feature 114 had the higher quantity and also the higher density of artifacts.

Locus C

Locus C of LAN-2768 is located on the southern end of the site, adjacent to LAN-193, and had sparse artifact density.

Table 16. Summary of Unshaped-Stone Artifacts from Nonburial Features at LAN-2768, Locus A (All Early Intermediate Period)

Feature No., by Feature Type	Unshaped Stone			Total Lithic Artifacts	Density (n/m^3)
	FAR	Manuport	Total		
Artifact concentrations					
3	83	1	84	107	27.9
10	33	—	33	34	85.0
19	47	—	47	66	3,300.0
26	—	—	—	3	
28	—	—	—	1	
29	2	—	2	2	1,000.0
Subtotal[a]	165	1	166	213	49.0
Hearth					
12	146	—	146	162	810.0
Subtotal[a]	146	—	146	162	810.0
Rock clusters					
14	10	—	10	10	
18	19	—	19	82	8,200.0
20	8	—	8	8	800.0
25	1	—	1	1	100.0
Subtotal[a]	38	—	38	101	3,033.3
Structure					
24	142	—	142	247	247.0
Subtotal[a]	142	—	142	247	247.0
Pits					
30	1	—	1	1	50.0
31	46	—	46	48	1,200.0
Subtotal[a]	47	—	47	49	816.7
Total	538	1	539	772	135.4

[a] Note that the density calculations only include artifacts from features with volume data.

Table 17. Summary of Lithic Artifacts from Analyzed Contexts at LAN-2768, Locus B

Context	Flaked Stone			Ground/Battered Stone				Unshaped Stone				Total
	Core	Debitage	Projectile Point	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Vessel	Bead	FAR	Cobble Hammerstone	Tarring Pebble	Asphaltum	
CU 502	—	74	—	—	—	—	1	47	—	—	—	122
CU 504	1	60	1	2	—	1	—	153	1	—	1	220
CU 524	—	112	—	—	1	—	—	109	—	1	—	223
Subtotal	1	246	1	2	1	1	1	309	1	1	1	565
Nonburial Feature 113	—	2	—	—	—	—	—	5	—	—	—	7
Nonburial Feature 114	—	2	—	—	—	—	—	10	—	—	—	12
Subtotal	—	4	—	—	—	—	—	15	—	—	—	19
Total	1	250	1	2	1	1	1	324	1	1	1	584

Table 18. Summary of Lithic Artifacts Recovered from Control Units at LAN-2768, Locus B

Temporal Period	Flaked Stone			Ground/Battered Stone				Unshaped Stone				Total	Density (n/m³)
	Core	Debitage	Projectile Point	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Vessel	Bead	FAR	Cobble Hammerstone	Tarring Pebble	Asphaltum		
Late Intermediate	—	20	—	1	1	—	—	1	1	—	—	24	18.8
Intermediate	1	108	1	1	—	1	1	307	—	1	1	422	422.0
Intermediate/ Millingstone	—	118	—	—	—	—	—	1	—	—	—	119	66.1
Total	1	246	1	2	1	1	1	309	1	1	1	565	138.5

Table 19. Summary of Lithic Artifacts from Nonburial Features at LAN-2768, Locus B

Feature	Feature Type	Flaked Stone	Unshaped Stone	Total	Density (n/m^3)
		Debitage	FAR		
113	artifact concentration	2	5	7	111.1
114	rock cluster	2	10	12	315.8
Total		4	15	19	188.1

Only three artifacts were analyzed: two flaked stones and one unshaped stone, all recovered from burial Feature 108, which consisted of a single primary inhumation. The two flaked stones are two complete core-reduction late-percussion quartzite flakes. The unshaped stone is a single rhyolite FAR fragment.

Locus D

Locus D is located in between Loci A and C and was also sparse in artifact density. In total, 12 artifacts were recovered from Locus D: 9 flaked stones and 3 pieces of FAR, all recovered from burial Feature 112.

The nine flaked stones from Locus D were one andesite multidirectional core, seven pieces of debitage, and one edge-modified flake. Waterworn cortex on one face of the core implies that it was collected from an alluvial deposit. The seven pieces of debitage are quartzite, andesite, chalcedony, chert, quartz, and rhyolite. The majority are core-reduction flakes; a single early-percussion, two late-percussion, and two indeterminate-percussion flakes were noted. One biface-reduction indeterminate-percussion flake and one indeterminate-percussion fragment of unknown technological type complete the sample. Waterworn cortex was noted on the andesite flake, and patina was noted on the quartz flake. The quartzite edge-modified flake featured unifacial flaking on the distal edge that resulted in an edge angle of 45°. Rounding was noted as evidence of use.

Summary Discussion of Lithic Artifacts from LAN-2768

LAN-2768 is located at the base of the Ballona Escarpment, adjacent to Centinela Creek. For management reasons, the site was divided into four loci (Loci A, B, C, and D). Loci A and B contained cultural deposits that dated to the pre-Intermediate, early Intermediate, Intermediate, and late Intermediate periods. This discussion will focus on the site as a whole (not organized by the management-related loci).

The contexts analyzed included 7 control units and 16 features. The 16 features were 7 artifact concentrations, 1 hearth, 5 rock clusters, 1 structure, and 2 pits (Table 20). Lithic artifacts were recovered in higher numbers from the structure and artifact concentrations than from other feature types. The frequency of lithic-tool production and maintenance was associated more with the structure and artifact concentrations than with the hearth, rock clusters, and pits.

The highest density of lithic artifacts (and greatest intensity of use and disposal) was noted in the rock clusters (1,614.3 artifacts per cubic meter), and the hearth and pit features had much lower and similar densities. Artifact concentrations had the lowest density, suggesting the lowest intensity of use and disposal. In terms of the intensity of stone-tool manufacture and maintenance, debitage density in CU 3 was higher (745.7 artifact per cubic meter) than that of the other control units. Furthermore, three control units (CUs 502, 504, and 524) had much lower densities than the others (61.7, 28.8, and 65.9 artifacts per cubic meter, respectively). CUs 2/22 and 8 had moderate densities, relative to the others (418.7 artifacts per cubic meter and 330.3 artifacts per cubic meter, respectively). Feature 18 (rock cluster) yielded, by far, the greatest debitage density (5,900 flakes per cubic meter) of all features at LAN-2768 and may represent tool-maintenance activities that occurred around the original hearth, because portions of the cores and flakes exhibited thermal alteration. At LAN-2768, there is a spatial and contextual association with higher intensity of lithic-tool manufacture and maintenance, as noted with the higher densities of debitage in Feature 18 and CU 3.

Diversity of lithic artifacts (highest number of lithic-artifact types) is explored to aid in the refinement of the functional interpretations of the features. At LAN-2768, the artifact concentrations had the highest diversity, and the structure and pits had the lowest. Note, however, that the sample size of the artifact concentrations is much larger than those of the other feature types. Higher diversity indicates a greater range of activities related to lithic-tool production, maintenance, and use. For example, fire-altered ground stone was recovered only from artifact concentrations, suggesting use of the ground stone for food processing (to process animal and plant foods) and subsequent use as heating rocks for food preparation. The recovery of these artifacts in addition to debitage and cores indicates multiple activities (lithic production and maintenance and food processing and preparation) within a single feature type. The structure and the pits had only debitage and FAR, indicating that they represent the remains of tool maintenance and hearth residues. Note, however, that ground stone was recovered from only 2 of the 16 features sampled during the PVAHP, which is consistent with the general paucity of ground stone at LAN-2768. Control units

Table 20. Lithic Artifacts from Nonburial Features at LAN-2768, Locus B

Feature Type	Flaked Stone				Ground/Battered Stone					Unshaped Stone		Total	Density (n/m³)
	Core	Debitage	Biface	Core Hammerstone	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Pestle	Mano	Pestle	FAR	Manuport		
Artifact concentrations	4	36	—	—	2	3	1	2	1	170	1	220	50.5
Hearth	—	6	1	2	6	—	—	1	—	146	—	162	810.0
Rock clusters	3	61	—	1	—	—	—	—	—	48	—	113	1,614.3
Structure	—	105	—	—	—	—	—	—	—	142	—	247	247.0
Pits	—	2	—	—	—	—	—	—	—	47	—	49	816.7
Total	7	210	1	3	8	3	1	3	1	553	1	791	139.0

also yielded small quantities of ground stone. However, larger amounts of ground stone were recovered from stripping units analyzed by Elston (see Appendix B.12); perhaps sampling strategies and recovery techniques are largely responsible for this difference in the recovery of ground stone. Finally, the seven control units displayed a slightly greater range of raw materials and artifact types than did features. For example, fused shale and tarring pebbles were only identified in the sample from control units. Note that the lithic-artifact collection at LAN-2768 does not aid in the refinement of the functional interpretations of the features.

There are notable differences in the densities of lithic artifacts over time from the Millingstone period to the early Intermediate, Intermediate, and late Intermediate periods (Table 21). The Intermediate period deposits had the highest density (423 artifacts per cubic meter), and the Millingstone period deposits had the lowest density (66.1 artifacts per cubic meter). Early Intermediate period deposits had a higher density (364 artifacts per cubic meter) than late Intermediate period deposits (258.6 artifacts per cubic meter). Lithic production was highest in the early Intermediate period, followed by the Intermediate, Millingstone, and late Intermediate periods, based on debitage quantities and densities (see Table 21). The diversity in artifact types was higher in the early Intermediate and Intermediate periods. Based on lithic-artifact density, occupation at LAN-2768 was most intense during the early Intermediate and Intermediate periods, relative to the prior and latter periods.

Elston (see Appendix B.12) analyzed an additional sample of 358 artifacts from LAN-2768, Locus A, not included in the descriptions above. Eleven of these artifacts are from contexts selected for the current analysis and thus supplement the artifacts described above. These artifacts include 1 ocher-stained pebble manuport, 2 core hammerstones, and 1 slate scraper. Also included from control units are 1 Stage 4 biface, 1 Stage 5 biface, 2 manuports, 2 steatite disk beads, and 1 pestle.

Notably, diagnostic projectile points in Elston's (see Appendix B.12) sample included dart points and Cottonwood Triangular arrow points (see Appendix B.12, "Small Concave-Base" points section). A fragment of a Humboldt point (Figure 34) from the early through late Millingstone period has been found along the southern California coast (Justice 2002:257–260). The presence of Cottonwood Triangular arrow points extends the time of site use to the

Table 21. Lithic Artifacts from LAN-2768, by Temporal Period

Artifact Category, by Type	Late Intermediate	Intermediate	Early Intermediate	Intermediate/ Millingstone	Total
Flaked stone					
Core	—	1	8	—	9
Debitage	20	108	3,122	118	3,368
Projectile point	—	1	1	—	2
Biface	—	—	1	—	1
Edge-modified piece	—	—	4	—	4
Core hammerstone	—	—	3	—	3
Ground/battered stone					
Fire-altered ground stone	1	1	8	—	10
Fire-altered mano	1	—	3	—	4
Fire-altered pestle	—	1	1	—	2
Fire-altered vessel	—	1	—	—	1
Bead	—	1	—	—	1
Mano	—	—	3	—	3
Pestle	—	—	1	—	1
Unshaped stone					
FAR	1	307	701	1	1,010
Cobble hammerstone	1	—	—	—	1
Manuport	307	—	1	—	308
Tarring pebble	—	1	1	—	2
Asphaltum	—	1	—	—	1
Total	331	423	3,858	119	4,731
Volume (m^3)	1.28	1	10.6	1.8	14.7
Density (n/m^3)	258.6	423.0	364.0	66.1	322.3

Note: Only includes contexts with chronostratigraphic data at Loci A and B.

Figure 34. Humboldt point from Unit 33, Level 2, at LAN-2768.

Late or Historical period (Justice 2002:368–372; Lanning 1963:252–253; Thomas 1981:15–16). The indeterminate-base Cottonwood Triangular arrow point and the Cottonwood Leaf-shaped arrow point were in early Intermediate period contexts and were likely intrusive.

In summary, analysis of lithic artifacts recovered from the analytical contexts at LAN-2768 reveals three major patterns. First, activities related to lithic-tool manufacture and maintenance were most intense during the early Intermediate and Intermediate periods. Second, spatially, the lithic-tool manufacture and maintenance were located in the northeastern part of the site (CU 3). Finally, rock clusters at LAN-2768 (including Feature 18) had the highest lithic-artifact manufacture indicators compared to the other five feature types.

Lithic Artifacts from LAN-54

Analysis of lithic artifacts recovered from LAN-54 involved the study of 876 artifacts recovered from three distinct contexts: control units, burial features, and nonburial features (Tables 22 and 23).

Sampling Strategy

Detailed technological analysis was conducted on stone artifacts, including 300 artifacts from 4 control units, 9 artifacts from 3 burial features, and 567 artifacts from 10 nonburial features. The lithic artifacts analyzed include flaked stone (41.4 percent), ground stone (1 percent), and unshaped stone (57.6 percent).

Control Units

In total, 300 lithic artifacts were recovered from the four control units (see Tables 22 and 23) and included cores, debitage, bifaces, edge-modified pieces, a chopper, a mano, a metate, and unshaped stone artifacts. The four control units are located along the long axis of the site; CU 3 is on the southwestern end, CU 11 is to the northeast of CU 3, along the long axis, and CUs 30 and 31 continue along the long axis to the northeast.

The four control units will be used as temporal and spatial controls to interpret human behavior as it pertains to lithic-tool production, discard, and use at LAN-54 during the late Millingstone and early Intermediate periods (Table 24). Detailed discussion of the distribution of artifacts in each control unit is presented in Appendix B.25, and data are presented in Appendixes B.26–B.32.

Spatially, CU 3 had a higher density of lithic artifacts (44 artifacts per cubic meter) than CU 11 (22.4 artifacts per cubic meter). CUs 3 and 11 are located in the southwestern part of the site. CUs 30 and 31 had much lower artifact densities (4 and 9 artifacts per cubic meter, respectively) and indicate a significantly lower intensity of prehistoric occupation in this part of the site. The northeastern end of the long axis across the site had a lower lithic-artifact density than the southwestern end. In addition, there were spatial distinctions in the recovery of particular types of lithic artifacts. For example, FAR was recovered only from CU 3, and cores, ground stone, and edge-modified pieces were recovered only from CUs 3 and 11. It is very likely that lithic production and maintenance occurred primarily in the southern part of the site and non-lithic-production-related activities occurred in the northern portion.

Based primarily on the frequencies and densities of artifacts recovered from temporally distinct strata, the early Intermediate period occupation at the site appears to have been the more prevalent (see Table 24). The low-density Millingstone period deposits predominantly yielded debitage, a mano, a metate, and a cobble hammerstone. A relatively wider range and frequency of artifacts were recovered from the early Intermediate period. FAR was recovered exclusively from the early Intermediate period deposits. Based on the lithic-artifact data from the four control units, the late Millingstone period occupation was exceedingly ephemeral, relative to that of the early Intermediate period.

Burial Features

Lithic artifacts were recovered from three burial features at LAN-54 (see Tables 22 and 23). Feature 3, located in the southwestern portion of the site and 1 m east of Feature 16 (an artifact concentration), consisted of a single fully flexed primary inhumation located between CUs 3 and 11. Feature 6, located in proximity to CU 11, consisted of two primary inhumations. Feature 11, located north of CU 11 and south of CU 30, consisted of a single primary inhumation. Based on the low frequencies of artifacts, it is likely that they represent midden fill rather than intentional inclusions.

Table 22. Summary of Flaked Stone Artifacts from Analyzed Contexts at LAN-54

Context	Core	Debitage	Drill	Biface	Edge-Modified Flake	Chopper	Core Hammerstone	Total Flaked Stone	Total Lithic Artifacts
CU 3	1	53	—	—	3	—	—	57	176
CU 11	2	103	—	1	1	1	—	108	111
CU 30	—	4	—	1	—	—	—	5	5
CU 31	—	6	—	—	—	—	—	6	8
Subtotal	3	166	—	2	4	1	—	176	300
Burial Feature 3	1	2	—	—	—	—	—	3	3
Burial Feature 6	—	4	—	—	—	—	—	4	4
Burial Feature 11	—	2	—	—	—	—	—	2	2
Subtotal	1	8	—	—	—	—	—	9	9
Nonburial Feature 1	—	—	—	—	—	—	—	0	71
Nonburial Feature 7	—	32	1	—	—	—	—	33	185
Nonburial Feature 12	3	11	—	—	—	—	1	15	26
Nonburial Feature 13	1	23	—	—	—	—	—	24	41
Nonburial Feature 16	1	3	—	—	—	—	—	4	6
Nonburial Feature 23	—	34	—	—	—	—	—	34	128
Nonburial Feature 24	—	30	—	—	—	—	1	31	67
Nonburial Feature 29	—	33	—	—	—	—	—	33	36
Nonburial Feature 33	—	2	—	—	—	—	—	2	4
Nonburial Feature 36	—	2	—	—	—	—	—	2	3
Subtotal	5	170	1	—	—	—	2	178	567
Total	9	344	1	2	4	1	2	363	876

Table 23. Summary of Ground Stone and Unshaped-Stone Artifacts from Analyzed Contexts at LAN-54

Context	Ground/Battered Stone						Unshaped Stone			Total
	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Pestle	Mano	Metate	Total Ground/ Battered Stone	FAR	Cobble Hammerstone	Total Unshaped Stone	
CU 3	—	—	—	1	—	1	118	—	118	176
CU 11	—	—	—	—	2	2	—	1	1	111
CU 30	—	—	—	—	—	—	—	—	—	5
CU 31	—	—	—	—	—	—	1	1	2	8
Subtotal	—	—	—	1	2	3	119	2	121	300
Burial Feature 3	—	—	—	—	—	—	—	—	—	3
Burial Feature 6	—	—	—	—	—	—	—	—	—	4
Burial Feature 11	—	—	—	—	—	—	—	—	—	2
Subtotal	—	—	—	—	—	—	—	—	—	9
Nonburial Feature 1	—	—	1	—	—	1	70	—	70	71
Nonburial Feature 7	—	—	—	—	—	—	152	—	152	185
Nonburial Feature 12	1	—	—	—	—	1	10	—	10	26
Nonburial Feature 13	—	—	—	—	—	—	17	—	17	41
Nonburial Feature 16	—	—	—	—	—	—	2	—	2	6
Nonburial Feature 23	3	1	—	—	—	4	90	—	90	128
Nonburial Feature 24	—	—	—	—	—	—	36	—	36	67
Nonburial Feature 29	—	—	—	—	—	—	3	—	3	36
Nonburial Feature 33	—	—	—	—	—	—	2	—	2	4
Nonburial Feature 36	—	—	—	—	—	—	1	—	1	3
Subtotal	4	1	1	—	—	6	383	—	383	567
Total	4	1	1	1	2	9	502	2	504	876

Table 24. Summary of Lithic Artifacts Recovered from Control Units at LAN-54, by Cultural Stratum

Cultural Stratum	Flaked Stone					Ground/Battered Stone		Unshaped Stone		Total	Volume (m^3)	Density (n/m^3)
	Core	Debitage	Biface	Edge-Modified Flake	Chopper	Mano	Metate	FAR	Cobble Hammerstone			
Fill	1	3	—	—	—	—	—	—	—	4	0.7	5.7
Early Intermediate period	2	137	2	4	1	—	1	119	1	267	6.52	41.0
Late Millingstone period	—	26	—	—	—	1	1	—	1	29	2.4	8.3
Total	3	166	2	4	1	1	2	119	2	300	9.6	31.2

Nonburial Features

In total, 567 lithic artifacts were analyzed from 10 nonburial features, including 6 artifact concentrations, 3 rock clusters, and a pit (Table 25). Most of the nonburial features dated to the early Intermediate period, with the exceptions of Features 1, 23, and 24.

Artifact Concentrations

The 6 artifact concentrations yielded 116 lithic artifacts (20.5 percent of artifacts from the 10 nonburial features) (see Tables 22 and 23). With the exception of Feature 33, which is located in the northern part of the site, the artifact concentrations are in the vicinity of each other within the southwestern part of the site. All the artifact concentrations were dated to the early Intermediate period, with the exception of Feature 33, which did not yield any datable materials.

There were immense differences in artifact recovery among the six artifact concentrations. For example, Features 33 and 36 yielded very low frequencies of artifacts relative to the other artifact concentrations. Both features yielded two pieces of debitage each and two pieces and one piece of FAR, respectively. By contrast, the other four artifact concentrations had much higher artifact densities. Feature 13 had the highest artifact density and yielded debitage (56.1 percent), a core (2.4 percent), and FAR (41.5 percent). Feature 13 also had the highest frequency of FAR among the artifact concentrations.

Three of the six artifact concentrations yielded only debitage and FAR, and the other three features had cores in addition to debitage and FAR. All the artifact concentrations are locales of lithic production and discard. The FAR in these features could well be related to lithic production, but food preparation also could have occurred, based on the recovery of faunal remains.

Rock Clusters

Lithic artifacts from three rock clusters were analyzed. All three rock clusters were located in the southeastern portion of the site. Two dated to the late Millingstone period (Features 1 and 23), and one (Feature 7) dated to the early Intermediate period. In total, 384 lithic artifacts were recovered from these three features, and FAR accounted for 81.3 percent of the collection. Feature 7 yielded debitage, one chert drill fragment, and FAR. The ground stone, the mano, and the pestle were recovered from late Millingstone period features. The artifact collection from the rock clusters appear to represent remnants of hearth or cooking-feature cleanouts, as evidenced by the FAR and fire-affected artifacts.

Pit

Feature 24, located in the vicinity of CU 3, yielded 67 lithic artifacts, including debitage (44.8 percent), a core hammerstone (1.5 percent), and FAR (53.7 percent). The artifact collection from the pit feature is largely similar to the collection from the artifact concentrations.

Summary of Nonburial Features

Of the three feature types at LAN-54, the rock clusters had the highest artifact density (see Table 25), followed by the pit feature, and the artifact concentrations had the lowest density. Particular features within each feature category had higher densities. For example, three features with the highest densities include Feature 1 (rock cluster), Feature 7 (rock cluster), and Feature 13 (artifact concentration).

The highest artifact diversity was noted among the rock clusters, followed by the artifact concentrations, and the pit had low diversity. Feature 23 (rock cluster) had the highest diversity in lithic artifacts, which suggests a greater range of activities at this particular locale, a generalized activity locale.

Summary Discussion of Lithic Artifacts from LAN-54

Investigations at LAN-54 add to our understanding of the function of wetland sites in the Ballona. Eberhart (1949) first recorded LAN-54 as a probable village site. The discovery of burials during the PVAHP also argues for a somewhat sedentary occupation during the Intermediate period. The lithic collection from LAN-54 suggests that although stone-tool manufacture occurred on-site, clear indicators of seasonal versus long-term occupation are lacking. Secondary use of broken ground stone in thermal features implies an occupation more substantial than an ephemeral habitation, although it is possible that objects could have been recycled during subsequent site visits.

The collection did not include projectile points or finished bifaces; temporally diagnostic artifacts were not recovered from the site. The two bifaces recovered from two control units were Stages 2 and 3 and had manufacturing breaks. Considering the location of LAN-54 on the edge of the wetlands, perhaps subsistence activities were focused more on fish and shellfish procurement and less on hunting of terrestrial animals requiring the use of projectile points.

Ground stone was scarce at LAN-54 and was only recovered in fragmentary form. Of the nine identified specimens, seven were recovered from late Millingstone period deposits, and two were recovered from early Intermediate period contexts (Table 26). Note that the late Millingstone period ground stone was recovered in higher frequencies from feature contexts than from the control units. Note that debitage density in the control units suggests a more intensive occupation during the early Intermediate period than during the late Millingstone period.

The most dominant material (of those artifacts identified to material type) represented at LAN-54 was granite; chert

Table 25. Lithic Artifacts Recovered from Nonburial Features at LAN-54

Feature No., by Feature Type	Temporal Period	Flaked Stone				Ground/Battered Stone			Unshaped Stone	Total	Volume (m^3)	Density (n/m^3)
		Core	Debitage	Drill	Core Hammerstone	Fire-Altered Ground Stone	Fire-Altered Mano	Fire-Altered Pestle	FAR			
Artifact concentration												
12	early Intermediate	3	11	—	1	1	—	—	10	26	0.20	130.0
13	early Intermediate	1	23	—	—	—	—	—	17	41	0.06	683.3
16	early Intermediate	1	3	—	—	—	—	—	2	6	0.03	200.0
29	early Intermediate	—	33	—	—	—	—	—	3	36	0.31	116.1
36	early Intermediate	—	2	—	—	—	—	—	1	3	0.70	4.3
33		—	2	—	—	—	—	—	2	4	3.12	1.3
Subtotal		5	74	—	1	1	—	—	35	116	4.42	26.2
Rock cluster												
7	early Intermediate	—	32	1	—	—	—	—	152	185	0.20	925.0
1	late Millingstone	—	—	—	—	—	—	1	70	71	0.04	1,775.0
23	late Millingstone	—	34	—	—	3	1	—	90	128	0.40	320.0
Subtotal		—	66	1	—	3	1	1	312	384	0.64	600.0
Pit												
24	late Millingstone	—	30	—	1	—	—	—	36	67	0.30	223.3
Subtotal		—	30	—	1	—	—	—	36	67	0.30	223.3
Total		5	170	1	2	4	1	1	383	567	5.36	105.8

Table 26. Lithic Artifacts from LAN-54, by Cultural Stratum

Artifact Type	Mixed/Fill	Early Intermediate Period	Late Millingstone Period	Total
Core	1	8	—	9
Debitage	5	249	90	344
Drill	—	1	—	1
Biface	—	2	—	2
Edge-modified flake	—	4	—	4
Chopper	—	1	—	1
Core hammerstone	—	1	1	2
Fire-altered ground stone	—	1	3	4
Fire-altered mano	—	—	1	1
Fire-altered pestle	—	—	1	1
Mano	—	—	1	1
Metate	—	1	1	2
FAR	2	304	196	502
Cobble hammerstone	—	1	1	2
Total	8	573	295	876

was found in slightly lower quantities (see Appendixes B.31 and B.32). With the exception of obsidian, all lithic materials recovered from LAN-54 could have been procured within a day's walk of the site. In addition, LAN-54 was located in the coastal drainage system, ideally situated for targeting the diverse cobbles and pebbles transported by local waterways into the basin. In fact, over two-thirds of flaked stone that retained cortex was waterworn, indicating that alluvial contexts were major sources of tool stone for the site occupants. By contrast, only 28.9 percent of flaked stone had primary geologic cortex.

Geochemical sourcing indicated that obsidian was imported to the site from the Coso volcanic field (see Appendix B.1). A single obsidian flake came from a late Millingstone period context, and the other five were from early Intermediate period contexts. The sample did not include any core-reduction flakes or debitage with cortex, indicating that finished obsidian tools were brought to the site and that only retouch occurred on-site. However, it was noted that obsidian tools were not recovered in the study sample from LAN-54.

In summary, lithic use was more prevalent during the early Intermediate period occupation than during that of the late Millingstone period, which was ephemeral. FAR was recovered in the highest relative frequencies from the analyzed contexts and accounts for a higher percentage of the late Millingstone period collection than of the early Intermediate period collection. Rock clusters had the highest artifact density and diversity, regardless of time period. The late Millingstone period component at LAN-54 is defined by FAR, ground stone, and debitage, and the early Intermediate period component is more diverse. Based on the collection, lithic production was minimal for the LAN-54 late Millingstone period populations, relative to the later populations. Instead, ground stone use and generalized food preparation (as evidenced by the higher frequencies of FAR and fire-altered ground stone) were more intensive.

LAN-62

Analysis of lithic artifacts from LAN-62 involved the study of artifacts recovered from Loci A and G and Loci C and D. Because of the large flaked-stone-artifact collection from the site, rigorous analysis was focused on particular contexts within each locus that had chronostratigraphic data and behavioral implications.

Loci A and G

Detailed technological analysis was conducted on 12,010 stone artifacts recovered from LAN-62, Loci A and G, which included six control units, burial features, the burial area, and nonburial features. The nonburial features were in FBs 3, 4, and 7 and sitewide contexts (Table 27). The lithic artifacts analyzed include flaked stone (70.7 percent), ground/battered stone (5.5 percent), and unshaped stone (27.1 percent). Collections from the burial area have the highest frequencies of ground/battered and unshaped stones, and the control units have the lowest frequencies of these lithic-artifact groups of all analyzed contexts at LAN-62, Loci A and G. Flaked stone artifacts account for a significant majority of the collections from all contexts except burial and burial-area contexts (34.7 and 37.5 percents respectively). These varying distributions have important behavioral implications that will be discussed.

Table 27. Summary of Lithic Artifacts from Analyzed Contexts at LAN-62, Loci A and G

Analytical and Excavation Context	Flaked Stone	Ground/Battered Stone	Unshaped Stone	Total
Control units				
CU 141	971	7	18	996
CU 316	939	2	9	950
CU 323/321	1,486	9	24	1,519
CU 682	549	8	19	576
CU 853	106	1	4	111
CU 1048	594	4	6	604
Subtotal	4,645	31	80	4,756
Burial features				
Items	382	236	429	1,047
Nonitems	159	165	189	513
Subtotal	541	401	618	1,560
Burial area				
Excavation units (items only)	375	172	706	1,253
Nonburial features	254	71	99	424
Subtotal	629	243	805	1,677
Nonburial features (sitewide)	1,694	72	922	2,688
Subtotal	1,694	72	922	2,688
FB 3				
Excavation units (items only)	21	10	46	77
Nonburial features	707	21	76	804
Subtotal	728	31	122	881
FB 4				
Excavation units (items only)	30	4	61	95
Nonburial features	156	4	54	214
Subtotal	186	8	115	309
FB 7				
Excavation units (items only)	39	5	45	89
Nonburial features	35		15	50
Subtotal	74	5	60	139
Total	8,497	791	3,260	12,010

Control Units

Stone artifacts from six control units were analyzed to evaluate the distribution and densities of artifacts in the midden and also to define chronological trends. Of these six control units, five are from Locus A, and one is from Locus G. The control units yielded 41.4 percent of the lithic-artifact collection analyzed from LAN-62, Loci A and G (Tables 28–30). Flaked stone artifacts accounted for the bulk (97.7 percent) of the collection from the control units, followed in decreasing frequency by unshaped stone (1.7 percent) and ground and battered stone (0.7 percent). In the following discussion, the results of each control unit are presented, including examinations of lithic types, relative distribution, density, trends over time, and comparisons between the control units. Detailed discussion of the distribution of artifacts in each control unit is presented in Appendix B.33, and data are presented in Appendixes B.34–B.39.

Overall, the relative artifact frequencies of flaked stone, ground and battered stone, and unshaped stone were identical in the control units; flaked stone composed more than 95 percent of each collection. Debitage and FAR consistently made up the bulk of the flaked stone and unshaped-stone collections, respectively. Various stages of lithic reduction were noted within each control-unit flaked stone collection, although most of the debitage was identified as core reduction. Cores were recovered from almost all of the control units, and given the recovery of cores associated with flakes of the same material type, these collections represent core-reduction activities across the site.

Table 28. Summary of Flaked Stone Artifacts from Analyzed Contexts at LAN-62, Loci A and G

Analytical and Excavation Context	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Other[a]	Total
Control units							
CU 141	7	952	2	4	5	1	971
CU 316	5	920	2	4	8	—	939
CU 323/321	3	1458	6	8	9	2	1,486
CU 682	3	537	—	3	6	—	549
CU 853	—	106	—	—	—	—	106
CU 1048	4	584	1	1	3	1	594
Subtotal	22	4,557	11	20	31	4	4,645
Burial features							
Items	27	229	34	32	46	14	382
Nonitems	9	39	54	38	12	7	159
Subtotal	36	268	88	70	58	21	541
Burial area							
Excavation units (items only)	48	155	41	47	65	19	375
Nonburial features	2	246	3	1	2	—	254
Subtotal	50	401	44	48	67	19	629
Nonburial features (sitewide)	21	1,648	3	3	10	9	1,694
Subtotal	21	1,648	3	3	10	9	1,694
FB 3							
Excavation units (items only)	4	7	1	1	7	1	21
Nonburial features	4	697	2	2	—	2	707
Subtotal	8	704	3	3	7	3	728
FB 4							
Excavation units (items only)	5	13	—	—	6	6	30
Nonburial features	4	151	—	—	—	1	156
Subtotal	9	164	—	—	6	7	186
FB 7							
Excavation units (items only)	9	18	—	2	8	2	39
Nonburial features	1	34	—	—	—	—	35
Subtotal	10	52	—	2	8	2	74
Total	156	7,794	149	146	187	65	8,497

[a] Other: drill, chopper, split cobble, core hammerstone, fire-altered core hammerstone, and effigy.

Table 29. Summary of Ground Stone Artifacts from Analyzed Contexts at LAN-62, Loci A and G

Analytical and Excavation Context	Ground Stone[a]	Mano	Metate	Pestle	Mortar	Bowl	Fire-Altered Vessel	*Comal*	Pendant	Bead	Other[b]	Total
Control units												
CU 141	1	1	—	—	—	—	4	—	—	—	1	7
CU 316	1	—	1	—	—	—	—	—	—	—	—	2
CU 323/321	2	2	1	—	—	1	—	1	—	2	—	9
CU 682	1	3	2	—	—	—	1	—	—	1	—	8
CU 853	—	1	—	—	—	—	—	—	—	—	—	1
CU 1048	3	—	—	1	—	—	—	—	—	—	—	4
Subtotal	8	7	4	1	—	1	5	1	—	3	1	31
Burial features												
Items	46	1	1	14	1	70	4	21	11	11	56	236
Nonitems	11	11	3	—	—	1	—	—	—	136	3	165
Subtotal	57	12	4	14	1	71	4	21	11	147	59	401
Burial area												
Excavation units (items only)	30	38	14	10	4	19	19	2	6	3	27	172
Nonburial features	3	—	—	1	—	27	—	2	—	9	29	71
Subtotal	33	38	14	11	4	46	19	4	6	12	56	243
Nonburial features (sitewide)	36	15	9	2	—	1	2	—	—	4	3	72
Subtotal	36	15	9	2	—	1	2	—	—	4	3	72
FB 3												
Excavation units (items only)	4	—	—	—	—	—	1	3	—	1	1	10
Nonburial features	3	—	8	—	—	1	2	4	—	1	2	21
Subtotal	7	—	8	—	—	1	3	7	—	2	3	31
FB 4												
Excavation units (items only)	2	2	—	—	—	—	—	—	—	—	—	4
Nonburial features	2	—	1	—	—	—	—	—	—	1	—	4
Subtotal	4	2	1	—	—	—	—	—	—	1	—	8
FB 7												
Excavation units (items only)	—	3	—	—	—	—	—	—	—	—	2	5
Nonburial features	—	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	3	—	—	—	—	—	—	—	—	2	5
Total	145	77	40	28	5	120	33	33	17	169	124	791

[a] Including indeterminate ground stone.
[b] Other: abrader, anvil, charm stone, disk, palette, pipe, plummet, vessel, and other.

Table 30. Summary of Unshaped-Stone Artifacts from Analyzed Contexts at LAN-62, Loci A and G

Analytical and Excavation Context	FAR	Cobble Hammerstone	Tarring Pebble	Manuport	Other[a]	Total
Control units						
CU 141	6	—	2	9	1	18
CU 316	8	—	1	—	—	9
CU 323/321	22	—	—	2	—	24
CU 682	17	—	1	1	—	19
CU 853	3	1	—	—	—	4
CU 1048	4	1	—	1	—	6
Subtotal	60	2	4	13	1	80
Burial features						
Items	251	7	6	46	117	427
Nonitems	147	1	14	5	22	189
Subtotal	398	8	20	51	139	616
Burial area						
Excavation units (items only)	604	20	18	25	39	706
Nonburial features	17	—	—	74	8	99
Subtotal	621	20	18	99	47	805
Nonburial features (sitewide)	659	4	20	219	20	922
Subtotal	659	4	20	219	20	922
FB 3						
Excavation units (items only)	41	—	2	1	2	46
Nonburial features	54	—	3	8	11	76
Subtotal	95	—	5	9	13	122
FB 4						
Excavation units (items only)	59	1	1	—	—	61
Nonburial features	53	—	1	—	—	54
Subtotal	112	1	2	—	—	115
FB 7						
Excavation units (items only)	43	2	—	—	—	45
Nonburial features	15	—	—	—	—	15
Subtotal	58	2	—	—	—	60
Total	2,401	45	89	442	359	3,336

[a] Other: quartz crystal, asphaltum, ocher, and other.

The control units also contained several different types of flaked stone tools, including 11 projectile points identified as leaf-shaped, Cottonwood Triangular concave base, Cottonwood Triangular straight base, Marymount, Elko Corner-notched, and Desert Side-notched. Although four of the six control units yielded projectile points, most of these (54.5 percent) were recovered from a single control unit, CU 323/321. Collectively, the projectile points indicate cultures dating from the late Millingstone period to the Mission period.

Compared to flaked stone, no single lithic type dominated the ground and battered stone collection. Ground stone and manos were recovered in slightly higher, but not significant, frequencies than other types. In general, the ground and battered stone artifacts were utilitarian in type, with the exceptions of three decorative ground stone artifacts and three beads recovered from CU 323/321 and CU 682.

The unshaped-stone category consisted primarily of utilitarian lithic artifacts, as well, composed mostly of FAR, in addition to steatite manuports of unknown function. In all, the lithic collection from control units represented a range of activities, including tool-stone processing and manufacture as well as food preparation. Considering the proximity to a burial area, some of these lithic artifacts (e.g., pestles, *comales*, and bowls) may have been associated with or intended for use in ritual activities, as well.

Lithic frequencies ranged widely within control units; CU 323/321 yielded the highest frequency. The concentration of artifacts within CU 323/321, located away from the main burial area, likely reflects intensive use of this portion of the site, particularly during the Late and Mission periods, as evidenced by the higher densities recovered from these contexts. CU 141 yielded the second-largest lithic concentration among control units. The relative abundance of lithic artifacts may have been a factor of the close proximity to the burial area, where intensive activities associated with the burials occurred. As with CU 323/321, the densest lithic concentrations in CU 142 were recovered from Late period deposits.

Chronostratigraphic contexts within LAN-62, Loci A and G, control units ranged from the Millingstone period to the Mission period, although the earlier component was not identified in CU 682. In general, contexts dating to the Intermediate period yielded the highest lithic frequencies, comprising 33.9 percent of the control-unit collection (Table 31). Protohistoric to Mission period contexts yielded nearly a third (30.3 percent) of the collection. The high frequencies recovered from Intermediate period were attributable to a single lithic type: debitage. Debitage aside, frequencies of ground and battered stone, as well as unshaped stone, were highest for Late to Mission period contexts.

Most of the lithic types were recovered from two or more stratigraphic contexts, indicating that they were used widely over time. The exception was *comales*, recovered only from Protohistoric to Mission period contexts. This distribution corresponds with the purported introduction of *comales* in southern California contexts following European contact (Gamble 2002). Additionally, the single pestle was recovered from the Protohistoric to Mission period deposits.

Although lithic frequencies were highest for Intermediate period deposits, comparisons of lithic densities reveal a slightly

Table 31. Lithic Artifacts from Control Units at LAN-62, Loci A and G, by Temporal Period

Artifact Category, by Type	Protohistoric to Mission	Late	Intermediate	Millingstone	Total
Flaked stone					
Core	7	3	16	8	34
Debitage	1,624	1,017	2,255	1,459	6,355
Projectile point	9	8	1	1	19
Biface	10	2	10	8	30
Edge-modified piece	4	1	19	12	36
Other	182	14	149	56	401
Subtotal	1,836	1,045	2,450	1,544	6,875
Ground/battered stone					
Ground stone (including indeterminate ground stone)	52	3	19	15	89
Mano	1	3	5	5	14
Metate	8	—	4	1	13
Pestle	1	—	—	—	1
Bowl	29	—	—	1	30
Vessel	33	—	5	2	40
Comal	7	—	—	—	7
Bead	11	8	3	—	22
Other	3	—	—	—	3
Subtotal	145	14	36	24	219
Unshaped stone					
FAR	174	36	82	50	342
Cobble hammerstone	2	—	1	—	3
Tarring pebble	6	3	1	1	11
Manuport	85	4	5	1	95
Other	57	1	4	1	63
Subtotal	324	44	93	53	514
Total	2,305	1,103	2,579	1,621	7,608

Note: Only contexts with strong chronostratigraphic data are included.

different pattern. Millingstone period contexts yielded the greatest density (381 per cubic meter) of artifacts, followed by the Intermediate (368 per cubic meter) and Protohistoric to Mission (322 per cubic meter) period deposits. This distribution may reflect more-intensive sitewide lithic-related activities during the Millingstone period that decreased over time. This temporal trend may have occurred if earlier activities were primarily domestic based and later activities focused on ritual centered within the main burial area. Alternatively, or in part, the higher lithic densities within the Millingstone period component may be a function of taphonomic agents, such as displacement of lithic artifacts from overlying levels as a result of bioturbation and/or gravity-driven settling of heavier materials in the lower levels.

Burial Features

Lithic artifacts recovered from burial features represent 13 percent of the total analyzed LAN-62, Loci A and G, collection and include 1,560 artifacts recovered from 300 burial features (Table 32; see Table 27). These artifacts consist of a wide range of artifact types representing ritual, domestic, manufacturing, and processing activities. Unshaped-stone artifacts account for a higher percentage of the burial collection, followed by flaked stone and ground/battered stone. Within the unshaped-stone category, most of the artifacts are FAR; lower frequencies of artifacts are classified in the "other" category and as manuports. The "other" category includes asphaltum, ocher, and quartz crystals.

The flaked stone collection from the burials is dominated by debitage; projectile points, bifaces, edge-modified flakes, cores, and other were found in lower frequencies (see Table 32). Flaked stone artifacts classified in the "other" category were drills, choppers, core hammerstone, and miscellaneous artifacts. Although ground and battered stone artifacts made up the smallest portion of the analyzed collection, this group contained the greatest variety of artifact types. Beads, bowls, and artifacts classified in the "other" category composed the bulk of this collection. Artifact diversity in ground and battered artifacts was within the "other" category, which consists of anvils, shaft straighteners, plummet stones, tablets, perforated disk, indeterminate vessel fragments, and miscellaneous artifacts. In general, FAR and debitage accounted for the bulk of the total analyzed burial collection. Many, if not most, of these artifacts may have been part of underlying and overlying midden deposits rather than purposely interred with burial individuals. In cases of cremation, FAR may have been part of the cremation process.

Overall, the frequency of lithic artifacts in burial features ranged widely from 1 to 369 artifacts. Given this wide range in frequencies and also the large number of burial features containing lithic artifacts, the burial features were grouped into three categories according to the frequencies of lithic artifacts recovered from individual burial features: Group 1 (frequencies of 15 or greater), Group 2 (6–14 lithic artifacts), and Group 3 (5 or fewer lithic artifacts) (see Appendixes B.40 and B.41). All three groups are located within the main burial area (Figure 35). Group 1 burial features are located in the southern and central portions, and Groups 2 and 3 are dispersed throughout the main burial area. Considering that few burial features yielded 15 lithic artifacts or more, these features are discussed in detail, whereas burial features in Groups 2 and 3 are discussed in general terms, highlighting unusual lithic types and distributions.

Group 1 (15 or More Lithic Artifacts)

Group 1 consisted of seven burial features. Burial Feature 38 was located in the southern portion of the main burial area, and burial Features 67 and 257 were located 10 cm apart in the central portion of the burial area. In total, analysis included 272 lithic items, comprising 17.4 percent of the total analyzed collection recovered from burial features.

Burial Feature 38

Burial Feature 38 yielded the highest frequency of lithic items (n = 130) (see Appendix B.40). The burial feature contained the remains of five individuals: a primary inhumation consisting of a 20–30-year-old female; a second primary individual, 20–30 years old, of indeterminate sex; a 20–30-year-old female; a possible male 6–22 years of age; and an adult (at least 18 years or older) of indeterminate sex.

Burial Feature 38 yielded a variety of artifacts, including flaked stone (7 percent), ground and battered stone (70 percent), and unshaped stone (23 percent). The primary-burial individual was associated with fragments of at least four steatite *comales*. The fragments were stacked in four separate clusters from the primary individual's head to the pelvis (Figure 36). Interestingly, conjoining fragments from each *comal* were separated so that no conjoining fragments from the same *comal* were present in a stack. It appeared that the mourners deliberately broke the *comales* in a controlled fashion and took great care to keep adjoining fragments separate. Of note, one *comal* fragment was placed on the heart or torso area of the primary individual. In addition to *comales*, a large clump of ocher associated with the primary individual was recovered from the hand region.

Most of the lithic items recovered from the feature were associated with the second primary individual. The remains of at least eight steatite vessels representing olla, dish, *comal*, mortar, or bowl fragments were recovered from the northern half of the feature. Some of these items were intentionally broken (Figures 37–39). The fragments exhibited both recent and relict fractures. Many of the fragments exhibited soot marks, including one vessel, likely an olla, with thick soot marks on the wall fragments rather than the base. The locations of these marks indicated that the vessel was heated in a fire built around it, presumably to cook or warm food or liquid. Fragments of a second vessel, a mortar or bowl, exhibited a smooth interior base, indicating grinding with a pestle in a rotational manner rather than a pounding motion. A black, lustrous, lunate stain, possibly asphaltum, was noted on the exterior base fragment.

Table 32. Lithic Artifacts in Burial Groups, LAN-62, Loci A and G[a] (Items and Nonitems)

Artifact Category, by Type	Burial-Feature Groups						Total		
	Group 1 (15 or More Lithic Artifacts)[b]		Group 2 (6–14 Lithic Artifacts)[c]		Group 3 (5 or Fewer Lithic Artifacts)[d]				
	n	With Group (%)	n	With Group (%)	n	With Group (%)	n	Within Artifact Category (%)	Total (%)
Flaked stone									
Core	2	3.0	19	5.7	15	6.8	36	150.0	5.8
Debitage	65	97.0	130	39.2	73	33.3	268	1,116.7	43.4
Projectile point	5	7.5	48	14.5	35	16.0	88	366.7	14.2
Biface	4	6.0	35	10.5	29	13.2	68	283.3	11.0
Edge-modified flake	7	10.4	30	9.0	21	9.6	58	241.7	9.4
Other[e]	2	3.0	16	4.8	6	2.7	24	100.0	3.9
Subtotal	85	126.9	278	83.7	179	81.7	542	2,258.3	87.7
Ground/battered stone									
Ground stone (including indeterminate ground stone)	7	10.4	15	4.5	12	5.5	34	57.6	5.5
Mano	3	4.5	19	5.7	13	5.9	35	59.3	5.7
Fire-altered metate	—	0.0	3	0.9	1	0.5	4	6.8	0.6
Pestle	4	6.0	6	1.8	4	1.8	14	23.7	2.3
Mortar	—	0.0	—		1	0.5	1	1.7	0.2
Bowl	37	55.2	20	6.0	13	5.9	70	118.6	11.3
Fire-altered vessel	—	0.0	2	0.6	2	0.9	4	6.8	0.6
Comal	16	23.9	5	1.5	—		21	35.6	3.4
Pendant	9	13.4	—		2	0.9	11	18.6	1.8
Bead	23	34.3	72	21.7	52	23.7	147	249.2	23.8
Other[f]	21	31.3	19	5.7	19	8.7	59	100.0	9.5
Subtotal	120	179.1	161	48.5	119	54.3	400	678.0	64.7
Unshaped stone									
FAR	20	29.9	229	69.0	150	68.5	399	283.0	64.6
Cobble hammerstone		0.0	3	0.9	4	1.8	7	5.0	1.1

continued on next page

Artifact Category, by Type	Burial-Feature Groups: Group 1 (15 or More Lithic Artifacts)[b]		Group 2 (6–14 Lithic Artifacts)[c]		Group 3 (5 or Fewer Lithic Artifacts)[d]		Total		
	n	With Group (%)	n	With Group (%)	n	With Group (%)	n	Within Artifact Category (%)	Total (%)
Tarring pebble	2	3.0	10	3.0	8	3.7	20	14.2	3.2
Manuport	6	9.0	37	11.1	8	3.7	51	36.2	8.3
Other[g]	39	73.1	53	14.8	49	22.4	141	100.0	7.9
Subtotal	67	100.0	332	100.0	219	100.0	618	438.3	100.0
Total	272	17.4	771	49.4	517	33.1	1,560		252.4

[a] Lithic items only analyzed; burial features are grouped according to the total number of itemized lithic artifacts recovered from each burial feature.
[b] Group 1 has 7 burials.
[c] Group 2 has 94 burials.
[d] Group 3 has 200 burials.
[e] Other: drill, chopper, core hammerstone, and other.
[f] Other: anvil, shaft straightener, indeterminate vessel, pipe, plummet, tablet, perforated disk, and other.
[g] Other: quartz crystal, asphaltum, and ocher.

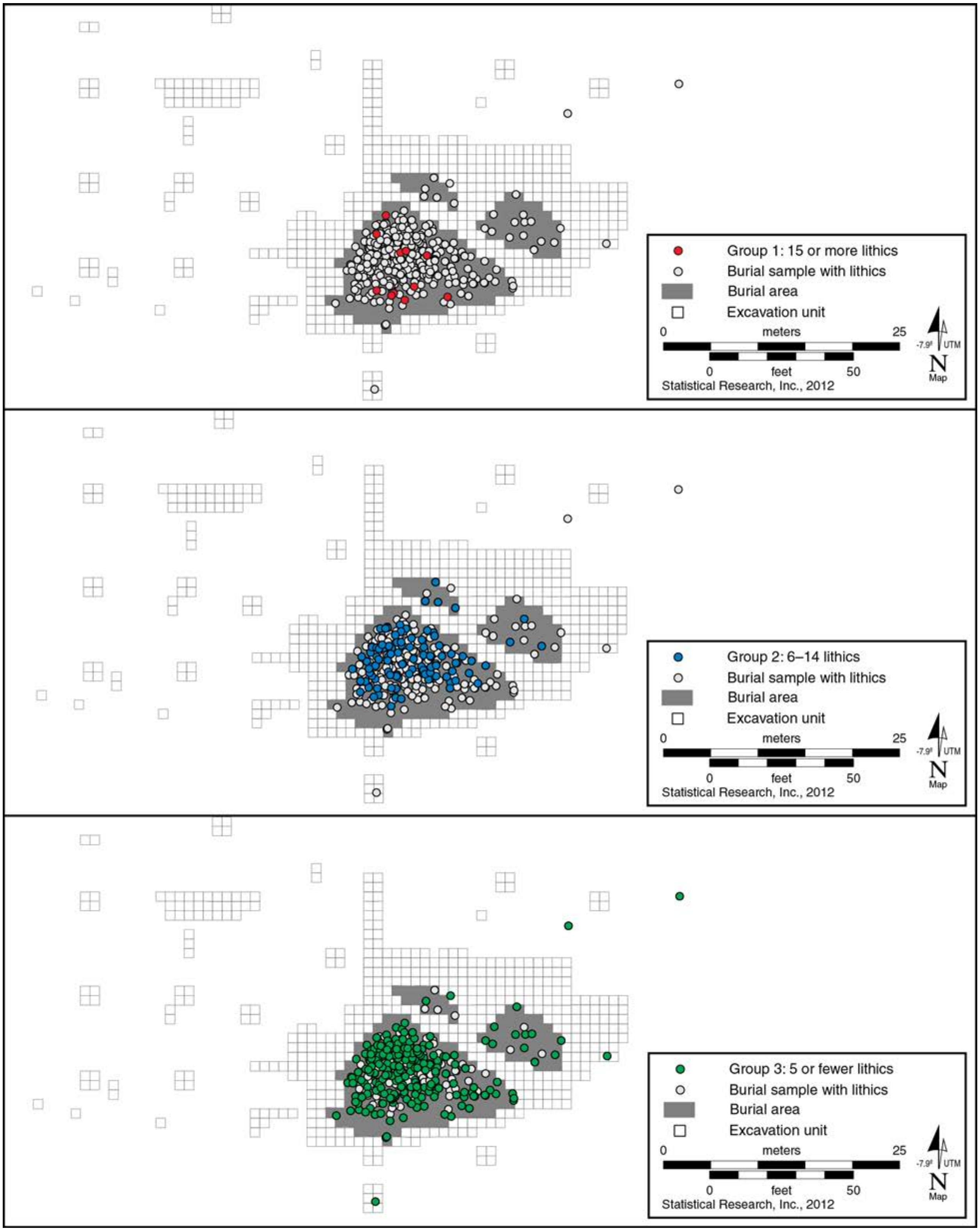


Figure 35. Burials grouped by lithic-artifact distribution.

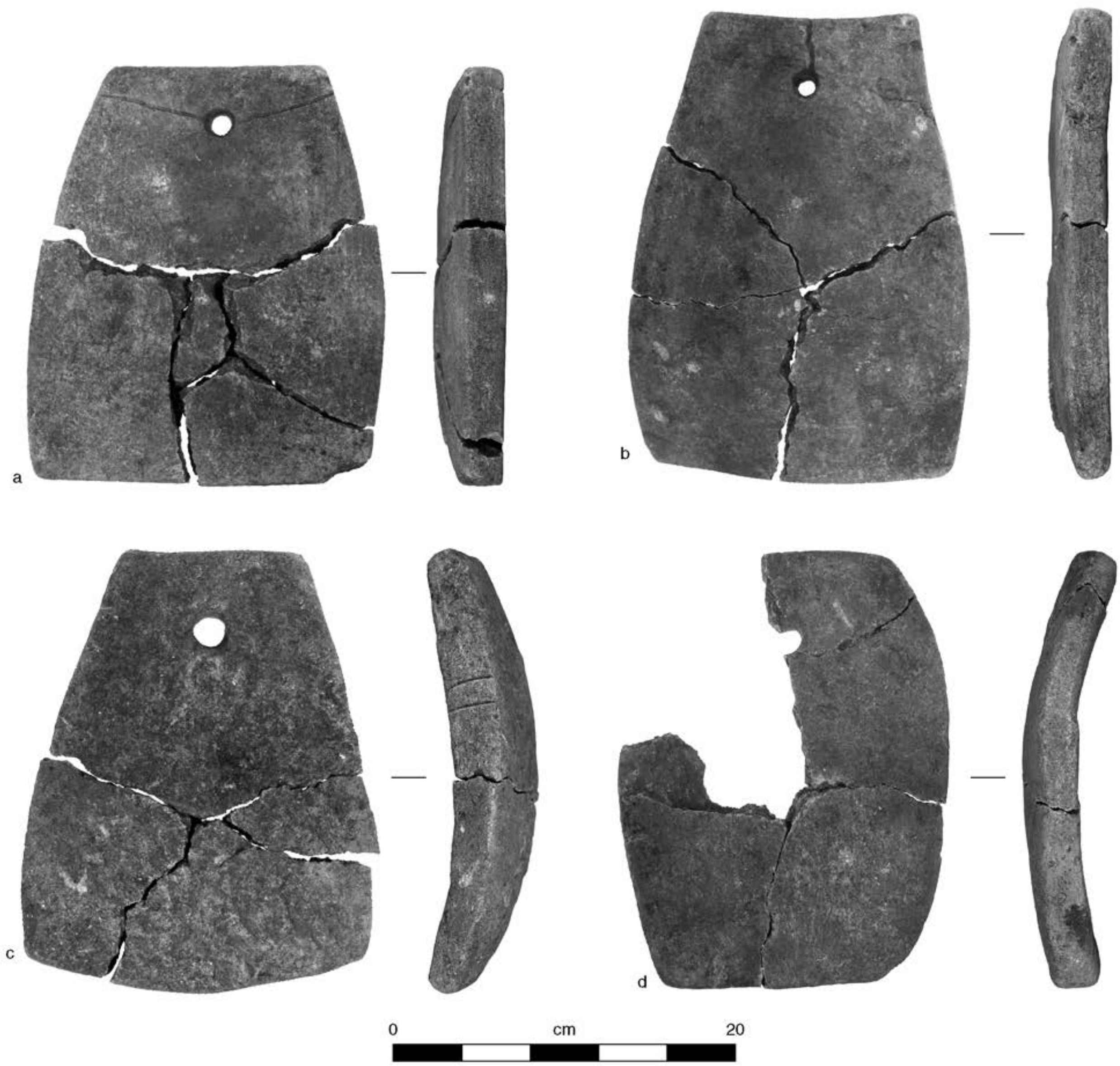


Figure 36. Four reconstructed *comales*, burial Feature 38 at LAN-62.

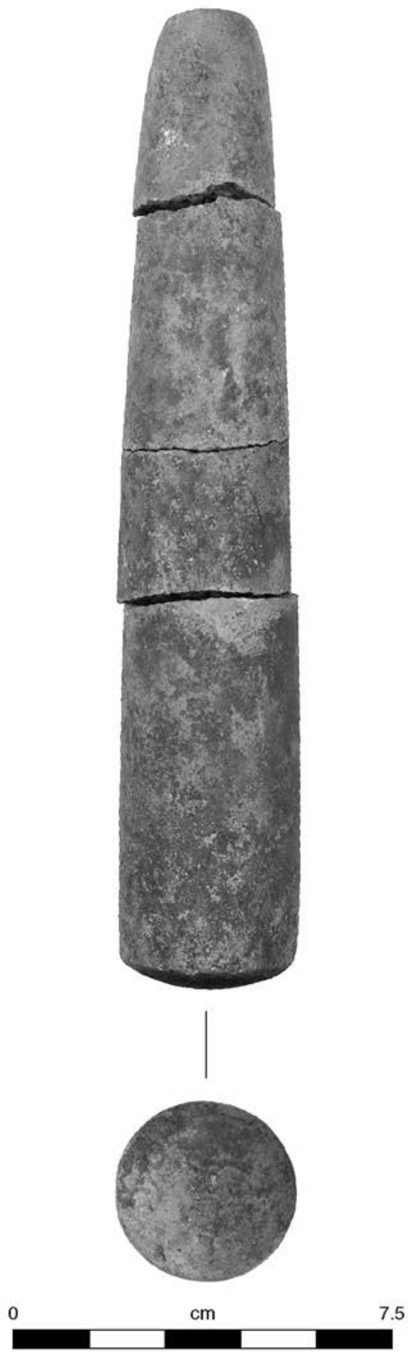


Figure 37. Intentionally broken object from burial Feature 38 at LAN-62: a reconstructed miniature pestle.

Figure 38. Intentionally broken object from burial Feature 38 at LAN-62: a reconstructed granite bowl.

Figure 39. Intentionally broken object from burial Feature 38 at LAN-62: a reconstructed steatite toloache bowl.

The second primary individual was also associated with three steatite pendants similar in appearance to miniature *comales*. Henry Koerper (personal communication 2006) noted that many objects were miniaturized by southern California coastal peoples, including bows and arrows. Other lithic artifacts associated with this individual included a granite pestle; a large, broken chert lanceolate biface coated with red ocher and stained subsequent to breakage; a steatite arrow-shaft straightener or grooved abrader; and two steatite manuports.

Comparisons of artifact types between the first and second primary individuals revealed marked differences in lithic types. The *comales* associated with the 20–30-year-old female appeared to correspond to traditional gender roles wherein women were more closely aligned with domestic activities, such as food preparation and hearths. The types of artifacts associated with the second primary individual, however, indicated ambiguous traditional gender roles. The *comal*-like pendants and vessel fragments allude to food preparation linked to traditional female roles, whereas the pestle may have been used in food processing or pigment preparation and associated with traditional female or male roles. Arrow-shaft straighteners, however, are commonly tied to hunting and thus traditional male roles. Assuming traditional gender roles, the second primary individual was found with both male- and female-associated artifacts.

In addition to artifacts associated with the primary individuals, the burial matrix contained chert edge-modified flakes, ocher, and two chert projectile points: Cottonwood Leaf-shaped and large contracting-stem. The presence of the Cottonwood Leaf-shaped point, the *comales*, and other diagnostic artifacts, including metal artifacts and glass beads, indicates that the burial feature likely dates between the Protohistoric and Mission periods. The large contracting-stem point dates earlier and likely represents a scavenged or heirloomed item.

Burial Feature 67

Located in the central portion of the main burial area and 10 cm east of burial Feature 257, burial Feature 67 consisted of a primary inhumation of an 18–21-year-old possible female and the isolated remains of at least one additional individual, a 17–25 year old of indeterminate sex. None of the lithic artifacts was directly associated with the burial individuals, although the burial matrix contained 18 pieces of ocher, which comprised the bulk (78.3 percent) of the feature's lithic collection. The matrix also contained 4 pieces of flaked stone debitage as well as 1 piece of FAR. Considering that ocher is often associated with burial individuals, it is very likely that the ocher was placed with one or more of the individuals at the time of interment. The FAR and flaked stone debitage may have already been present at the time of interment, as part of the midden deposit.

Burial Feature 134

This burial feature consisted of a single primary inhumation with isolated skeletal remains associated with at least three additional individuals. The primary individual was a 25–35-year-old male interred semiflexed on the left side, oriented to the east, with the head facing southwest. The burial matrix contained 16 artifacts, including debitage, a biface, and FAR (n = 2).

Burial Feature 174

Burial Feature 174, located in the southern portion of the main burial area, contained 20 smaller-sized disks or disk beads comprising 14 percent of the total number of stone beads recovered from burial features (and the highest bead count). The chlorite schist disks, which were found fused to shell beads (olivella bushing and cylinder, California mussel cylinder, and Pismo clam tube, beads) were recovered from the cranium area of the primary individual, a 25–35-year-old female. The burial matrix also contained a tarring pebble and 2 pieces of FAR.

Burial Feature 187

This burial was located in the northeastern portion of the main burial concentration and consisted of a single primary inhumation and isolated human remains associated with at least two additional individuals. The primary inhumation was a 30–40-year-old male interred fully flexed on the left side, oriented to the north, with the head facing east. Sixteen artifacts were recovered from this burial: 7 flaked stones, 1 fire-affected ground stone fragment, and 8 unshaped stones. The flaked stone included 2 projectile points—both concave-base Cottonwood Triangular points, 1 made of chert and the second of fused shale. The burial matrix contained unshaped lithic artifacts, including FAR, a tarring pebble, and two manuports.

Burial Feature 257

Burial Feature 257, located 10 cm west of burial Feature 67, contained the remains of at least four individuals exhibiting varying levels of preservation. Sex could not be determined for any of the remains, which included an individual of indeterminate age, a subadult or youth, an individual 15–20 years of age, and an adult of indeterminate age. Disturbance to the feature was due to adjacent burial features' intrusion into burial Feature 257.

The burial feature contained a total of 48 lithic items, including flaked stone, ground and battered stone, and unshaped-stone artifacts. The bulk (68.8 percent) of the collection was composed of 33 pieces of debitage. The debitage consisted of chalcedony core-reduction flakes recovered in three groups. Considering the arrangement, it appeared to represent deliberate smashing of a white chalcedony cobble as part of a mortuary ritual.

The burial matrix also contained a chert Cottonwood Triangular concave-base point, a steatite indeterminate vessel fragment, a fire-altered mano fragment, a cobble manuport with ocher staining, four edge-modified flakes, and one piece of FAR. In all, artifacts recovered from the burial feature represent items that may have been purposely interred with the burial individuals as well as those that may have been present in midden contexts prior to interment. The former includes the point, the steatite vessel fragment, and possibly the manuport, and the latter includes the debitage and edge-modified flakes. The presence of the Cottonwood Triangular concave-base point indicates that the burial feature or matrix may date to between the Late and Mission periods.

Burial Feature 288 (*Note*: numbers represent Features 369 and 288 combined)

This burial feature was located along the southeastern periphery of the main burial concentration and consisted of several fragments of human bone from at least one individual. This individual was estimated to be between 5 and 7 years of age. Sex was indeterminate. In total, 21 stone artifacts were recovered, including 15 flaked stone, 2 ground stone, and 3 unshaped-stone artifacts. The bulk of the collection was composed of debitage (52 percent).

Group 2 (6–14 Lithic Artifacts)

Group 2 consisted of a total of 94 burial features distributed throughout the main burial area. Collectively, these burials yielded 771 lithic items, comprising 49.4 percent of the analyzed collection recovered from burial features. The Group 2 collection included higher frequencies of flaked stone (36.1 percent) and unshaped-stone (43.1 percent) artifacts (see Appendix B.41). Ground and battered stone artifacts composed 20.9 percent of the collection and, as with Group 1, exhibited the widest range of artifact types. In general, FAR (29.7 percent) made up the bulk of the collection, followed in decreasing frequency by debitage (16.9 percent), beads (9.3 percent), unshaped stone classified as other (6.4 percent), projectile points (6.2 percent), and manuports (4.8 percent).

The relative frequencies of artifact types differed between Groups 1 and 2. Ground and battered stone artifacts dominated the Group 1 collection (44.1 percent) and comprised the smallest portion of the collection in Group 2 (20.9 percent). In both groups, bowls and artifacts classified in the "other" category comprised the bulk of the ground- and battered-stone-artifact collections. Another marked difference was the considerably higher relative frequency of FAR recovered from Group 2 (29.7 percent) features than from Group 1 (7.4 percent). The FAR was recovered from burial matrix rather than directly associated with individuals.

Within the flaked stone category, projectile points made up approximately 6 percent of the collection. In total, 48 projectile points were recovered from 33 burial features (see Appendix B.40) distributed throughout the main burial area, including 1 located north of the Van Horn trench. With the exceptions of 3 points from 3 burial features, the remaining features yielded 4 leaf-shaped Cottonwood Triangular points, 34 Cottonwood Triangular concave-base points, 6 Cottonwood Triangular straight-base points, and 1 Cottonwood Triangular indeterminate-base point. Most of the points were manufactured from chert, with the exceptions of 2 fused-shale points, 4 chalcedony points, 1 obsidian point, and 1 basalt point. Two dart points were recovered: a large side-notched point from burial Feature 141 and a Silver Lake dart point from burial Feature 461. Burial Feature 539 yielded a Marymount point (dating to the Intermediate period) and also a concave-base Cottonwood Triangular point. Burial Feature 141, located in the northeastern portion of the main burial area, yielded concave-base Cottonwood Triangular points, which typically date to the Late period through the Protohistoric period, and a Silver Lake dart point, which would typically date to the Millingstone period. In addition to a Silver Lake point, burial Feature 461 yielded a chert drill. The drill, the only one identified in the burial-feature collection, was recovered from the burial matrix and not directly associated with the burial individual, an adult of indeterminate sex aged 35 years or older. Burial Feature 141 also contained a rhyolite pipe as well as fragments of a sandstone bowl. The pipe had a portion of a vegetal-reed mouthpiece still attached. The bowl fragments, which appeared to have been intentionally broken, exhibited faint ocher staining on the exterior surfaces as well as small drops of black residue, likely asphaltum, on both the exterior and interior surfaces.

In the case of burial Feature 305, three Cottonwood Triangular concave-base points were found embedded in the bones of the individual: one in the spine, one in the hip area, and one in the mid back. At least two of the points entered through the front of the abdomen. The male died from these wounds or as a result of infection. Burial Feature 305 also contained two waterworn chalcedony pebbles. Henry Koerper (personal communication 2006) suggested that such small stones, often mined out of ant nests, may have been used as elements inside rattles.

Burial Feature 267, located in the northern portion of the main burial area, contained a hafted foliate biface. Asphaltum on the end of the biface had impressions of the haft still visible. The burial matrix contained a second biface of indeterminate stage as well as ocher-stained sediment, four flakes, and one piece of FAR. Located approximately 3.5 m southwest of Feature 267, burial Feature 562 also contained a biface with asphaltum for hafting. The asphaltum on the large lanceolate biface exhibited impressions and fragments of wood. A reddish tinge was noted on the biface, perhaps blood residue.

Of note was a lithic cache recovered from burial Feature 101, located in the western portion of the main burial area; it consisted of a Cottonwood Triangular concave-base point and a core recovered southeast of the pelvis of a 20–25-year-old female. Interestingly, these types of artifacts typically reflecting traditional male roles were found with a female; perhaps these artifacts do not represent traditional roles, or they may reflect burial gifts from a male mourner (among other explanations).

In addition to flaked stone tools, burial Features 217 and 282 contained relatively unusual collections of artifacts. Burial Feature 217, located in the central portion of the burial area and consisting of five burial individuals between the ages of 12 and 34, yielded a steatite barrel-shaped bowl with faint ocher staining in the interior, a chlorite schist tubular bead, and small flecks of ocher, among other lithic artifacts. None of these artifacts was associated with burial individuals. Artifacts of note in burial Feature 282 included a steatite shaft straightener and the only anvil recovered from burial features. The anvil's ventral surface was blackened, likely from a combination of fire and asphaltum; asphaltum was noted on the dorsal surface, as well. The artifacts were not directly associated with the burial individual, a 20–30 year old of indeterminate sex.

Burial Feature 14 contained a wide range of ground stone implements, including a granite pestle midsection, two steatite *comales* with V- and X-shaped decorative incising, and three steatite bowls, two of which had zigzag and U-shaped decorative incising. Only the *comal* with X-shaped incising was directly associated with the burial individual, a 40–55-year-old male. The *comal*, along with an abalone shell, was located immediately southwest of the cranium. The association of the *comal* with the male individual is of note and indicates that domestic and/or ritual use of *comales* may not have been gender specific.

A *comal* fragment was also identified in burial Feature 286, located in the western portion of the main burial area and containing the remains of an adult male and female as well as a 4–5 year old of indeterminate sex. The burial matrix also contained a steatite vessel fragment, a biface, and asphaltum with Z-twist coiled-basketry impressions. Burial Feature 565 contained a small steatite bowl, flowerpot shaped, with a basal flange. Light ocher staining was on much of the exterior, interior, and rim, and there were small clusters of very fine asphaltum spray on the interior and exterior walls and exterior base. Three steatite vessel fragments were also recovered from the feature, all likely from the same vessel.

Located adjacent to Feature 14, burial Feature 50 contained a steatite olla, broken into three fragments, located 10 cm southwest of the primary individual, a 20–30 year old of indeterminate sex. All three olla fragments were covered with ocher after breakage, and the rim sherd exhibited rounding and dulling of one broken edge that may have been the result of an older break, although some of the damage may have resulted from rodent gnawing. The other body sherd, which conjoined with the rim, had a very thick layer of soot on the exterior. Burial Feature 30 also contained a large piece of asphaltum with vegetal or perhaps reed impressions. Burial Feature 112 also contained ocher, recovered from the burial matrix, in addition to a relatively unusual ground stone collection, including one of two perforated disks recovered from LAN-62, Loci A and G, burial features. The steatite disk had a black, lustrous sheen, likely from burning, as well as small flecks of asphaltum, possibly where decorative items were once attached. Wear along the perforation indicates that it was likely strung. A steatite arrow-shaft straightener (Figure 40), a granite bowl, a steatite bowl, and a steatite *comal* were also recovered from the burial matrix. None of the artifacts was

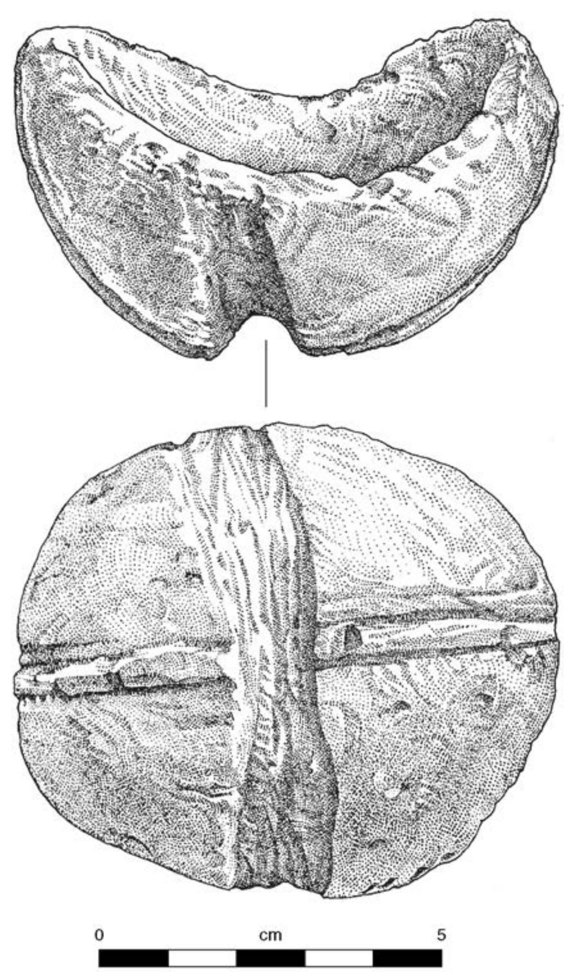


Figure 40. Shaft straightener/*tamya-mal* from burial Feature 112 at LAN-62.

directly associated with burial individuals, which included female adults, adults of indeterminate sex, and children. The steatite arrow-shaft straightener was a palm-sized steatite object resembling a small mortar or cup with a carved, U-shaped groove (64.6 mm long, 15.1 mm wide, and 5.5 mm deep) that intersected a raised ridge (5.2 mm wide and 1.8 mm high) on its exterior surface (see Figure 40). The ridge may have served to bend cane arrow shafts at their joints (Kroeber 1908a:53–54). The compound vessel and shaft straightener was a diminutive 77.5 mm in maximum diameter. The shaft straightener possibly served a dual purpose as a *tamyush* or *tamya-mal*, an artifact type that reportedly served as a paint mortar (Kroeber 1925:653; Sparkman 1908:207; True 1954:70) or a *Datura* cup (DuBois 1905:623; Hudson and Blackburn 1986:291–292; Waterman 1910:344, Plate 21).

Burial Feature 313, located in the southwestern portion of the main burial area, contained numerous lithic items associated with the primary individual, a 25–35-year-old adult of indeterminate sex. Items included a finely shaped, phallic pestle with abundant, large asphaltum drops over all surfaces but the proximal end (Figure 41). The distal end had a small chip possibly representing postdepositional damage. However, similar damage was noted for pipes recovered from burial features. The chips may have been intentional, perhaps representing ritual killing of the object.

Burial Feature 227, located in the center of the burial area, also yielded a chlorite schist bead recovered from the burial matrix as well as a piece of ocher contained within the fragments of what was likely a leather pouch. The ocher and leather fragments were found on the left femur of the primary individual, a 17–25-year-old female. Immediately west of the primary inhumation in the burial matrix, a small artifact concentration contained three elongate and three ovate waterworn pebbles with ocher staining, as well as a biface. As noted above, uses of waterworn pebbles varied widely and included utilitarian, game and amusement, magical-religious, medical, musical, and souvenir purposes. Burial Feature 470, located approximately 2 m to the northwest of Feature 227, contained a cache of seven elongated, waterworn pebbles coated with ocher.

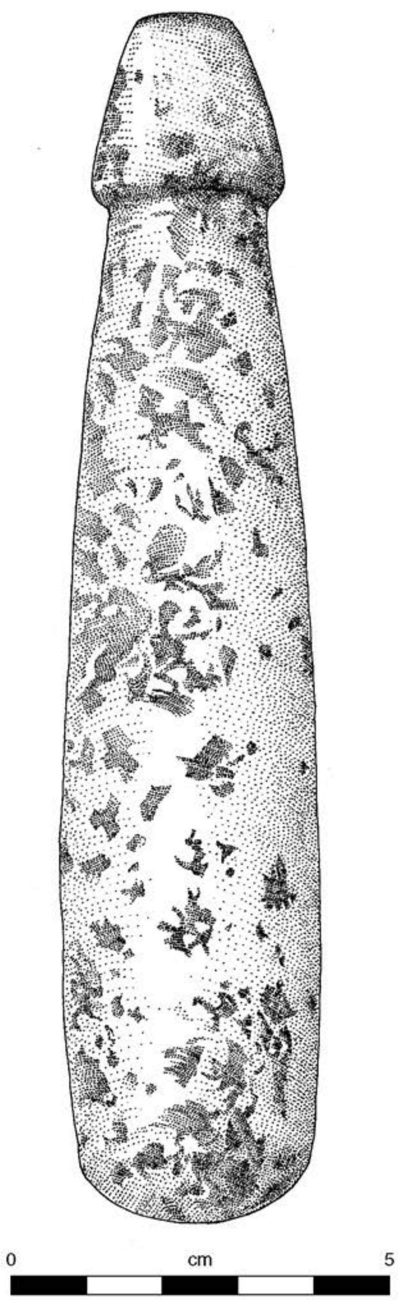


Figure 41. Phallic pestle from burial Feature 313 at LAN-62.

Located in the western/southwestern portion of the main burial area, burial Feature 306 contained a tabular piece of siltstone, likely a distal pendant fragment. The tablet, with rounded edges and numerous small asphaltum drops, or asphaltum splatter, appeared to have been broken intentionally across the midsection. The burial matrix also contained a core, a possible fire-damaged charm-stone fragment that had been subsequently flaked. The broken edge exhibited a pecked line of divots, perhaps related to stringing or hanging of the object. The burial matrix also contained FAR, debitage, and an edge-modified flake.

Two burial features within Group 2 contained stone pipes: burial Features 390 and 497, located in the northern and central-northern portions of the burial area, respectively. Small chips were noted in pipes recovered from both features. The rhyolite pipe found in burial Feature 390 had asphaltum impressions of a mouthpiece and was recovered from the burial matrix, not directly associated with burial individuals, which were an adult of indeterminate sex and three children ranging in age from 1 to 12 years of age. The pipe in Feature 497 was also recovered from the burial matrix. Burial individuals in Feature 497 included a 17–30 year old, an adult of indeterminate age, two children between the ages of 3 and 9 years, and an infant 1–2 years old. The four pipe fragments from Feature 497 appeared to have belonged to a single steatite pipe, but none of the fragments conjoined.

A cobble manuport was also identified in burial Feature 336, located in the eastern portion of the main burial area. The waterworn pebble manuport, consisting of a fine-grained, dark gray material, possibly metasedimentary, was incised with a series of parallel lines on both faces (Figure 42). A few small drops of asphaltum on both faces were noted, as well as faint ocher staining on the ventral surface and sides.

Asphaltum with basketry impressions was recovered from two burials: Features 438 and 610. The asphaltum from burial Feature 438 had impressions of Z-twist coiled basketry with row heights ranging between 3.1 and 4.3 mm. Additional mineral specimens recovered from the feature included ocher. The asphaltum from burial Feature 610, located 3.5 m to the northeast, still had basketry material attached, although only the warp fibers were still visible. Small seed capsules remained adhered to the asphaltum surface.

A repaired pestle fragment was recovered from the matrix associated with burial Feature 346, located in the central portion of the main burial area. The distal portion of the pestle was coated with a thick layer of asphaltum, indicating that

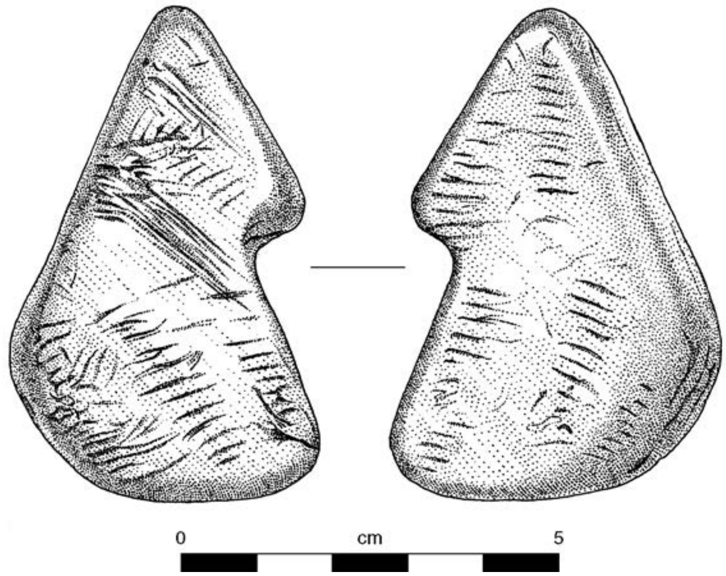


Figure 42. Incised, waterworn pebble from burial Feature 336 at LAN-62.

the pestle had been repaired. The sides adjacent to the break were pecked, evidently to roughen the surface and enhance adhesion of the asphaltum.

Finally, several relatively unusual ground stone bowl fragments were identified in Group 2 burials, including burial Feature 370, located in the central portion of the main burial area. The feature contained a bowl fragment with asphaltum spray over approximately half of the interior, extending upward from the base. Significant soot staining was noted on the exterior wall, but the base was nearly soot-free. Dense, parallel, oblique striations from manufacture were noted on the wall.

Group 3 (5 or Fewer Lithic Artifacts)

Most (66.4 percent) of the burial features with lithic items fell within this group (containing five or fewer lithic artifacts). The 200 burial features composing Group 3 were dispersed across the main burial area in a distribution similar to that of Group 2. In all, Group 3 burials yielded 517 lithic items, comprising 33.1 percent of the total analyzed lithic collection recovered from burial features. Unshaped stone composed the bulk (42.4 percent) of the collection, followed in decreasing frequency by flaked stone (34.6 percent) and ground and battered stone (23 percent) artifacts. FAR (29 percent) occurred most frequently in Group 3 burial features, followed by debitage (14.1 percent), beads (10.1 percent), unshaped other (9.5 percent), projectile points (6.8 percent), and bifaces (5.6 percent) (see Appendixes B.40 and B.41).

Group 3 burial features yielded a total of 35 projectile points recovered from 33 features. Points recovered from the Group 3 burials included 1 large contracting-stem dart point recovered from burial Feature 96, Cottonwood Triangular concave-base points (n = 24), straight-base Cottonwood Triangular points (n = 4), and Cottonwood Leaf-shaped points (n = 6). The large contracting-stem dart point exhibited red ocher staining on both faces. The concave-base Cottonwood Triangular point was directly associated with burial individuals in Feature 101. Burial Feature 6 produced a small shard of colorless glass fashioned into a flaked projectile point (see Chapter 8, this volume).

Burial Features 196, 597, and 616 contained bifaces with asphaltum for hafting. Two of the bifaces, from Features 196 and 616, had been reworked across breaks. In the case of Feature 196, the large, foliate biface had substantial dulling of the blade edge above the haft. Other relatively unusual flaked stone artifacts included a crescent recovered from burial Feature 519, which contained an adult individual of indeterminate sex and was located in the central portion of the burial area. The crescent was made of Coso volcanic field obsidian in a tight, claw-like shape rather than a traditional crescent shape. Broken at one end, the crescent appeared to have been reworked. Both faces were coated with ocher. The burial feature also contained a steatite bowl decorated with a U-shaped groove beneath the rim. A few small drops of asphaltum and a medium-brown-colored residue were present on the interior bases and walls of the bowl. Both the bowl and the crescent were recovered from the matrix. Ocher was also recovered from burial Feature 58. The ocher, molded into a barrel or conical shape, was recovered from above the pelvis of an adult female 20–30 years of age.

The Group 3 ground stone collection consisted of a wide array of utilitarian, ritualistic, and decorative items. Stone pipes, totaling seven, were identified in Group 3 burials in

Figure 43. Pipe with reed mouthpiece from burial Feature 9 at LAN-62.

a slightly higher frequency than in those of Group 2. Burial features containing stone pipes clustered slightly in the western portion of the main burial area. The pipe in burial Feature 225, located in the southern portion of the main burial area, was recovered from the chest region of a 25–35-year-old adult of indeterminate sex. Unlike pipes recovered from Group 2, three of the pipes recovered from Group 3 were intact and had no chips or other damage prior to or at the time of deposition.

Burial Feature 9, located in the south-central portion of the burial area, contained a pipe as well as the only mortar identified in burial features. Ocher staining was evident on both artifacts. The mortar fragment conjoined with the base from EU 144. The pipe retained a portion of vegetal-reed mouthpiece (Figure 43). Though not directly associated, the two artifacts were recovered from a burial feature containing a 17–25-year-old possible female. Burial Feature 60 was the only feature containing a pipe directly associated with a burial individual, a male 20–30 years of age. The pipe was recovered from the abdominal region of the individual, and a shaft straightener was found near the right leg and foot. The sandstone pipe recovered from burial Feature 39 was associated with a cobble manuport with black to brown drops of residue (perhaps asphaltum or a vegetal derivative) on both faces and a blackened area on one face, possibly from hand oils.

Burial Feature 13, located in the southwestern portion of the burial area, contained a red porphyritic rhyolite lanceolate plummet with a battered end (Figure 44). The plummet stone was found beneath the cranium of a female 25–35 years of age, as were a concentration of ocher and a bead cluster. Plummet-like charm stones were reported to date to as early as the late Millingstone period and did not occur during and following the Late period (Henry Koerper, personal

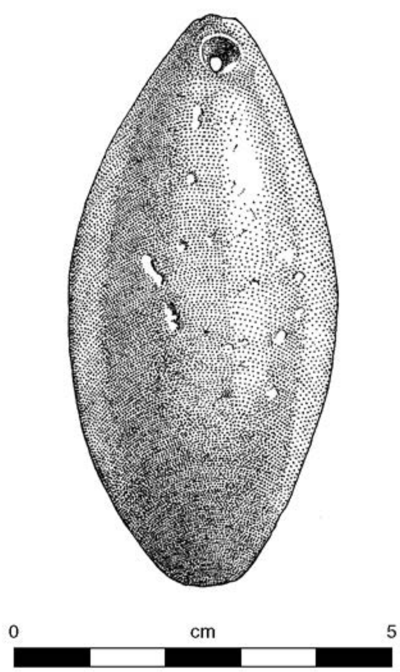


Figure 44. Plummet from burial Feature 13 at LAN-62.

communication 2006). Mission period olivella beads were also identified in the burial feature. Considering the temporal disparity, the plummet stone may have been curated or heirloomed. Located approximately 7 m to the northeast, burial Feature 349 contained a large, spherical serpentine bead. The bead was recovered from the jaw area of 45–55-year-old male.

Burial Feature 63, located in the southwestern portion of the main burial area, contained a perforated, incised steatite tablet or palette and a fire-altered granite pestle. The rectangular tablet or palette had a series of parallel incisions along the long axis and was found above the right tibia of the primary individual, a 25–35-year-old male. The pestle was recovered from the burial matrix.

Burial Feature 76, located in the central portion of the main burial area, contained a barrel-shaped steatite tablet, a waterworn pebble, and a clear quartz flake recovered from the abdominal region of the primary individual, a 23–30-year-old possible male. The barrel-shaped steatite tablet had an incised lizard design on one face and a headless quadruped on the other (Figure 45). The perforation on the end of the tablet indicated that it was likely originally used as a pendant. The burial feature also contained a quartz flake and two pieces of FAR. The lizard and the headless creature with jointed appendages were similar in form to Chumash rock art at Mutua Flat near Fraizer Park (see Eberhart and Babcock 1963). Considering the similarities in style, the tablet may represent Chumash rock art and may have originated in Chumash territory.

Quartz crystals and one quartz core were also identified in burial Feature 176, located in the central portion of the main burial area. The two quartz crystals and the core were recovered from between the flexed left tibia and femur of a 17–25 year old of indeterminate sex. Quartz was also identified in burial Feature 576, located in the northern portion of the main burial area. The quartz item consisted of an ornament likely worn as a nasal-septum piercing (Figure 46). The ornament, broken on one end and with a rounded point on the other end, exhibited shallow, transverse incised lines around its circumference, likely from shaping. The ornament, recovered from the burial matrix, was not directly associated with the burial individual, a 35–45-year-old male. The burial matrix also contained FAR and large amounts of charcoal. The charcoal and possibly the FAR were associated with the adjacent burial feature, Feature 524, which contained the remains of a partial cremation.

Burial Feature 352, located in the southern portion of the main burial area, contained a relatively unusual lithic item: a steatite perforated disk incised with four three-pronged rays emanating in cardinal directions around its central perforation (Figure 47). Incisions ran perpendicular to the rays, forming a spider-web effect. As noted earlier, the disk may represent a possible sun effigy, often hafted to a stick, that was used in

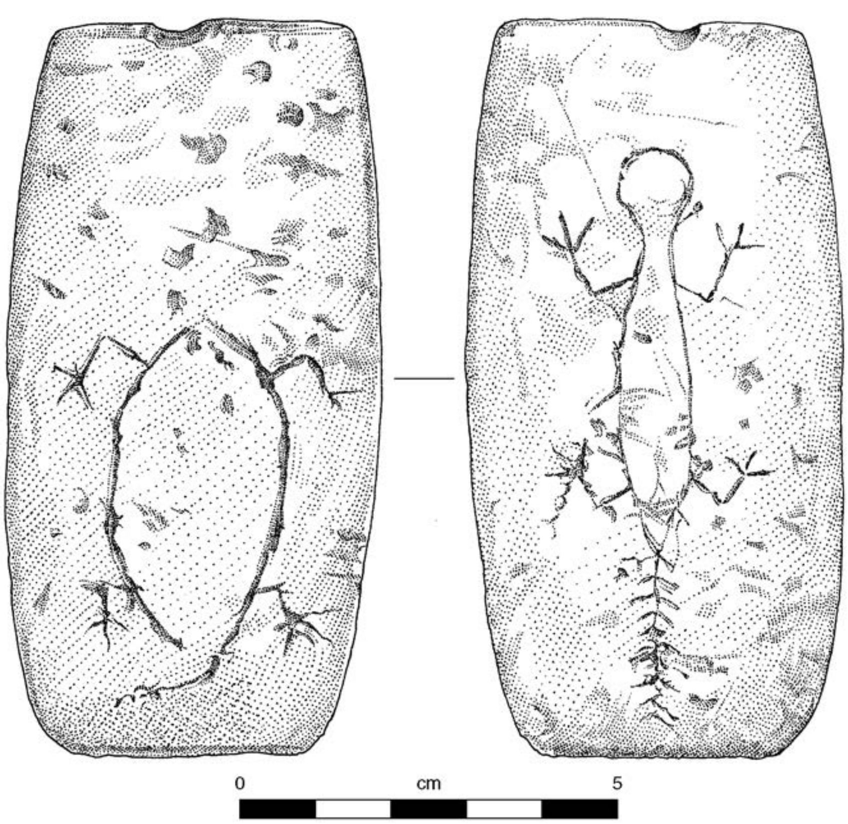


Figure 45. Steatite pendant from burial Feature 76 at LAN-62.

Figure 46. Nose ornament from burial Feature 576 at LAN-62.

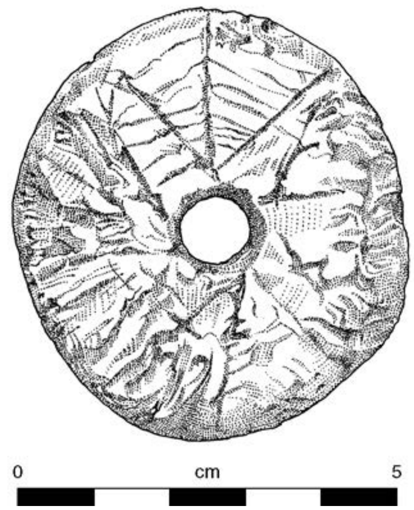


Figure 47. Perforated disk from burial Feature 352 at LAN-62.

Tongva and Chumash solstice ceremonies. If not a sun-stick disk, it may have been an effigy representing a ceremonial solstice disk, or perhaps it symbolized the sun but without the sun-stick disk as a referent. The disk was recovered from the burial matrix in addition to a piece of FAR. The burial feature contained the remains of two individuals of indeterminate sex, a 10–14 year old and an 18–22 year old.

Finally, several relatively unusual ground stone bowl fragments were identified in Group 3 burials, including burial Feature 143, located in the southern portion of the burial area. The feature yielded a steatite bowl containing ocher and shell beads that was found lying on its side with ocher spilling out from the top. The bowl was associated with the primary individual, an infant of indeterminate sex between the ages of birth and 1 year. Burial Feature 268 yielded a steatite bowl with two perforations near the rim. The bowl was stained with ocher and was found adjacent to the chest region of the primary individual, a 17–25-year-old possible female.

Located in the northern portion of the main burial area, burial Feature 126 contained three conjoining steatite bowl-rim fragments. One fragment had a perforation near the rim that may have been related to repair or initial manufacture. Dark black, somewhat greasy-looking staining was noted around the perforation on the inside of the vessel. The exterior surface of a few of the fragments had parallel striations that appeared to have been made with a comb-like instrument.

Burial Feature 451, located in the southwestern portion of the main burial area, contained a small granitic bowl with decorative incisions around the rim and asphaltum "patching" of the rim. Fine asphaltum spray was noted on the interior side of the bowl, and asphaltum-filled divots were located along the rim, possibly representing areas that were repaired or were decorated with items such as cowry shells. Considering the splattering, the asphaltum may have been blown through a tube. The burial feature also contained broken fragments of a sandstone vessel exhibiting asphaltum splatter over a portion of the interior base and wall. One of the base fragments had faint ocher staining. The vessel fragments were dispersed in the adjacent burial features, Features 141 (from Group 2), 244, and 255. Likely, the vessel was broken and spread out among the four burial features, indicating that the burials were contemporaneous. Burial Feature 255 also yielded two conjoining pestle fragments.

Burial-Feature Summary

Lithic items recovered from 300 burial features offered insight into ritual and domestic lifeways spanning at least 7,000 years. The collection consisted of slightly higher frequencies of unshaped stone in addition to flaked, ground, and battered stone artifacts. Most of the burial features contained fewer than six lithic items each. Burial features with higher lithic frequencies tended to have concentrations of flakes, FAR, or both. It is unclear, though, whether flakes and FAR represented accompanying grave items or were present as midden constituents at the time of interment. Some of the FAR pieces were recovered from cremations, indicating that they were likely associated with the cremation process.

The lithic items were widely distributed throughout the main burial area, although there was an intense clustering of burial features in the southern, central, and western portions of the main burial area. This concentration of burials may reflect intensity of use of the burial area, particularly during the Mission period. Alternatively, these concentrations may reflect cultural traditions, such as differential status. For further discussion of the burial ground, please refer to Volumes 2, 4 and 5 of this series.

In general, burial features containing more than 15 analyzed lithic items were located in the southern and central areas of the main burial area, and those with 15 or fewer lithic items were widely distributed across the burial area. Spatial clustering of certain artifacts was noted within the burial area. For example, although stone pipes were noted throughout the burial area, two concentrations occurred within the southwestern and northern portions. Pipes were directly associated with two individuals: one adult male and an adult of indeterminate sex. Pipes recovered from the other burial features may have at one time been associated with the burial individuals, which included adult males and females and adult individuals of indeterminate sex as well as children and infants. This wide range in age and sex indicates that pipes may not have been associated with a particular gender or age. Additionally, pipes were not associated with particular lithic-artifact types. Rather, they were recovered from burial contexts also containing projectile points, ocher, manuports, debitage, and FAR.

Ocher appeared to be differentially distributed throughout the main burial area. Burial features containing ocher clustered in the western portion of the burial area, although a few were located in the eastern and northern portions. In total, pieces of ocher were recovered from 46 burial features. Of these, ocher pieces were directly associated with 20 burial individuals, including 15 adult females (75 percent), 1 adult male, 1 adult of indeterminate age and sex, and 3 children ranging in age from 1 to 10 years old. The tendency for ocher to be associated with females may be a factor of demographics in the burial ground, which consisted mostly of female burial individuals (see Volume 4 of this series). Alternatively, the tendency may reflect cultural and ritual practices, perhaps those related to female fertility and childbirth, among other gender-related factors.

There was only minor evidence of an association of shaft straighteners with male burials. Shaft straighteners were recovered from seven burials in the southwestern and central portions of the burial area. Of these seven burial features, shaft straighteners were directly associated with two individuals, both males.

Comparisons of other artifact types do not reveal gender-specific distributions within the LAN-62, Loci A and G, burial area. The lack of distinct patterns may be a result of the small sample size rather than gender-neutral cultural practices. Alternatively, the burial items may reflect the sex of the mourners offering the grave goods rather than the sex of the burial individuals. Non-gender-specific artifact distributions were also noted in a study of Chumash burials in the Santa Barbara region (Hollimon 2001:51). Although projectile points were traditionally associated with predominantly male activities and ground stone was associated primarily with female roles, these artifacts were distributed almost evenly throughout Chumash burials of both genders (Hollimon 2001:51).

Artifacts found associated with males and females at LAN-62, Loci A and G, included *comales*, which were recovered from the southwestern portion of the main burial area. Projectile points were widely distributed in the burial area and were recovered from 66 burial features. Of these, only 2 contained points directly associated with individuals, 1 adult male and 1 adult female. In both instances, the points were identified as Cottonwood Triangular concave-base points. The point found with the adult female was likely a grave offering, whereas the points identified with the male were used to kill the individual.

In general, Cottonwood Triangular points (particularly those with concave bases) dominated the burial-feature-collection accounting. The ratio of all Cottonwood Triangular (both concave and straight bases) to Cottonwood Leaf-shaped points for burial features is 8:1. This markedly contrasts with the distribution noted for the LAN-62, Loci A and G, control units, which was 1.2:1. The higher frequencies of Cottonwood Triangular points (both types) may be a function of cultural affiliation and/or temporal association.

Bowls and pestles were also widely distributed in the main burial area and were directly associated with both male and female individuals. These items were used for a variety of different functions, including food preparation, ocher and other pigment preparation, and the containing of both domestic and ritual items. The distribution in both male and female burials may reflect this wide range in functions. Many of the bowls and pestles, as well as other ground stone artifacts, were recovered in fragments. Although some of these artifacts may have broken postdepositionally, in at least two burial features (burial Features 38 and 451), ground stone artifacts exhibited deliberate breakage in a controlled fashion, likely representing ritual killing. Additionally, these fragments were deliberately placed within the burial features so as not to touch adjoining fragments.

In general, many of the ground stone artifacts recovered from burial features were manufactured from steatite. The preference for steatite over other material types is likely attributable to availability from nearby Santa Catalina Island as well as quarries on the mainland, the relative ease with which steatite could be worked and shaped, and its ability to retain heat. The steatite collection did show some variability in type. In general, steatite vessels tended to be manufactured from light tan or light gray material, whereas *comales*, perforated objects, and abraders were made of dark gray steatite. The difference in color may be attributable, in part, to the heating of vessels, and the variability may represent selection of certain materials for particular artifact types or, perhaps, acquisition of objects through different exchange networks.

Many of the vessels exhibited ocher or asphaltum residue, and ocher residue was identified in the interiors of bowls, indicating that the vessels were likely used for pigment preparation. Ocher was also identified on ground stone fragments, having been applied following breakage, which indicates that ocher was likely an integral part of burial ritual. Many ground stone items, as well as FAR from Feature 64, had asphaltum or other dark residue sprayed or splattered on their surfaces. In some cases, the spray was concentrated and may have been applied by blowing through a tube.

Finally, several ground stone artifacts, such as stone beads, pendants, and tablets, highlighted aesthetic preferences and artistry. Stone beads were found associated with shell beads, indicating that the two were strung together. Some of the pendants exhibited pitting and grooves at one end, likely where each object had been strung. The incised tablet from burial Feature 76 may have functioned as both a decorative item and a ritual item. In addition to the incised lizard and headless-creature designs, the double parallel longitudinal lines were similar to those on several of the grooved abraders, perhaps reflecting sexual symbolism. Henry Koerper (personal communication 2006) suggested that the leg position of the headless creature indicates childbirth and that the appendages (other than arms and legs) may be an umbilical cord. As noted, the image is similar to rock-art designs located in Chumash territory. Although the connection is unclear, the tablet may reflect ties between the ethnographic territories of the Tongva and the Chumash or, perhaps, similarity in rock-art traditions between the two groups.

Burial Area

The densest concentrations of human burials at LAN-62, Loci A and G, were located in the burial area. Lithic analysis included a total of 1,677 artifacts comprising 14.6 percent of the total analyzed lithic collection recovered from LAN-62, Loci A and G (see Table 26). Burial-area analysis focused on lithic items recovered from excavation units as well as lithic artifacts from 12 nonburial features.

Most of the lithic artifacts recovered from the burial area consisted of unshaped stone (48 percent), followed in decreasing frequency by flaked stone (37.5 percent) and ground and battered stone (14.5 percent) (see Appendixes B.42–B.45). Overall, this distribution was similar for burial features, indicating that the two areas, as the burial area was defined, were likely associated. Within the unshaped-stone category, FAR composed the bulk (77.1 percent) of the collection, and manuports (12.3 percent) and artifacts that were classified in the "other" category (5.8 percent) occurred in lower frequencies. The latter category included asphaltum, ocher, and quartz crystals.

The flaked stone category consisted primarily of debitage (63.8 percent); edge-modified pieces (10.7 percent), bifaces (7.6 percent), and projectile points (7 percent) occurred in lower frequencies. The other flaked stone category, composed of a drill, choppers, a split cobble, and core hammerstones, made up 3 percent of the flaked stone collection.

The "other" category composed the bulk (23 percent) of the battered and ground stone collection, followed in decreasing frequency by bowls (18.9 percent), fire-altered manos (15.6 percent), and ground stone (13.6 percent), including indeterminate varieties. Shaft straighteners, an anvil, tablets, a figurine, indeterminate vessels, and miscellaneous artifacts constituted the "other" category. The following is a discussion of the results of analysis, by analytical context.

Excavation Units

Analysis included 1,253 lithic items recovered from 196 excavation units located throughout the main burial area. Collectively, these items made up 74.7 percent of the total analyzed burial-area collection. Overall, frequencies of itemized lithic artifacts within excavation units varied between 1 and 30; EU 156, located in the center of the main burial area, contained the highest frequency. In general, most (77.6 percent) of the excavation units contained fewer than 9 lithic items.

Unshaped stone composed the bulk of the excavation-unit collection, followed by flaked stone and ground and battered stone. FAR made up nearly half of the excavation-unit collection. The flaked stone collection included 41 projectile points grouped into five different types: Cottonwood Triangular concave- and straight-base points, Cottonwood Leaf-shaped points, Elko Eared, Marymount, and large contracting-stem. The collection also included the only drill identified in the burial area, a chert drill recovered from EU 215.

Although the ground and battered stone category contained the lowest frequency of artifacts, it represented the greatest variety of artifact types. The category included many of the domestic, ritual, and decorative items identified in burial features, including bowls, *comales*, pestles, mortars, pipes, tablets, and pendants. Of note was a serpentine zoomorphic figurine with light ocher staining recovered from EU 166 (Figure 48). The figurine consisted of a possible dolphin effigy with what appeared to have been a notched mouth composed of a waterworn pebble showing, overall, little to no shaping. A serpentine figurine recovered from EU 161 was an armless human form 3.9 cm in height (Figure 49). A 1.3-mm-wide, V-shaped groove served as the neck, creating a "head" 5.6 mm

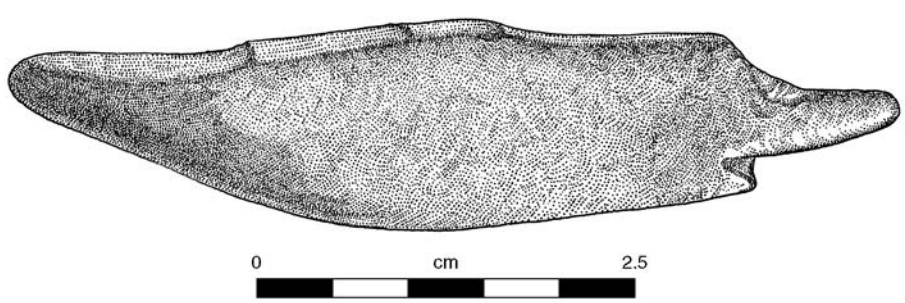


Figure 48. Zoomorphic figurine from burial-area EU 166 at LAN-62.

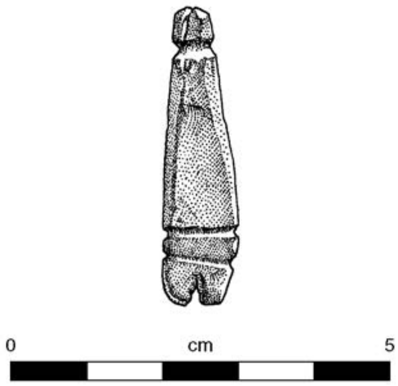


Figure 49. Anthropomorphic figurine from burial-area EU 161 at LAN-62.

in length. Two parallel 1.4-mm-wide and 0.5-mm-deep, V-shaped grooves encircled the body just above the cleft "legs" formed by a 1.8-mm-deep groove. A light ocher staining covered the figurine. The only maul identified in the LAN-62, Loci A and G, collection was recovered from EU 390, located in the central portion of the main burial area. The maul consisted of a natural-oval granodiorite cobble with notches to facilitate hafting. Small divots were present on one face as a result of pounding. Debitage, a tarring pebble, and indeterminate ground and battered stone were recovered from the same level. Burial-area EU 174 yielded a steatite shaft straightener (Figure 50). A pair of 3.9-mm-wide and 0.6-mm-deep, V-shaped, longitudinal incisions ran parallel to each other and perpendicular to the central transverse groove. Likely made from a recycled *comal* fragment, it had a biconical hole drilled near the midline of one end. The large size of the hole (9.8–16.5 mm in diameter) suggested that it was more than purely decorative. It was 17.2 mm long, was drilled at an angle, and exhibited indentations on opposite edges of the perforation on the dorsal face, indicating use as a lever to bend shafts (Cosner 1956:300; Mason 1905:92) or as a means of lifting the heated straightener, or *comal* in a previous use, out of the fire.

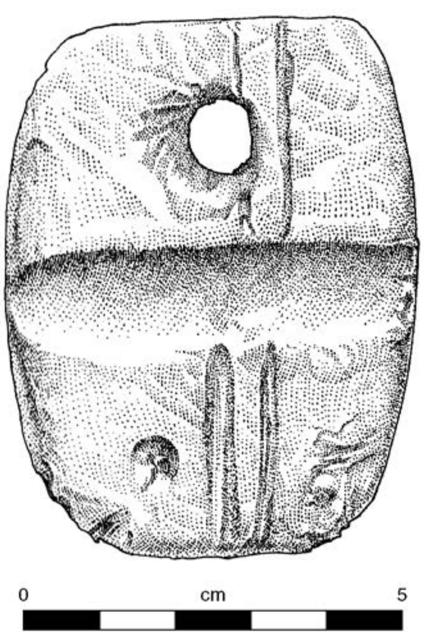


Figure 50. Shaft straightener from burial-area EU 174 at LAN-62.

A steatite artifact was recovered from burial-area EU 155 at LAN-62, Loci A and G, and was interpreted by Koerper as a steatite rattlesnake-rattle effigy (Figure 51; see Appendix B.55). Five V-shaped grooves 0.3 cm deep and 0.35 cm wide were incised and/or abraded around its circumference to create a six-button rattle. The object was flat on one face, suggesting that it might have been made for display or worn as a pendant, although no signs of wear from cordage were noted.

Two pendants from burial-area EU 146 appeared to have been created from rim sherds of the same steatite vessel (Figure 52). A distinctive linear groove below the rim and incised lines running perpendicular to the rim were the identifying characteristics. Conical perforations were drilled near the rim of one pendant and opposite the rim of the other so that the design would have been on opposite ends if the pendants were strung together. Also, both pendants were made of tan steatite with light ocher staining.

Burial-Area Features

In total, 424 lithic artifacts recovered from 12 nonburial features located in the burial area were analyzed and accounted for 25.3 percent of the total analyzed burial-area collection. The 12 features included an animal burial, artifact concentrations, a pit, and a rock cluster. Unlike the collections from the excavation units in the burial area and the burial features themselves, the burial-area-feature collection was dominated by flaked stone, followed by unshaped stone and ground and battered stone. Debitage accounted for the bulk of the feature collection; manuports were found in lower frequencies. FAR comprised only a small portion of the collection, which was markedly different from collections from excavation units in the burial area and burial features. Nearly equal frequencies of FAR were recovered from the rock-cluster feature and from the artifact-concentration features combined. Overall, FAR did not appear to be an integral part of the feature-related activities. The following is a discussion of the results of lithic analysis by feature type.

Animal-Burial Feature

One animal burial, located in the southwestern portion of the main burial area, yielded seven flaked stone artifacts. The feature consisted of a cluster of canine bones exhibiting cut marks, indicating that the canine had been processed. Considering the proximity to human burials, the canine may be indicative of a ritual offering or could simply be the result

Figure 51. Rattlesnake-rattle effigy from burial-area EU 155 at LAN-62.

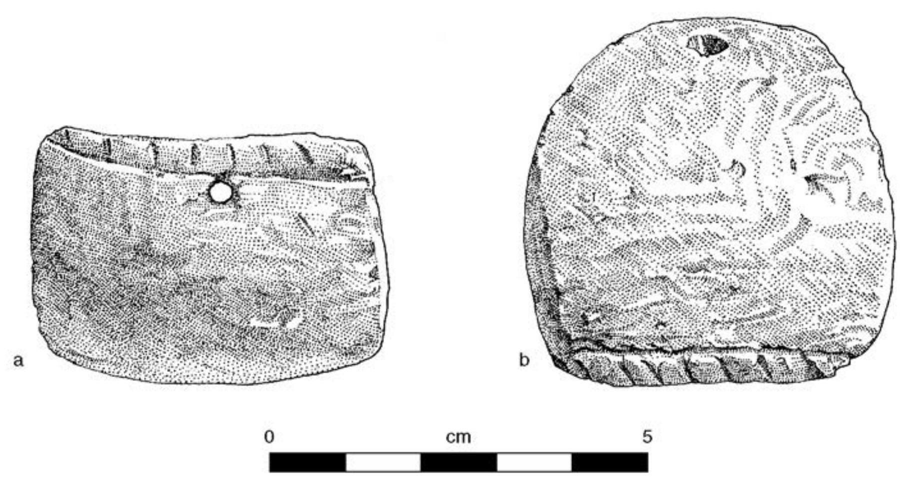


Figure 52. Rim-sherd pendants from burial-area EU 146 at LAN-62.

of natural or other nonritual processes. Lithic artifacts recovered from the feature include six pieces of debitage and one edge-modified flake. Chronology was not determined for this feature.

Artifact Concentrations

The vast majority (70.8 percent) of analyzed lithic artifacts from burial-area features were recovered from the nine artifact concentrations, which yielded 300 lithic artifacts. With the exceptions of Features 114 and 129, artifact-concentration features clustered in the central and southern portions of the main burial area. Feature 114 was located in the eastern portion, and Feature 129 was in the northern portion.

Debitage composed the bulk (45.7 percent) of the collection, which had low frequencies of manuports (24.3 percent). All but one of the manuports were recovered from a single feature, Feature 252. Lithic artifacts recovered from Feature 252 made up half of the overall artifact-concentration collection. Feature 252 also yielded the greatest artifact diversity, consisting of 11 different types of lithic artifacts. By contrast, Features 119 and 224 yielded the lowest frequencies and contained the least artifact diversity, each yielding a single piece of debitage. Two projectile points were recovered from two features: a Cottonwood Leaf-shaped point was recovered from Feature 252, and a Marymount point was recovered from Feature 35. The Marymount point was very probably curated, because it dates to the late Intermediate period (note that glass beads were recovered from Feature 35, placing it in the Historical period).

Manuports, consisting of pieces of steatite, made up the bulk (48 percent) of the Feature 252 collection, followed by debitage (21.7 percent) and indeterminate vessels (17.8 percent). Feature 252 also yielded ground stone vessels and a *comal*, which appeared to have been ritually killed, as well as ocher, tablet fragments (one of which was incised with a four-legged-animal motif) (Figure 53), stone beads, and a Cottonwood Leaf-shaped point. Considering the proximity of this feature to two burial features and the large quantity and diversity of lithic types, it is likely that Feature 252 is a feature associated with a burial.

Feature 68 yielded 26 bowl fragments and a stone bead and, similarly to Feature 252, may have been associated with mortuary activities, given the proximity to burial features and the bowl fragments (which may represent ritual grave offerings). Debitage was also recovered from Feature 68; it is unclear whether it was directly associated with feature-related activities or deposited in an underlying midden context. Overall, six of the nine artifact-concentration features dated to the Mission period. Temporal placement of Features 114, 119, and 129 was not determined because of the lack of diagnostic artifacts and ^{14}C dates.

Pit

Feature 441, located in the west-central portion of the main burial area, contained five lithic artifacts comprising 1.2 percent of the total analyzed collection from burial-area features.

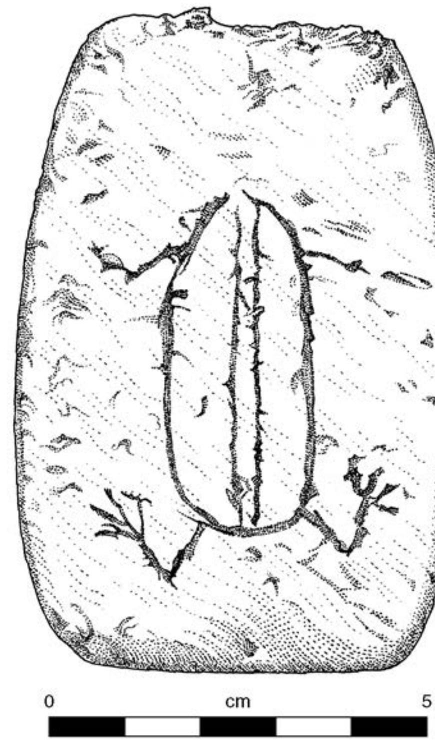


Figure 53. Incised steatite tablet from Feature 252 at LAN-62.

Lithic artifacts included one Cottonwood Triangular concave-base projectile point, one core, and three pieces of debitage. The pit, lined with animal hides, also contained human teeth and what appeared to have been oxidized metal.

Rock Cluster

The burial-area feature that yielded the second-highest concentration of lithic artifacts was a rock cluster located in the central portion of the main burial area. The rock cluster yielded a total of 112 artifacts comprising 26.4 percent of the total analyzed lithic collection from burial-area features. Debitage composed the bulk (89.3 percent) of the Feature 29 collection, which also included 9 pieces of FAR and ground stone artifacts (1 biface, 1 pestle, and 1 bowl). The feature was largely defined based on the granite bowl and pestle. Evidence of in situ thermal activities was not identified, indicating that the FAR may have been deposited from another area, possibly prior to feature-related activities. Feature 29, dating to the Mission period, appeared to have been contemporaneous with most of the burial-area artifact-concentration features and much of the burial area.

Summary of Burial-Area Features

The 424 lithic artifacts analyzed from burial-area nonburial features represent less than a third of the total burial-area collection. Compared to excavation units, artifact diversity was notably less in the features (17 different lithic-artifact types in features vs. 39 in excavation units). This differential distribution may be due in part to the higher frequency of excavation units (n = 196) than of features (n = 12). Relative frequency of artifact types also differed between features and excavation units; flaked stone dominated the feature collection, and unshaped stone composed the bulk of the excavation-unit collection. Comparisons of relative frequencies within burial features indicated that the distributions shared more similarities with burial-area excavation units than with burial-area features.

Nevertheless, similar artifact types were identified in both burial and burial-area nonburial features, particularly in artifact-concentration and rock-cluster features. Of the four different burial-area feature types, artifact-concentrations and rock-cluster features yielded the highest lithic frequencies. These two feature types consisted of artifact types often found directly associated with burial individuals, including bowls, *comales*, vessels, pestles, and tablets; in some instances, these artifacts appeared to have been ritually killed. Based on the similarity in artifact types as well as proximity to burial features, artifact-concentration and rock-cluster features likely represent remnants of associated burial activities or offerings. The Cottonwood Triangular concave-base projectile point found in pit Feature 441 was associated with human teeth and may have been a burial offering. If the lithic artifacts were in fact associated with the canine remains in Feature 307, it would indicate flaked stone manufacturing and processing; artifacts may have been deposited as burial offerings or may have been the tools used to process the canine, which exhibited cut marks. Alternatively, the lithic artifacts may have been displaced from an underlying midden deposit. Most of the artifact concentrations, as well as the rock-cluster feature, dated to the Mission period.

Sitewide Features

In addition to such analytical contexts as burial features, the burial area, and feature blocks (discussed below), numerous features located throughout LAN-62, Loci A and G, were also selected for analysis. These features consisted of activity areas, artifact concentrations, pits, rock clusters, and thermal features. Analysis included a total of 2,688 lithic artifacts comprising 23.4 percent of the LAN-62, Loci A and G, lithic collection (see Table 27). Flaked stone composed the bulk (63 percent) of the collection, followed in decreasing frequency by unshaped stone (34.3 percent) and ground and battered stone (2.7 percent) (see Appendixes B.46 and B.47). Overall, this distribution pattern is similar to that of the collection from the burial-area features. Furthermore, the sitewide collection has a preponderance of debitage (61.3 percent) as well as lower frequencies of FAR (24.5 percent) and manuports (8.1 percent), similar to observations made regarding the collection from burial-area features. Artifacts in the flaked stone "other" category, recovered in relatively lower frequencies, included choppers and core hammerstones, and the unshaped-stone "other" category comprised asphaltum, ocher, and quartz crystal. The following is a discussion of analysis results by feature type.

Activity Area

Feature 687, defined as an activity area and located 100 m north of the burial area, consisted of a large, ovate artifact scatter and an underlying clay-lined pit. The feature contained mostly unworked shell and faunal bone in addition to lower frequencies of worked shell and charcoal and a total of 41 analyzed lithic artifacts. Debitage composed the bulk (85.4 percent) of the lithic collection, in addition to lower frequencies of flaked stone artifacts, including a Cottonwood Triangular concave-base projectile point and a core as well as fire-altered ground stone, a core hammerstone, and ocher (see Appendixes B.46 and B.47). Approximately half of the faunal remains recovered from the feature were burned; however, only two ground stone fragments exhibited fire alterations, indicating that not all of the cultural constituents were subjected to thermal alterations. The feature may represent a hearth cleanout or discard area, although the presence of ocher and the relatively high frequencies of abalone shell indicate that the feature may have been associated with ritual activities. Feature 687 dates to the Late and Mission periods.

Artifact Concentrations

Eight sitewide artifact concentrations were selected for analysis, all located outside the main burial area, with the exceptions of three concentrations situated within the main burial area but outside the feature blocks. In all, analysis included a total of 103 lithic artifacts comprising 3.8 percent of total lithic artifacts recovered from sitewide features. Only one of the artifact concentrations could be given a temporal assignment. Feature 506, dated to the Millingstone period, was located in the northern portion of the main burial area and yielded 1 piece of FAR.

Similar to Feature 687, the activity area, artifact concentrations mostly yielded flaked stone (68 percent), followed by unshaped stone (23.3 percent) and ground and battered stone (8.7 percent) (see Appendixes B.46 and B.47). Debitage made up the bulk (64.1 percent) of the artifact-concentration collection; there were also relatively high frequencies of asphaltum (15.5 percent), which comprised the unshaped-stone "other" category, and FAR (6.8 percent).

Lithic frequencies in artifact concentrations ranged from 1 to 31. Interestingly, the three features located within the main burial area yielded the lowest lithic counts. Feature 356, which contained the highest lithic frequency, was located approximately 1 m from the main burial area. The feature was largely defined based on the presence of ground stone artifacts, including a complete mano and a metate. The feature also contained debitage, FAR, and unworked shell and faunal bone. The presence of FAR, burned faunal remains, and charcoal flecks indicates that some of the feature's cultural constituents were subjected to thermal alterations. The mano and metate were not thermally altered. The burned cultural constituents may have been part of the underlying midden context, deposited at a different time from the ground stone implements. Considering the proximity to the burial area, the mano and metate may have been part of or intended for burial offerings. Of note, however, is that these items were not broken as was often the case for ground stone implements recovered from burial features, which were typically broken as a result of ritual killing.

In general, the sitewide artifact concentrations contained low frequencies of ground and battered stone artifacts, compared to burial features and burial-area artifact concentrations. Most (77.8 percent) of these artifacts were recovered from a single feature, Feature 690, located approximately 70 m north of the main burial area. The feature contained four mano fragments as well as a metate, a bowl, and pieces of fire-altered ground stone. Debitage and edge-modified pieces were also recovered.

Feature 93, located approximately 2 m north of the main burial area and 10 m west of Feature 356, has a concentration of asphaltum. Charcoal and faunal bone were also recovered from the feature. The significance of the asphaltum concentration and the activities resulting in its deposition are unclear.

Pit Features

In total, 17 features were identified as pits within sitewide contexts. Most of these features were located away from the main burial area; 5 pits were situated within the main burial area but outside the feature blocks. Analysis included a total of 590 lithic artifacts comprising 21.9 percent of the sitewide feature lithic collection. Chronology was determined for only 1 pit, Feature 621, located approximately 29 m northwest of the main burial area. The pit, dating to the Intermediate period, yielded a single piece of debitage and a steatite manuport.

In general, the pits exhibited characteristics of hearth cleanouts, refuse, possible storage pits, and concentrations of charcoal. There is limited artifact diversity in the pits compared to artifact concentrations and activity areas. The limited diversity is partially due to the absence of ground and battered stone artifacts from pit features. More than half (60 percent) of the lithic artifacts were identified as flaked stone, and 40 percent were identified as unshaped stone (see Appendixes B.46 and B.47). Debitage (97.7 percent) and manuports (92.4 percent) contributed to the bulk of the flaked stone and unshaped-stone collections, respectively.

Frequencies of lithic artifacts recovered from pit features ranged from 1 to 251. Feature 293, located along the eastern edge of the main burial area, contained mostly steatite manuports (86.1 percent) as well as debitage (12.4 percent), 1 projectile point, and 3 pieces of FAR. The projectile point, a leaf-shaped Cottonwood Triangular point, retained asphaltum on one end as evidence of hafting. The pit, located beneath burial Feature 73, which contained an 11–14-month-old infant of indeterminate sex, was largely defined based on a concentration of charcoal and 2 pieces of FAR. Considering the contrast in defining cultural constituents as well as proximity to burial features, it is possible that the projectile point was displaced from the overlying burial.

Feature 619 yielded the second-highest lithic frequency for pit features, totaling 108 lithic artifacts: 103 pieces of debitage, 5 pieces of FAR, and small quantities of unworked shell and faunal bone. The large size of the pit and the absence of in situ thermal alteration, despite the presence of FAR, indicate that the pit may have been used for storage and perhaps, later, for discarding refuse.

Rock-Cluster Features

The majority of the analyzed lithic artifacts from sitewide feature contexts were recovered from 48 rock clusters. Analysis included a total of 1,927 lithic items comprising 71.1 percent of the total lithic collection recovered from sitewide features. Most of the rock clusters were located throughout LAN-62, Loci A and G; several were concentrated within the main burial area, including Feature 9, located south of the Van Horn trench, and 17 features located immediately north of the trench.

Flaked stone dominated (62.5 percent) the rock-cluster collection, followed in decreasing frequency by unshaped stone (34.3 percent) and ground and battered stone (3.2 percent) (see Appendixes B.46 and B.47). Debitage comprised the bulk (97.4 percent) of the collection. Within the unshaped-stone category, most of the artifacts were FAR (95.9 percent); the ground and battered stone category primarily included fire-altered ground stone (49.2 percent). The flaked stone “other” category consisted of a chopper and core hammerstones, including one that had been fire-altered. Ocher and a quartz crystal composed the unshaped “other” category.

Compared to activity-area, artifact-concentration, and pit features, rock clusters contain the highest artifact diversity and the highest lithic-artifact frequencies recovered from individual features. Rock-cluster lithic frequencies ranged from 1 to 357 lithic artifacts. Feature 169 was located adjacent to the southeastern edge of the main burial area, approximately 30 cm south of burial Feature 256. The feature, which was part of a larger, multicomponent activity area, consisted of a large rock cluster containing lithic artifacts as well as worked and unworked shell and faunal bone, some of which was burned. Lithic artifacts recovered from the rock cluster consisted mostly of debitage (91.8 percent) as well as FAR (6.7 percent), a Cottonwood Leaf-shaped projectile point, and a chlorite schist bead, among other lithic types. Feature 169 dated to the Late period.

Feature 649, located approximately 9 m north of the main burial area, also contained a relatively high frequency of lithic artifacts (n = 230). The feature consisted of a large rock cluster composed of rock concentrations within the northern and southern areas but devoid of rocks in the center. Most of the lithic artifacts were debitage (60.9 percent) and FAR (37.8 percent). Despite the presence of FAR and one piece of fire-altered ground stone, there was no evidence of in situ thermal alterations within Feature 169. The feature could be a hearth cleanout.

Uncommon artifacts were recovered from four rock clusters. A quartz crystal was recovered from Feature 640, located approximately 10 m northeast of the main burial area. The feature contained mostly FAR (70 percent). Feature 478, located approximately 6 m north of the main burial area, primarily yielded debitage (78 pieces) in addition to a cluster of 15 tarring pebbles and a complete steatite pestle. Features 659 and 683 each contained a cache of ground stone artifacts consisting, in part, of manos and metates as well as FAR. Both features contained burned faunal remains and charcoal. In the case of Feature 659, the mano and metate fragments were fire altered, indicating that they were part of thermal activities. Feature 659 was located approximately 7 m from the main burial, and Feature 683 was approximately 110 m northwest of the main burial area.

Chronology was determined for eight rock clusters: Features 518 (Millingstone period), 688 (Intermediate and Late periods), 169 and 684 (Late period), 640 (Late and Protohistoric periods), 335 (Protohistoric and Mission periods), and 51 and 527 (Mission period). Feature 169 yielded two temporally sensitive artifacts: a Cottonwood Leaf-shaped point and a stone disk that dated to the Late period. Other than Feature 169, comparisons of overall artifact types and relative distributions did not reveal patterns that could be linked with temporal trends or hallmark characteristics.

Thermal Feature

Lithic artifacts from Feature 22, located approximately 5 m north of the main burial area, were analyzed. The feature, dating to between the Late and Mission periods, yielded 27 lithic artifacts comprising 1 percent of the total analyzed lithic collection recovered from sitewide features. This feature, primarily a charcoal stain, was likely part of a larger activity area that included Feature 21, a pit, and Feature 478, a rock cluster. All of the Feature 22 lithic artifacts were identified as debitage consisting of six different material types: chert (63 percent), basalt (11.1 percent), andesite (7.4 percent), chalcedony (7.4 percent), quartzite (7.4 percent), and obsidian (3.7 percent) (see Appendix B.46). Collectively, the flakes represent core-reduction and biface-reduction activities. Whether they were associated with the activities resulting in the charcoal stain is unclear. Considering that the debitage is not fire altered, the flakes may have been part of the underlying midden deposit or related to activities that occurred elsewhere within the activity area.

FB 3

FB 3, adjacent to the western edge of the main burial area, consisted of a series of features and surrounding excavation units. One of the features (Feature 384) may represent the remains of mourning-ceremony activities. Of the three feature blocks at the site, FB 3 yielded the highest lithic frequency, totaling 881 lithic artifacts. Furthermore, the FB 3 lithic artifacts comprised 7.7 percent of the analyzed lithic collection recovered from LAN-62, Loci A and G. Flaked stone composed the bulk (82.6 percent) of the FB 3 collection, followed by unshaped stone (13.8 percent) and ground and battered stone (3.5 percent) (see Appendixes B.48 and B.49). Analysis included two contexts in FB 3: all items from excavation units and all lithic artifacts recovered from features.

Excavation Units

Lithic items recovered from FB 3 excavation units composed 9.6 percent of the FB 3 lithic collection and included 77 items recovered from 23 excavation units. By contrast to the general trend for FB 3, unshaped stone composed the bulk (59.7 percent) of the excavation-unit collection, followed by lower quantities of flaked stone (27.3 percent) and ground and battered stone (13 percent) (see Appendixes B.48 and B.49). The unshaped-stone collection was dominated by FAR (53.2 percent); debitage (9.1 percent) and edge-modified pieces (9.1 percent) were recovered in lower frequencies.

Frequencies of lithic artifacts within excavation units ranged from 1 to 13. EU 812, located approximately 3 m west of the main burial area, primarily yielded debitage and FAR. Artifacts from other excavation units included steatite *comal* fragments from EUs 824 and 811. EU 811 also yielded a Cottonwood Triangular concave-base projectile point. The two units were located within 1 m of each other and approximately 5 m west of the main burial area. A limestone tubular bead; fire-altered ground stone, including a vessel fragment; and FAR were also recovered from EU 812.

The flaked stone "other" category included a limestone shell effigy recovered from EU 717, located approximately 1.5 m west of the main burial area. The limestone was flaked into the shape of a clamshell, and the limestone bands were oriented to give the appearance of shell growth lines. The other unshaped-stone category included two pieces of ocher from two units.

Features

The majority of the lithic artifacts analyzed from FB 3 was recovered from feature contexts, which comprised 91.3 percent of the feature-block collection (see Table 27). In total, 804 lithic artifacts were recovered from 13 features, including artifact concentrations, rock clusters, a thermal feature, and pits. Features yielded a slightly greater lithic-artifact diversity than did excavation units (18 types compared to 15 types). Nevertheless, as noted for FB 3 excavation units, flaked stone composed the bulk (87.9 percent) of feature contexts, followed by unshaped stone (9.5 percent) and ground and battered stone (2.6 percent) (see Appendixes B.48 and B.49). Most (86.7 percent) of the flaked stone was debitage, and FAR comprised the second-highest frequency (6.7 percent). FB 3 artifact concentrations (70.3 percent) yielded the highest lithic frequencies, followed by rock clusters (15.7 percent), pit features (13.3 percent), and thermal features (0.7 percent).

Artifact-Concentration Features

Seven artifact concentrations from FB 3 were analyzed and yielded 565 lithic artifacts comprising 70.3 percent of the FB 3 feature collections. The features were clustered in the center portion of the feature block, all overlapping, with the exception of one feature, Feature 454, located approximately 0.75 m west of the cluster. Feature 384, the largest of the artifact concentrations, extended almost the entire length of the feature block.

The FB 3 artifact-concentration features had less lithic-artifact diversity than did burial and burial-area features. Artifact diversity and relative frequencies of these artifact concentrations are similar to those observed for the sitewide features. Flaked stone artifacts composed the bulk (94.3 percent) of the FB 3 feature collection, followed by unshaped stone (4.4 percent) and ground and battered stone (1.2 percent) (see Appendixes B.48 and B.49). Most of the lithic artifacts consisted of debitage (93.1 percent), asphaltum (1.8 percent) (in the unshaped-stone "other" category), and FAR (1.2 percent).

Lithic frequencies within artifact concentrations ranged from 11 to 416. Feature 384 consisted of multiple overlapping subfeatures, including a series of pits and artifact concentrations. Collectively, the overlapping features likely represent mourning-ceremony activities. In general, the area was characterized by large quantities of charcoal and basketry fragments as well as burned seed concentrations (see Volume 2 of this series for detailed discussion of this feature). Feature 384 had the second-highest lithic-artifact diversity, with seven different types. Despite the diversity, most of the lithic artifacts were identified as debitage (97.1 percent); there were lower frequencies of FAR (1.2 percent). The collection also included a chert Cottonwood Triangular concave-base point, a chert biface, and three steatite manuports.

Feature 458, the artifact concentration with the greatest artifact diversity, was located in the northern portion of the feature block. The feature consisted of burned basketry fragments, carbonized botanical remains, ground stone fragments, and unworked faunal bone. The feature also yielded 54 lithic artifacts primarily consisting of debitage (74.1 percent). Four steatite *comal* fragments were recovered from Feature 458; these conjoined with fragments recovered from FB 3, EUs 824 and 811, located adjacent to the feature. Of note is that one of the partially reconstructible *comales* from the feature is a miniature, approximately half the size of those identified in burial features. This *comal* had a perforation, possibly for hanging, as well as an incised groove along the proximal margin. Feature 458 also yielded a chert Cottonwood Triangular concave-base projectile point, asphaltum, and tarring pebbles. Considering the presence of considerable frequencies of burned basketry, some of which was coated with asphaltum, the tarring pebbles may have originally been used to coat the baskets with asphaltum. All of the FB 3 artifact-concentration features dated to the Mission period.

Rock-Cluster Features

Analysis of lithic artifacts recovered from three rock clusters included the study of 126 lithic artifacts comprising 15.7 percent of the collection from FB 3 features. The lithic-artifact collections from rock clusters are primarily composed of debitage; there are lower frequencies of FAR and ground stone fragments. Other artifact types include worked and unworked faunal bone and shell and basketry fragments. Feature 331 was located along the eastern edge of the feature block, Feature 673 was situated near the southwestern boundary, and Feature 471 was identified along the central-eastern edge.

Flaked stone artifacts dominated (49.2 percent) the collection from rock clusters; unshaped stone (39.7 percent) and ground and battered stone (11.1 percent) were found in lower frequencies (see Appendixes B.48 and B.49). Rock clusters contained debitage (47.6 percent) and FAR (37.3 percent) in addition to low frequencies of metates (6.3 percent).

Most of the lithic artifacts (71 percent) were recovered from Feature 331, which consisted of a concentration of ground stone bowl fragments and manos as well as worked bone and shell and debitage. Most of the lithic artifacts were fire-affected, but there was no evidence of in situ burning. Human remains were located in surrounding excavation units, and a human femur was found directly below the feature. Feature 331 was likely associated with Feature 384 and the other FB 3 artifact-concentration features. Although debitage composed the bulk (56.2 percent) of the Feature 331 lithic collection, several other artifacts were also recovered, including 23 pieces of FAR; 1 piece of ocher; 1 steatite shaft straightener manufactured from a recycled *comal* fragment; 1 large, thick sandstone metate or vessel fragment with significant postdepositional dulling, likely recycled; 1 lightly used cobble metate broken in several pieces; 1 fire-altered cobble metate; and fire-altered, conjoining specimens that represented 2 cobbles. The collection also included 2 vessels, 1 of which exhibited intentional breakage, and a metate made of vesicular basalt. This type of basalt, with very large vesicles, was identified only in Feature 331. Considering the rarity of vesicular basalt at LAN-62, Loci A and G, the items may have been associated with the same individual, family, or group who could have acquired the material at the same time/location and brought the items to the site. The absence of the entire vessel and metate, though, suggests transport of only these fragments, rather than the entire implement.

Much of the FAR recovered from Feature 331 was reddened in the interior. This may reflect how the heat was applied (i.e., temperature, placement, and oxygen availability). Interestingly, much of the FAR could be refit, indicating that the materials had not been displaced since breakage. This was markedly different from the FAR in the burial features, suggesting that there had been considerable displacement of midden material and/or that the burials had been disturbed by placement of later interments.

Compared to Feature 331, Features 471 and 673 exhibited relatively limited artifact diversity and frequency. Both were composed mostly of debitage and FAR. Feature 673 also yielded two choppers and one piece of fire-affected ground stone. The feature dated to the Millingstone period, whereas Features 331 and 471 dated to the Mission period.

Pit Features

Two pit features yielded a total of 107 lithic artifacts comprising 13.3 percent of the total analyzed FB 3 analyzed lithic collection (see Appendixes B.48 and B.49). The pits were located adjacent to one another in the southwestern portion of FB 3.

The two features were pits containing moderate quantities of charcoal and small fragments of carbonized basketry fragments. Whether in situ thermal activities occurred within the pits is unclear. Most of the lithic artifacts were recovered from Feature 672, which consisted of a large pit composed of three smaller pits. The pit yielded 92 pieces of debitage and 1 tarring pebble. Feature 671 also contained mostly debitage in addition to 1 chalcedony core. One of the pieces of debitage was chalcedony and may have been removed from the core. The remaining flakes were identified as quartzite and chert. Overall, the pit features exhibited little artifact diversity, compared to other FB 3 features. As with artifact concentrations, the pit features dated to the Mission period.

Thermal Features

Feature 373, located in the southern portion of the feature block, consisted of a small concentration of charcoal and burned basketry fragments. Analysis included six pieces of debitage composed of three different material types: basalt, rhyolite, and chert (see Appendix B.49). None of the lithic artifacts exhibited thermal alterations, indicating that they may have been part of the underlying midden deposit rather than related to activities directly associated with the thermal feature. Feature 373 dated to the Mission Period.

FB 4

FB 4 was located in the center of LAN-62, Loci A and G, adjacent to the main burial area. In total, 309 lithic artifacts recovered from excavation units and features were analyzed. This collection accounted for 2.7 percent of the total analyzed LAN-62, Loci A and G, lithic collection (see Table 27) and included flaked stone (60.2 percent), unshaped stone (37.2 percent), and ground and battered stone (2.6 percent) (see Appendix B.50). The majority of the lithic artifacts from FB 4 were identified as debitage (53.1 percent) and FAR (36.2 percent). The flaked stone "other" category included a chopper, a split cobble, and a core hammerstone. Within the ground- and battered-stone-artifact category, fire-altered ground stone comprised half of the collection. With the exception of a stone bead, all of the ground and battered stone artifacts from FB 4 contexts were identified as fire altered.

Excavation Units

In total, 95 lithic items were recovered from 32 excavation units located throughout the feature block (see Table 27). Similar to the pattern identified for FB 3 excavation units, unshaped stone comprised the bulk (64.2 percent) of the FB 4 excavation-unit collection, followed by flaked stone (31.6 percent) and ground and battered stone (4.2 percent) (see Appendix B.50). FAR dominated (96.7 percent) the unshaped-stone collection, and debitage composed the bulk (43.3 percent) of the flaked stone category. Artifact diversity and frequency were limited for the ground and battered stone category, consisting of 2 pieces of fire-altered ground stone fragments and 2 fire-altered mano fragments.

Lithic frequencies for excavation units ranged from one to nine lithic items. EU 437, located in the southeastern corner of the feature block, yielded mostly FAR in addition to two pieces of debitage, one piece of fire-altered ground stone, and one fire-altered mano.

Features

Compared to excavation units, FB 4 features contained higher frequencies and greater lithic-artifact diversity. Lithic artifacts were recovered from 10 features, including rock clusters (90.7 percent), pits (4.2 percent), artifact concentrations (2.8 percent), and activity areas (2.3 percent). The collection from the FB 4 features included 707 lithic artifacts constituting 97.1 percent of the FB 4 collection (see Table 27).

Most of the artifacts were identified as flaked stone (72.9 percent); lower frequencies of unshaped stone (25.2 percent) and ground and battered stone (1.9 percent) (see Appendix B.50) were recovered. Overall, this relative distribution is similar to that of FB 3 features. Debitage composed the bulk (70.6 percent) of the collection; lower frequencies of FAR (24.8 percent) and cores (1.9 percent) occurred. Other lithic-artifact types were recovered in very low quantities and accounted for less than 1 percent. Within the ground and battered stone category, half of the artifacts were identified as fire-altered ground stone.

Artifact-Concentration Features

Two artifact concentrations yielded lithic artifacts. These two features were adjacent to each other within the central portion of the feature block and consisted of clusters of marine shell in addition to unworked faunal bone. Features 535 and 536 contained four and two pieces of debitage, respectively, and accounted for 2.8 percent of the FB 4 analyzed lithic collection (see Appendix B.50). Debitage material types identified for Feature 535 consisted of chert, rhyolite, and andesite, and Feature 536 contained quartzite and chert. Both features included core-reduction and biface-reduction flakes.

Activity-Area Features

Collectively, activity-area Features 541 and 542, adjacent to one another in the central portion of FB 4, yielded a total of five lithic artifacts comprising only 2.3 percent of the total FB 4 feature analyzed lithic collection (see Appendix B.50).

Feature 542 consisted of a subfeature within Feature 541; both were composed of small clusters of shells in addition to low frequencies of lithic artifacts and unworked faunal bone. The lithic artifacts included two pieces of andesite debitage from Feature 541 and one piece of chert debitage from Feature 542. One piece of FAR was recovered from each feature, as well.

Rock-Cluster Features

Four rock clusters yielded a total of 194 lithic artifacts (see Appendix B.50). Compared to other FB 4 features, rock clusters were slightly more dispersed within the feature block; Features 419, 509, and 572 were located in the southern portion of the feature block, and Feature 612 was situated in the northwestern portion. Feature 419 consisted of a large rock cluster with subfeatures, including Feature 509.

Flaked stone composed the bulk (72.2 percent) of the rock-cluster collection, followed by unshaped stone (25.8 percent) and ground and battered stone (2.1 percent) (see Appendix B.50). Within the flaked stone category, most (96.4 percent) of the lithic artifacts were identified as debitage. FAR composed the bulk (98 percent) of the unshaped-stone category, and half of the battered and ground stone artifacts were identified as fire-altered ground stone. The flaked stone "other" category included one chopper.

Lithic frequencies in the rock clusters ranged from 5 to 172. Each feature contained debitage as well as FAR, with the exception of the latter in the case of Feature 572. Feature 419 contained the highest lithic frequency as well as the greatest lithic-artifact diversity, with six different lithic types identified. Most of the Feature 419 lithic artifacts were identified as debitage (71.5 percent) and FAR (24.4 percent). Artifacts of note included one chlorite schist bead and an andesite chopper. Feature 419, which also yielded unworked shell and faunal bone, likely represented a hearth-cleanout area or was associated with food preparation. The feature dated to the Intermediate period.

Both Features 509 and 572 were composed of small clusters of shell and unworked faunal bone, and Feature 612 consisted of tightly clustered cobbles. Features 509 and 612 contained low frequencies of debitage and FAR. Feature 572 yielded debitage, a tarring pebble, and a fire-altered metate fragment. In the case of all three features, evidence of in situ thermal alterations was absent, indicating that they were likely associated with hearth-cleanout activities.

Pit Features

Pit features yielded nine lithic artifacts comprising 4.2 percent of the FB 4 feature analyzed lithic collection (see Appendix B.50). The pits, Features 483 and 563, were located approximately 2.3 m apart; Feature 483 was located in the southern portion of FB 4, and Feature 563 was situated in the northern area. Both features were characterized as pits containing marine-shell concentrations in addition to low frequencies of lithic artifacts. Feature 563 was associated with rock-cluster Feature 419. Both pit features likely represented hearth cleanouts or refuse deposits.

Lithic artifacts recovered from these two features included one piece of debitage from Feature 563 and six pieces of debitage and two pieces of FAR from Feature 483. Pieces of debitage from both features were identified as chert; one chalcedony flake was recovered from Feature 563.

FB 7

FB 7 yielded the lowest frequency of lithic artifacts of the three feature blocks. Lithic artifacts from FB 7 analyzed contexts comprised 10.5 percent of the feature-block collection and 1.2 percent of the total analyzed lithic collection recovered from LAN-62, Loci A and G (see Table 27). Analysis included a total of 139 lithic artifacts recovered from excavation units (64 percent) and features (36 percent).

FB 7 was located approximately 2 m north of the main burial, between FB 3 (3.7 m to the southwest) and FB 4 (4.2 m to the southeast). Flaked stone composed more than half (53.2 percent) of the FB 7 analyzed lithic collection, followed by unshaped stone (43.2 percent) and ground and battered stone (3.6 percent) (see Appendix B.51). Unlike the pattern identified in the other feature blocks, FAR made up most (41.7 percent) of the FB 7 collection; there were lower frequencies of debitage (37.4 percent) and edge-modified pieces (5.8 percent). The ground and battered stone collection consisted of manos and indeterminate vessel fragments.

Excavation Units

In total, 89 lithic items were recovered from 19 excavation units in FB 7 and comprised 64 percent of the FB 7 collection (see Appendix B.51). Most of the artifacts were FAR (48.3 percent), followed by debitage (20.2 percent) and cores (10.1 percent). Frequencies within excavation units ranged from 1 to 20. EU 344, located in the northeastern portion of the feature block, contained mostly FAR (65 percent) in addition to flaked stone artifacts, including 1 chert biface. Ground and battered stone artifacts recovered from excavation units consisted of fire-altered ground stone, indeterminate vessel fragments, and a complete basin mano (from EU 346).

Features

Lithic artifacts from four features in FB 7, all rock clusters, were analyzed and included 50 artifacts comprising 36 percent of the total FB 7 analyzed lithic collection (see Table 27). Features 573 and 574 were adjacent to one another in the central portion of the feature block, and Features 623 and 449 were in the western and northeastern areas, respectively.

These four features consisted of clusters of FAR and debitage in addition to low frequencies of charcoal and unworked marine shell and faunal bone. Evidence of in situ thermal alterations were absent, indicating that the rock clusters may represent hearth cleanouts or refuse deposits. Collectively, the four rock clusters yielded three types of lithic artifacts: debitage (68 percent), FAR (30 percent), and cores (2 percent) (see Appendix B.51). Frequencies within the features ranged from 5 to 25. With the exception of Feature 574, debitage composed the bulk of each feature. FAR occurred in slightly higher frequencies in the collection from Feature 574 than did debitage. Of note, Feature 449 contained the only core in the analyzed FB 7 feature collection. Chronology was determined for only one feature, Feature 449, which dated to the Millingstone period.

Summary of LAN-62, Loci A and G, Sitewide Features and Feature Blocks

Features in the sitewide context and the three feature blocks represent a wide range of activities over time, some of which were associated with the main burial area. Sitewide features and feature blocks yielded a variety of flaked stone, ground and battered stone, and unshaped-stone artifacts. By contrast to burial features, which contained high frequencies of unshaped stone, these sitewide features and feature-block contexts yielded mostly flaked stone artifacts. Debitage contributed to the bulk of the flaked stone category.

Comparisons of the three feature blocks (Table 33) revealed that more than half (66.3 percent) of the analyzed lithic artifacts were recovered from FB 3. FB 3 also contained the greatest lithic-artifact diversity (see also Appendix B.52). With the exception of FB 3, most of the analyzed lithic artifacts from feature blocks and sitewide features were recovered from rock-cluster features. In FB 3, artifact concentrations yielded most of the lithic artifacts. Mourning-ceremony activities associated with the main burial area likely occurred at FB 3 and may account for the propensity of lithic artifacts to be located within artifact concentrations rather than rock-cluster features. In general, rock clusters sitewide and feature blocks were composed of debitage and FAR and were likely associated with hearth-cleanout or refuse-deposit activities. With the exceptions of chronologically sensitive artifacts, such as projectile points and *comales*, there were no apparent temporal trends in artifact types and relative distributions over time.

Discussions and Ethnographic Comparisons of Particular Artifacts

Several artifacts recovered from LAN-62 were unique and warranted further study. These studies were conducted by Henry Koerper and are presented in Appendixes B.53–B.61. The artifacts include quartz crystals, a possible sun effigy made of micaceous steatite, a soapstone rattlesnake effigy, several transversely grooved stone artifacts, steatite tablets, steatite receptacles, a donut-shaped stone artifact, and waterworn pebbles. Koerper's study focuses specifically on the symbolic associations and meanings of these artifacts to the aboriginal populations, in particular their roles in mortuary and ritual realms. In exploring the symbolic roles of these artifacts, Koerper (see Appendixes B.53–B.61) provided a regional context of other sites where similar artifacts were recovered and also reviewed ethnographic and ethnohistoric accounts to provide a basis for the interpretations.

Loci C and D

Loci C and D were located in the northeasternmost portion of LAN-62, approximately a kilometer from LAN-62, Loci A and G, and the main activity area. Compared to Loci A and G, Loci C and D yielded a relatively small lithic collection. The two loci are discussed together. With the exception of one artifact recovered from a nonburial feature, LAN-62, Loci C and D, lithic artifacts were all recovered from control units. In all, seven control units yielded 1,357 lithic artifacts comprising 10.6 percent of the total analyzed LAN-62, Loci C and D, lithic collection (see Appendixes B.62 and B.63). Three of the control units were located in Locus C, and four were excavated within Locus D. Similar to the pattern identified for LAN-62, Loci A and G, control units, flaked stone (96.8 percent) dominated the LAN-62, Loci C and D, control-unit lithic collection, followed by unshaped stone (2.7 percent) and battered and ground stone (0.5 percent) (Table 34). The following is a discussion of the results of analysis, by control unit.

Compared to LAN-62, Loci A and G, lithic-related activities within the northeastern portion of the site were relatively limited, as evidenced by lower artifact frequencies and diversity. This portion of the site may have been used seasonally or for only a short period or perhaps was the focus of non-lithic-related activities. Lithic frequencies ranged widely within LAN-62, Loci C and D, from 759 lithic artifacts in CU 937/560 (Locus C) to 1 lithic artifact in CU 970 (Locus D) (Table 35). The two control units that yielded the highest frequencies also had the greatest lithic-artifact diversity. These units yielded several different types of flaked stone tools as well as ground stone implements and FAR, among other lithic types. Of note was the absence of *comales* and vessels as well as decorative items, such as beads and pendants, from Loci C and D. The collection was primarily utilitarian in nature.

Locus C control units yielded slightly higher lithic frequencies than those in Locus D; the latter consisted entirely of low frequencies of debitage. Within the debitage collection, which comprised the majority of the LAN-62, Loci C and D, lithic collection, other than differences in frequencies, there was little variability between the two loci, indicating that similar types of lithic-reduction activities occurred in these areas. Debitage consisted mostly of core and biface reduction and, collectively, represented mainly late-stage percussion, which may account for the low frequencies of cores. However, considering the high frequencies of debitage and the near-absence of flaked stone tools, it would appear that tool maintenance

Table 33. Comparison of Lithic Artifacts Recovered from FBs 3, 4, and 7, LAN-62, Loci A and G

Artifact Category, by Type	FB 3		FB 4		FB 7		Total	
	n	%	n	%	n	%	n	%
Flaked stone								
Core	8	6.6	9	7.8	10	16.7	27	9.1
Debitage	704	577.0	164	142.6	52	86.7	920	309.8
Projectile point	3	2.5	—		—		3	1.0
Biface	3	2.5	—		2	3.3	5	1.7
Edge-modified flakes	7	5.7	6	5.2	8	13.3	21	7.1
Other	3	2.5	7	6.1	2	3.3	12	4.0
Subtotal	728	596.7	186	161.7	74	123.3	988	332.7
Ground/battered stone								
Ground stone (including indeterminate ground stone)	7	5.7	4	3.5	—		11	3.7
Mano	—		2	1.7	3	5.0	5	1.7
Metate	8	6.6	1	0.9	—		9	3.0
Pestle	—		—		—		—	0.0
Chopper	—		—		—		—	0.0
Mortar	—		—		—		—	0.0
Bowl	1	0.8	—		—		1	0.3
Vessel	3	2.5	—		2	3.3	5	1.7
Comal	7	5.7	—		—		7	2.4
Pendant	—		—		—		—	
Bead	2	1.6	1	0.9	—		3	1.0
Other	3	2.5	—		—		3	1.0
Subtotal	31	25.4	8	7.0	5	8.3	44	14.8
Unshaped stone								
FAR	95	77.9	112	97.4	58	96.7	265	89.2
Cobble hammerstone	—		1	0.9	2	3.3	3	1.0
Tarring pebble	5	4.1	2	1.7	—		7	2.4
Manuport	9	7.4	—		—		9	3.0
Other	13	10.7	—		—		13	4.4
Subtotal	122	100.0	115	100.0	60	100.0	297	100.0
Total	881	722.1	309	268.7	139	231.7	1,329	447.5

Note: % = percent of total artifacts recovered per feature block.

Table 34. Summary of Lithic Artifacts from Analyzed Contexts at LAN-62, Loci C and D

Excavation Context	Flaked Stone					Ground/Battered Stone			Unshaped Stone				Total
	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Fire-Altered Ground Stone	Mano	Fire-Altered Metate	FAR	Cobble Hammerstone	Tarring Pebble	Manuport	
CU 937/560	5	718	2	3	2	—	4	1	18	—	2	4	759
CU 534	—	519	—	1	4	1	1	—	11	1	—	—	538
CU 922	—	29	—	—	—	—	—	—	—	—	—	—	29
CU 970	—	1	—	—	—	—	—	—	—	—	—	—	1
CU 981	—	13	—	—	—	—	—	—	—	—	—	—	13
CU 998	—	4	—	—	—	—	—	—	—	—	—	—	4
CU 1000	—	13	—	—	—	—	—	—	—	—	—	—	13
Subtotal	5	1,297	2	4	6	1	5	1	29	1	2	4	1,357
Nonburial Feature 201	—	—	—	—	—	—	—	—	1	—	—	—	1
Subtotal	—	—	—	—	—	—	—	—	1	—	—	—	1
Total	5	1,297	2	4	6	1	5	1	30	1	2	4	1,358

Table 35. Lithic Artifacts Recovered from CUs 534, 922, 970, 981, 998, and 1000 by Cultural Stratum, LAN-62, Loci C and D

Cultural Stratum, by CU No.	Flaked Stone					Ground/Battered Stone			Unshaped Stone		Total	Density (n/m³)
	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Ground Stone	Mano	Fire-Altered Metate	FAR	Other[a]		
534												
Late period	—	519	—	1	4	1	1	—	11	1	538	197.79
922												
Late/Mission period	—	29	—	—	—	—	—	—	—	—	29	22.31
937/560												
Late/Mission period	2	69	1	2	—	—	1	—	3	1	—	98.75
Millingstone/Late period	—	12	—	—	—	—	—	—	—	—	—	120.00
Millingstone period	1	345	1	1	1	—	—	1	10	2	—	208.05
Indeterminate period	2	292	—	—	1	—	3	—	5	3	—	235.00
Subtotal	5	718	2	3	2	—	4	1	18	6	—	172.50

continued on next page

Cultural Stratum, by CU No.	Flaked Stone					Ground/Battered Stone			Unshaped Stone		Total	Density (n/m^3)
	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Ground Stone	Mano	Fire-Altered Metate	FAR	Other[a]		
970												
Fill	—	—	—	—	—	—	—	—	—	—	—	0.00
Late/Mission period	—	1	—	—	—	—	—	—	—	—	1	1.61
Subtotal	—	1	—	—	—	—	—	—	—	—	1	1.35
981												
Fill	—	—	—	—	—	—	—	—	—	—	—	0.00
Late/Mission period	—	13	—	—	—	—	—	—	—	—	13	8.84
Subtotal	—	13	—	—	—	—	—	—	—	—	13	7.78
998												
Fill	—	—	—	—	—	—	—	—	—	—	—	0.00
Late/Mission period	—	4	—	—	—	—	—	—	—	—	4	2.70
Subtotal	—	4	—	—	—	—	—	—	—	—	4	2.38
1000												
Fill	—	7	—	—	—	—	—	—	—	—	7	14.00
Late/Mission period	—	6	—	—	—	—	—	—	—	—	6	4.51
Intermediate period	—	—	—	—	—	—	—	—	—	—	—	0.00
Subtotal	—	13	—	—	—	—	—	—	—	—	13	5.58
Total	5	1,297	2	4	6	1	5	1	29	7	598	57.3

[a] Other: cobblestone, tarring pebble, and manuport.

occurred in this locale but not necessarily tool production or use. By far, most of the lithic artifacts were recovered from Late/Mission period contexts. Only CU 937/560 contained lithic artifacts from chronostratigraphic deposits ranging in age from the Millingstone period to the Late/Mission period. Based on low frequencies and densities, it appears that lithic-related activities in this portion of the site during the Millingstone period were limited.

Summary Discussion of Lithic Artifacts from LAN-62

The lithic collection from LAN-62 contains a diverse array of lithic artifacts, largely as a result of the presence of a specialized mortuary assemblage dating primarily to the Late and Mission periods and an extensive midden from earlier periods. The large collection of 12,010 stone artifacts recovered from the site provides insight into temporal, spatial, and contextual trends in human behavior as it relates to lithic production, maintenance, and use in mortuary contexts. The collection is dominated by flaked stone (70.7 percent); ground stone (5.5 percent) and unshaped stone (27.1 percent) occurred in significantly lower frequencies.

Contexts ranged from the Millingstone period to the Mission period; the contexts dating to the Intermediate period yielded the highest lithic frequencies, and Protohistoric to Mission period contexts yielded nearly a third (30.3 percent) of the collection. Although lithic frequencies were highest for Intermediate period deposits, Millingstone period contexts yielded the greatest density (381 per cubic meter) of artifacts, followed by the Intermediate (368 per cubic meter) and Protohistoric to Mission (322 per cubic meter) period deposits. This distribution reflects more-intensive sitewide lithic-related activities during the Millingstone period that decreased over time. Millingstone and Intermediate period contexts were primarily the locus of domestic activities, and later activities focused on ritual activities centered within the main burial area. It may be that Millingstone period activities were concentrated in a few areas, but if they had been denser and distributed sitewide, they would have produced the highest frequencies.

In addition to the chronostratigraphic associations of lithic artifacts, several time-sensitive stone tools provide insight into temporal associations of deposits at LAN-62. In total, 151 points were recovered from analyzed contexts (149 from Loci A and G and 2 from Loci C and D). These projectile points include 10 dart points and 141 arrow points; the majority were recovered from the burial features (n = 88, or 58.3 percent). The arrow points are dominated by straight-base Cottonwood Triangular points (n = 76, or 54 percent), concave-base Cottonwood Triangular points (n = 32), and Cottonwood Leaf-shaped points (n = 28); Marymount points (n = 2), Desert Side-notched points (n = 1), and indeterminate arrow points (n = 2) occurred in much lower frequencies. The 10 dart points consist of 1 Silver Lake, 1 Pinto series, 1 large side-notched, 4 large contracting-stem, 1 Elko Corner-notched, 1 Elko Eared, and 1 bipointed dart of indeterminate type. Five of the 10 dart points were recovered from burials: the single large side-notched, the Silver Lake, and 3 of the 4 large contracting-stem points. The temporal associations of these 5 projectile points and 6 dart points span 8,000 years (see Figure 29). For example, the dart points are associated with the early Millingstone period through the early Intermediate period. Note that of the 5 dart points recovered from burial features, 2 were found in association with arrow points.

The arrow points are associated with the late Intermediate period through the Protohistoric period. The prevalence of Cottonwood Triangular arrow points (straight and concave base) in burial features suggests use of the burial area during the Late period through the Protohistoric to Mission period (Justice 2002:368–372; Lanning 1963:252–253; Thomas 1981:15–16). Recovery of slightly older leaf-shaped Cottonwood Triangular arrow points suggests that some of the interments may date to the late Intermediate period (Van Horn 1987a:88–91, Figure 25, 268).

Spatially, lithic frequencies ranged widely, and the control sample to the northwest of the burial area yielded the highest frequency. This likely reflects intensive use of this portion of the site, particularly during the Late and Mission periods, as evidenced by the higher densities recovered from these contexts. CU 141, located within the burial area, yielded the second-largest lithic concentration of the control samples. Spatially and contextually, a comparison of lithic artifacts from the burial features, the burial area, and FB 3 provides ample data to address human behavior and activities related to lithic-tool production, maintenance, and disposal (Table 36). Temporally, these three contexts primarily date to the Protohistoric to Mission period, although there are instances of Intermediate period features. In terms of sheer frequencies of total artifacts, the burials have the highest recovery, and the FB 3 midden has the lowest frequency. There is an interesting contrast between the midden and features of the burial area and those of FB 3. The burial-area midden has a higher frequency than its features, whereas FB 3 features have a higher frequency than the midden (see Table 36).

Ratios of ground stone to flaked stone show an interesting association, with 1:3 (ground stone to flaked stone) for burials compared to 1:33.7 for features. This distribution indicates that ground stone occurred in higher ratios in burials than at FB 3 (25.7 percent of the burial collection) (see Table 27). This implies that ground stone artifacts, though related to food processing, were important offerings in burials. This is further supported by the ratio of unformed to formed ground stone artifacts, which is higher in burials and the burial area (Table 37). In other words, there are more formed than unformed ground stone artifacts in burials and the burial area (compared to FB 3). The formed ground stone artifacts include manos, metates, pestles, bowls, vessels, and *comales*. The ratios of unformed to formed ground stone artifacts in

Table 36. Comparison of Three Contexts at LAN-62

Analytical and Excavation Context	Flaked Stone	Ground/Battered Stone	Unshaped Stone	Total
Burial features	541	401	618	1,560
Burial area				
Midden (excavation units)	375	172	706	1,253
Features	254	71	99	424
Subtotal	629	243	805	1,677
FB 3				
Midden (excavation units)	21	10	46	77
Features	707	21	76	804
Subtotal	728	31	122	881
Total	1,898	675	1,545	4,118

Table 37. Ratios of Artifacts from Three Contexts at LAN-62

Analytical and Excavation Context	Points to Debitage	Cores to Debitage	Ground Stone to Flaked Stone	Ground Stone to Formed Ground Stone[a]	FAR to Non-FAR
Burial features	1:3	1:7	1:1.3	1:6	1:3
Burial area					
Midden (excavation units)	1:3.8	1:3.2	1:2.2	1:4.7	1:29.6
Features	1:82	1:123	1:3.6	1:22.7	1:7
Subtotal	1:9	1:8	1:2.6	1:6.3	1:16.7
FB 3					
Midden (excavation units)	1:7	1:1.75	1:2.1	1:1.5	1.1:1
Features	1:348.5	1:174.3	1:33.7	1:6	1:14
Subtotal	1:234	1:88	1:23.5	1:3.5	1:8.3

[a] Includes manos, metates, *comales*, pestles, bowls, vessels, and "other" category.

the burials and the FB 3 features are similar. Burial-area features have a higher ratio (1:22.7), indicating that these features (artifact concentrations, pits, and rock clusters) were more likely to be trash dumps (or cleanouts) rather than locations of domestic activities.

FB 3 features present an intriguing trend of a high ratio of flaked stone to ground stone, compared to the burials or burial-area features (Tables 38–40; see Tables 36 and 37). In other words, there is a much higher proportion of flaked stone in FB 3 features. The higher proportion is primarily due to the debitage (1 point to 348.5 pieces of debitage; 1 core to 174.3 pieces of debitage). Therefore, indicators of tool maintenance and production are higher in FB 3 features. Given the higher ratio than in burials and burial-area features, this pattern does not support a relationship between FB 3 features and a mourning-ceremony area, unless debitage was deliberately offered (or disposed of) as part of mourning offerings. Note, though, that the debitage ratios from FB 3 features are lower than those of the general habitation midden at the site (compare data from the control units).

The debitage recovered from the burials, the burial area, and FB 3 is dominated by core-reduction flakes (48 percent)—in particular, late percussion flakes (23 percent) (see Appendix B.42). However, in FB 3, the biface-reduction flakes account for 46 percent (n = 320) of the FB 3 debitage (see Appendix B.42). In particular, the pressure flakes (n = 140) in FB 3 could be the by-products of resharpening and reshaping of tools that were ultimately offered either as part of the mourning ceremonies or as grave offerings during burial. The full sequence of biface production from initial shaping to final pressure flaking is represented in FB 3 features. This suggests that some bifaces were fully manufactured in this area. Given the relatively modest quantity of biface-production debitage (n = 320) in comparison to the larger number of bifaces and points recovered from burials, most of the artifacts from burials were not manufactured near the burial area or at FB 3. The objective of the core reduction may have been to produce expedient tools for immediate use in mourning activities (to cut meat and other foods) or possibly to shape raw material into cores that were subsequently offered. It would

Table 38. Comparison of Flaked Stone Artifacts from Three Contexts at LAN-62

Analytical and Excavation Context	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Other[a]	Total
Burial features	36	268	88	70	58	21	541
Burial area							
Midden (excavation units)	48	155	41	47	65	19	375
Features	2	246	3	1	2		254
Subtotal	50	401	44	48	67	19	629
FB 3							
Midden (excavation units)	4	7	1	1	7	1	21
Features	4	697	2	2		2	707
Subtotal	8	704	3	3	7	3	728

[a] Other: drill, chopper, split cobble, core hammerstone, fire-altered core hammerstone, and effigy.

Table 39. Comparison of Ground Stone Artifacts from Three Contexts, LAN-62

Analytical and Excavation Context	Ground Stone[a]	Mano	Metate	Pestle	Mortar	Bowl	Fire-Altered Vessel	*Comal*	Pendant	Bead	Other[b]	Total
Burial features	57	12	4	14	1	71	4	21	11	147	59	401
Burial area												
Midden (excavation units)	30	38	14	10	4	19	19	2	6	3	27	172
Features	3	—	—	1	—	27	—	2	—	9	29	71
Subtotal	33	38	14	11	4	46	19	4	6	12	56	243
FB 3												
Midden (excavation units)	4	—	—	—	—	—	1	3	—	1	1	10
Features	3	—	8	—	—	1	2	4	—	1	2	21
Subtotal	7	—	8	—	—	1	3	7	—	2	3	31

[a] Including indeterminate ground stone.
[b] Other: abrader, anvil, charm stone, disk, palette, pipe, plummet, vessel, and other.

Table 40. Comparison of Miscellaneous Artifacts from Three Contexts, LAN-62

Analytical and Excavation Context	Unshaped Stone					Total
	FAR	Cobble Hammerstone	Tarring Pebble	Manuport	Other[a]	
Burial features	398	8	20	51	139	616
Burial area						
Midden (excavation units)	41	—	2	1	2	46
Features	54	—	3	8	11	76
Subtotal	95	—	5	9	13	122
FB 3						
Midden (excavation units)	41	—	2	1	2	46
Features	54	—	3	8	11	76
Subtotal	95	—	5	9	13	122

[a] Other: quartz crystal, asphaltum, ocher, and other.

have been imperative to have fresh, sharp tools readily on hand as implements became dull or lost.

There may have been a relatively high degree of recycling that occurred at LAN-62, based on reuse of cores as hammerstones and then as FAR. Even FAR was scavenged and the edges modified to make expedient tools. This may have been because of the scarcity of lithic raw materials in the immediate vicinity of the Ballona. However, what is noteworthy is that despite this scarcity, the Protohistoric to Mission period occupants included high frequencies of lithic artifacts in the burials and at FB 3 as offerings. In other words, social factors played an important role in decision making, and what was offered was not necessarily an indicator of what was readily available.

Burial features at LAN-62, Locus A, contained a variety of lithic artifacts, including objects that in other contexts would be interpreted as "utilitarian." For example, 85.6 percent (n = 137) of the projectile points from LAN-62, Loci A and G, were recovered from the burial area. Projectile points may have functioned as grave accoutrements or could alternatively point to the causes of death of the individuals interred. For example, burial Feature 305 contained an adult male with three Cottonwood Triangular arrow points still embedded in his bones. Two of these arrow points exhibited facial fluting from impact on the distal ends. Additionally, a complete Stage 5 chert biface with asphaltum and vegetal impressions (evidence of hafting) was found with burial Feature 267 and matched the cut marks on the adult female's ribs, indicating that the cause of death was repeated stabbing from the back. The denticulate edges of the biface blade are still sharp, and no edge damage was observed under low (10×) magnification. Large numbers of projectile points with impact fractures may imply their function as weapons. Perhaps environmental circumscription and the arrival of the Spanish and their herds of sheep and cattle led to increased warfare during the Late and Historical periods.

Several patterns are discerned among the burial area, the burials, and FB 3; particular artifacts occurred in higher and lower frequencies and ratios in these three distinct contexts. These patterns and their implications need to be explored further, and the elucidation of the source of artifacts in the burial area will be critical, because much of the material culture in that area (including the surrounding midden) was likely at some point related to burials.

Several signatures are noted in FB 3 and the burial area that are indicative of ceremonialism as manifested in lithic-artifact distribution. There is strong evidence of ritual offerings in FB 3, a mourning-ceremony area. According to ethnohistoric documentation, mourners burned offerings and the deceased's property during a periodic community-wide ceremony (Heizer 1955:157; Hudson and Blackburn 1986:266; King 1969:52; Kroeber 1976:360, 430). For example, FB 3 yielded six fire-altered metate fragments that refit together, suggesting that the metate was deliberately broken and burned in situ. Additionally, five steatite *comal* fragments were recovered from FB 3 that refit to form two *comales*, one of which was a miniature or votive specimen barely large enough for one tortilla. FB 3 also contained ocher, jadeite and chlorite schist beads, and a clamshell effigy (Figure 54). Because the property of the deceased was burned, items buried with an individual were offerings made by mourners and thus may not reflect the gender of the interred. For example, in a study of Chumash burials in the Santa Barbara area, projectile points associated with predominantly male activities and ground stone associated primarily with female roles were distributed almost evenly throughout burials of both genders (Hollimon 2001:51). At LAN-62, many of the burial features contained multiple interments, making it difficult to test whether this pattern holds true for Gabrielino burials.

Similar to FB 3, burial Feature 38 contained 79 lithic fragments that were apparently broken in situ and refit to form 1 Stage 3 biface, 1 indeterminate piece of ground stone, 1 shaped pestle, 4 bowls, 4 *comales*, 4 indeterminate vessels, and 3 pendants (see Figures 37–39). In fact, burial Feature 38, a multiple burial with two primary individuals

Figure 54. Shell effigy made of a flaked-limestone concretion, FB 3, LAN-62.

and the disarticulated remains of at least three other individuals, contained by far the richest lithic collection (n = 130) of any of the interments in the burial area. In addition to the conjoining pieces, burial Feature 38 also yielded 1 bipolar chert core, 2 flakes, 1 Cottonwood Leaf-shaped arrow point, 1 large contracting-stem dart point, 2 edge-modified flakes, 2 indeterminate pieces of ground stone, 1 shaft straightener, 4 indeterminate vessel fragments, 5 steatite bowl fragments (which may belong to one of the reconstructed vessels), 2 steatite pendant fragments, 6 pieces of FAR, 21 chunks of ocher, and 1 granite and 2 steatite manuports. If grave wealth directly reflects sociopolitical status, as Hollimon (2001:51) suggested, the two primary adults (one female and one of indeterminate gender) interred in burial Feature 38 are distinct from the rest of the burial population.

Other artifact associations that are noteworthy include *comales*, pendants, and beads, which were primarily recovered from burial contexts (see Table 29). Most of the tarring pebbles (48 percent) were recovered from burials, the burial area, and FB 3. The tarring pebbles indicate that waterproofing of baskets and/or canteens with asphaltum was done in this area before the baskets were placed as offerings in the burials and mourning features.

In summary, five main trends and patterns were identified in the lithic-artifact collection from LAN-62. First, Millingstone and Intermediate period signatures are limited. Only 8 percent of the projectile points are associated with these earlier periods. Some of the dart points most likely either were scavenged and heirloomed or were in secondary contexts, given their recovery from the midden surrounding the burials and in association with later-dating arrow points.

Second, cores were recovered from burials in much higher relative frequencies (n = 36, or 6.7 percent) than from the general midden (i.e., control units). This is noteworthy because this suggests that cores were deposited as offerings. Similarly, they occurred in high relative frequencies in the burial-area midden, which suggests that cores were not used fully and exhausted. This contradicts some of the reuse patterns observed in the lithic collection. If raw material was sparse, cores would not be discarded in midden areas before they were completely exhausted. So, why were some cores reused as hammerstones and FAR and others discarded prior to optimal use? Does reuse necessarily indicate scarcity?

Third, of the five different types of arrow points recovered from the site, straight-base Cottonwood Triangular points constitute the majority of the site collection (54 percent) and dominate the points recovered from burials (68 percent). By contrast, the Cottonwood Leaf-shaped points account for only 19 percent of the collection, although 41 percent were recovered from burials. In summarizing a sequence of coastal Cottonwood types earlier in this chapter, it was noted that the leaf-shaped type was the earlier, followed by the straight-base form, although both persisted until contact. Whether these two point types indicate earlier and later components of the Late period is not currently discernible in the LAN-62 data.

Fourth, features within FB 3 (related to mourning) contained more than expected debitage, and the types of debitage suggest expedient flaking and resharpening/shaping of tools. Debitage was expected in low frequencies, given the nature of FB 3. If the expedient flakes were used for food preparation (cutting or slicing), then the vertebrate remains should shed light on this behavior. Related to the debitage patterning, burials had lower frequencies of debitage than did the midden areas, indicating that the tools in the burials were not made at the immediate burial location.

The last observation is related to the function of FB 3. The collection from this group of features is distinct from that of a generalized midden and more akin to that of a specialized activity area, as suggested by the relative ratios of various artifact classes and the recovery of unique artifacts (such as a limestone effigy and a shaft straightener). Certain objects with ritual connotations (such as pipes, quartz crystals, waterworn pebbles, and ocher) were recovered from the burial area at LAN-62. The burial area also yielded shaft straighteners and pendants, but such artifacts were rare in or absent from the FB 3 collection. The precise character of FB 3, in terms of lithic artifacts, can be defined with comparisons to other mourning features (such as those at LAN-63, LAN-64, and LAN-206). Is there a lithic-artifact signature for mourning features? How does it vary over time? What characteristics persist?

LAN-211

Analysis of lithic artifacts from LAN-211 involved the study of artifacts recovered from five control units, features outside FB 1, and excavation units within FB 1 (see Chapter 1, this volume, for information on FB 1). Because of the large flaked-stone-artifact collection from the site, rigorous analysis was focused on particular contexts that had chronostratigraphic data and behavioral implications.

Sampling Strategy

Detailed technological analysis was conducted on the 21,269 stone artifacts, including 2,693 artifacts from five control units, 734 artifacts from 12 nonburial features outside FB 1, 17,060 artifacts from excavation units within FB 1, and 782 artifacts from nonburial features within FB 1 (Table 41). The 21,269 lithic artifacts analyzed include 19,772 flaked stones, 402 ground stones, and 1,095 unshaped stones.

Control Units

Five control units were selected for analysis to assess artifact frequencies, densities, and distributions as well as temporal continuity and changes at LAN-211. Analysis included two control units located within FB 1 and three control units outside FB 1. Collectively, the control units yielded 2,693 lithic artifacts constituting 12.4 percent of the total analyzed lithic collection recovered from LAN-211 (see Table 41). Frequencies within the control units ranged widely from 32 to 1,012. Detailed discussions of the control units are presented in Appendix B.64, and data from the control units are presented in Appendixes B.65–B.69.

The collections from the five control units were composed of flaked stone artifacts (98 percent); ground and battered stone (0.1 percent) and unshaped stone (1.9 percent) accounted for small portions of the collection (Tables 42–44; see Table 41). Debitage composed the bulk (98.9 percent) of the flaked stone collection, and the ground and battered stone collection included fire-altered vessels and stone beads (see Tables 42 and43). The unshaped-stone category included four artifact types consisting mostly of FAR (48 percent) and manuports. Quartz crystals composed the unshaped-stone “other” category. The following is a discussion of the results of lithic analysis for each control unit.

Overall, the LAN-211 control units revealed several interesting spatial and temporal patterns. The control units were generally similar in overall artifact distributions; flaked stone, and more specifically debitage, composed the bulk of each collection. Core-reduction flakes accounted for the majority of the debitage collection for each control unit. Technological stage, though, varied between the units; early-stage percussion flakes occurred most frequently in three of the control units, and the remaining units contained mostly late-stage percussion flakes. Apart from the emphasis on late-stage percussion flakes and their location outside FB 1, CUs 353 and 359 shared few similarities with respect to lithic-artifact types and chronostratigraphic distributions. For the most part, ground and battered stone artifacts were absent from or rare in the control units, with the exception of CU 120. The unshaped-stone collections were more limited in frequencies than the flaked stone collections.

Several similarities are noted between the two control units located within FB 1: CUs 119 and 120. Both units yielded the only quartz crystals recovered from the LAN-211 control units, and both contained similar types of unshaped-stone artifacts. The Late/Mission period deposits of these two units yielded the highest lithic frequencies and densities. The similarities between CUs 119 and 120 are related to their locations within FB 1. The two control units located east of FB 1 shared similar chronostratigraphic distributions. Both units had only late Intermediate and Intermediate period deposits. Control units located in FB 1 and to the west, on the other hand, had deposits dating between the Intermediate and Late/Mission periods; most of the lithic artifacts were recovered from the latter. Considering this temporal distribution, it is

Table 41. Summary of Lithic Artifacts from Analyzed Contexts at LAN-211

Analytical and Excavation Context	Flaked Stone Total		Ground/Battered Stone Total		Unshaped Stone		Total
	n	Within Context (%)	n	Within Context (%)	n	Within Context (%)	
			Control Units				
CU 119	375	96.9	—		12	3.1	387
CU 120	981	96.9	3	0.3	28	2.8	1,012
CU 274	587	99.3	—		4	0.7	591
CU 353	32	100.0	—		—		32
CU 359	665	99.1	—		6	0.9	671
Subtotal	2,640	98.0	3	0.1	50	1.9	2,693
			Nonburial Features outside FB 1				
Feature 2	160	97.0	—		5	3.0	165
Feature 11	68	100.0	—		—		68
Feature 15	73	97.3	—		2	2.7	75
Feature 29	23	54.8	—		19	45.2	42
Feature 30	11	91.7	—		1	8.3	12
Feature 31	25	89.3	—		3	10.7	28
Feature 39	—		—		7	100.0	7
Feature 40	1	9.1	3	27.3	7	63.6	11
Feature 46	29	80.6	—		7	19.4	36
Feature 52	192	75.3	18	7.1	45	17.6	255
Feature 53	5	31.3	3	18.8	8	50.0	16
Feature 56	5	26.3	—		14	73.7	19
Subtotal, outside FB 1	592	80.7	24	3.3	118	16.1	734
			Excavation Units (Checkerboard) inside FB 1				
Full analysis	15,820	93.8	248	1.5	796	4.7	16,864
Items only	54	27.6	85	43.4	57	29.1	196
Subtotal	15,874	93.0	333	2.0	853	5.0	17,060
			Nonburial Features inside FB 1				
Feature 4	265	94.3	4	1.4	12	4.3	281
Feature 5	31	79.5	—		8	20.5	39
Feature 8	3	100.0	—		—		3
Feature 13	64	81.0	—		15	19.0	79
Feature 14	146	91.8	9	5.7	4	2.5	159
Feature 21	134	95.0	—		7	5.0	141
Feature 51	—		1	100.0	—		1
Feature 6[a]	1	20.0	—		4	80.0	5
Feature 12[a]	—		—		3	100.0	3
Feature 16[a]	—		3	37.5	5	62.5	8
Feature 18[a]	1	100.0	—		—		1
Feature 19[a]	—		2	33.3	4	66.7	6
Feature 24[a]	1	20.0	4	80.0	—		5
Feature 25[a]	—	0.0	3	75.0	1	25.0	4
Feature 26[a]	8	38.1	3	14.3	10	47.6	21

continued on next page

Analytical and Excavation Context	Flaked Stone Total		Ground/Battered Stone Total		Unshaped Stone		Total
	n	Within Context (%)	n	Within Context (%)	n	Within Context (%)	
Feature 41[a]	3	100.0	—		—		3
Feature 42[a]	1	11.1	8	88.9	—		9
Feature 50[a]	8	57.1	5	35.7	1	7.1	14
Subtotal	666	85.2	42	5.4	74	9.5	782
Subtotal, inside FB 1	16,540	92.7	375	2.1	927	5.2	17,842
Total	19,772	93.0	402	1.9	1,095	5.1	21,269

[a] Items only.

Table 42. Summary of Flaked Stone Artifacts from Analyzed Contexts at LAN-211

Analytical and Excavation Context	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Other[a]	Total
			Control Units				
CU 119	—	374	—	—	1	—	375
CU 120	—	965	3	5	8	—	981
CU 274	3	582	—	2	—	—	587
CU 353	1	31	—	—	—	—	32
CU 359	2	658	—	1	4	—	665
Subtotal	6	2,610	3	8	13	—	2,640
			Nonburial Features outside FB 1				
Feature 2	—	159	—	—	—	1	160
Feature 11	—	67	—	1	—	—	68
Feature 15	—	72	—	—	1	—	73
Feature 29	—	23	—	—	—	—	23
Feature 30	—	11	—	—	—	—	11
Feature 31	—	25	—	—	—	—	25
Feature 39	—	—	—	—	—	—	—
Feature 40	—	1	—	—	—	—	1
Feature 46	—	29	—	—	—	—	29
Feature 52	—	189	1	2	—	—	192
Feature 53	—	5	—	—	—	—	5
Feature 56	—	5	—	—	—	—	5
Subtotal	—	586	1	3	1	1	592
			Excavation Units (Checkerboard) inside FB 1				
Full analysis	59	15,408	117	126	95	15	15,820
Items only	10	19	3	2	9	11	54
Subtotal	69	15,427	120	128	104	26	15,874
			Nonburial Features inside FB 1				
Feature 4	—	256	3	2	3	1	265
Feature 5	—	31	—	—	—	—	31
Feature 8	—	3	—	—	—	—	3
Feature 13	—	64	—	—	—	—	64

Analytical and Excavation Context	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Other[a]	Total
Feature 14	—	143	—	1	1	1	146
Feature 21	—	131	2	1	—	—	134
Feature 51	—	—	—	—	—	—	—
Feature 6[b]	—	1	—	—	—	—	1
Feature 12[b]	—	—	—	—	—	—	—
Feature 16[b]	—	—	—	—	—	—	—
Feature 18[b]	1	—	—	—	—	—	1
Feature 19[b]	—	—	—	—	—	—	—
Feature 24[b]	—	1	—	—	—	—	1
Feature 25[b]	—	—	—	—	—	—	—
Feature 26[b]	1	4	—	—	2	1	8
Feature 41[b]	—	3	—	—	—	—	3
Feature 42[b]	—	1	—	—	—	—	1
Feature 50[b]	—	7	—	—	—	1	8
Subtotal	2	645	5	4	6	4	666
Subtotal, inside FB 1	71	16,072	125	132	110	30	16,540
Total	77	19,268	129	143	124	31	19,772

[a] Other: chopper and core hammerstone.
[b] Items only.

Table 43. Summary of Ground/Battered Stone Artifacts from Analyzed Contexts at LAN-211

Analytical and Excavation Context	Ground/Battered Stone										Total
	Ground Stone[a]	Mano	Metate	Pestle	Bowl	Fire-Altered Vessel	Comal	Pendant	Bead	Other[b]	
Control Units											
CU 119	—	—	—	—	—	—	—	—	—	—	—
CU 120	—	—	—	—	—	1	—	—	2	—	3
CU 274	—	—	—	—	—	—	—	—	—	—	—
CU 353	—	—	—	—	—	—	—	—	—	—	—
CU 359	—	—	—	—	—	—	—	—	—	—	—
Subtotal	—	—	—	—	—	1	—	—	2	—	3
Nonburial Features outside FB 1											
Feature 2	—	—	—	—	—	—	—	—	—	—	—
Feature 11	—	—	—	—	—	—	—	—	—	—	—
Feature 15	—	—	—	—	—	—	—	—	—	—	—
Feature 29	—	—	—	—	—	—	—	—	—	—	—
Feature 30	—	—	—	—	—	—	—	—	—	—	—
Feature 31	—	—	—	—	—	—	—	—	—	—	—
Feature 39	—	—	—	—	—	—	—	—	—	—	—
Feature 40	—	—	—	1	2	—	—	—	—	—	3
Feature 46	—	—	—	—	—	—	—	—	—	—	—
Feature 52	4	—	—	—	—	13	—	—	—	1	18
Feature 53	1	1	—	—	—	—	—	—	—	1	3
Feature 56	—	—	—	—	—	—	—	—	—	—	—
Subtotal	5	1	—	1	2	13	—	—	—	2	24
Excavation Units (Checkerboard) inside FB 1											
Full analysis of complete collection	163	14	1	6	—	28	2	1	9	24	248
Selected items only	54	1	—	6	—	18	1	—	—	5	85
Subtotal	217	15	1	12	—	46	3	1	9	29	333

Analytical and Excavation Context	Ground/Battered Stone										Total
	Ground Stone[a]	Mano	Metate	Pestle	Bowl	Fire-Altered Vessel	Comal	Pendant	Bead	Other[b]	
	Nonburial Features inside FB 1										
Feature 4	4	—	—	—	—	—	—	—	—	—	4
Feature 5	—	—	—	—	—	—	—	—	—	—	—
Feature 8	—	—	—	—	—	—	—	—	—	—	—
Feature 13	—	—	—	—	—	—	—	—	—	—	—
Feature 14	2	2	—	2	—	3	—	—	—	—	9
Feature 21	—	—	—	—	—	—	—	—	—	—	—
Feature 51	1	—	—	—	—	—	—	—	—	—	1
Feature 6[c]	—	—	—	—	—	—	—	—	—	—	—
Feature 12[c]	—	—	—	—	—	—	—	—	—	—	—
Feature 16[c]	1	1	—	—	—	—	1	—	—	—	3
Feature 18[c]	—	—	—	—	—	—	—	—	—	—	—
Feature 19[c]	2	—	—	—	—	—	—	—	—	—	2
Feature 24[c]	3	—	—	—	—	1	—	—	—	—	4
Feature 25[c]	2	—	—	—	—	1	—	—	—	—	3
Feature 26[c]	3	—	—	—	—	—	—	—	—	—	3
Feature 41[c]	—	—	—	—	—	—	—	—	—	—	—
Feature 42[c]	7	1	—	—	—	—	—	—	—	—	8
Feature 50[c]	4	—	—	—	—	—	—	—	—	1	5
Subtotal	29	4	—	2	—	5	1	—	—	1	42
Subtotal, inside FB 1	246	19	1	14	—	51	4	1	9	30	375
Total	251	20	1	15	2	65	4	1	11	32	402

[a] Including indeterminate ground stone.
[b] Other: netherstone, shaft straightener, anvil, indeterminate vessel, pipe, and other.
[c] Items only.

Table 44. Summary of Unshaped Stone Artifacts from Analyzed Contexts at LAN-211

Analytical and Excavation Context	Unshaped Stone					Total Unshaped
	FAR	Cobble Hammerstone	Tarring Pebble	Manuport	Other[a]	
	Control Units					
CU 119	5	—	2	4	1	12
CU 120	11	1	8	7	1	28
CU 274	2	—	—	2	—	4
CU 353	—	—	—	—	—	—
CU 359	6	—	—	—	—	6
Subtotal	24	1	10	13	2	50
	Nonburial Features outside FB 1					
Feature 2	4	—	—	—	1	5
Feature 11	—	—	—	—	—	—
Feature 15	2	—	—	—	—	2
Feature 29	19	—	—	—	—	19
Feature 30	1	—	—	—	—	1
Feature 31	3	—	—	—	—	3
Feature 39	7	—	—	—	—	7
Feature 40	7	—	—	—	—	7
Feature 46	6	—	1	—	—	7
Feature 52	44	1	—	—	—	45
Feature 53	8	—	—	—	—	8
Feature 56	12	—	2	—	—	14
Subtotal	113	1	3	—	1	118
	Excavation Units (Checkerboard) inside FB 1					
Full analysis of complete collection	370	16	99	307	4	796
Select items only	50	2	1	3	1	57
Subtotal	420	18	100	310	5	853
	Nonburial Features inside FB 1					
Feature 4	9	1	1	—	1	12
Feature 5	8	—	—	—	—	8
Feature 8	—	—	—	—	—	—
Feature 13	10	1	1	3	—	15
Feature 14	4	—	—	—	—	4
Feature 21	3	—	—	4	—	7
Feature 51	—	—	—	—	—	—
Feature 6[b]	3	1	—	—	—	4
Feature 12[b]	3	—	—	—	—	3
Feature 16[b]	5	—	—	—	—	5
Feature 18[b]	—	—	—	—	—	—
Feature 19[b]	4	—	—	—	—	4
Feature 24[b]	—	—	—	—	—	—
Feature 25[b]	1	—	—	—	—	1

Analytical and Excavation Context	Unshaped Stone					Total Unshaped
	FAR	Cobble Hammerstone	Tarring Pebble	Manuport	Other[a]	
Feature 26[b]	9	—	1	—	—	10
Feature 41[b]	—	—	—	—	—	—
Feature 42[b]	—	—	—	—	—	—
Feature 50[b]	1	—	—	—	—	1
Subtotal	60	3	3	7	1	74
Subtotal, inside FB 1	480	21	103	317	6	927
Total	617	23	116	330	9	1,095

[a] Other: ocher, quartz crystal, and other.
[b] Items only.

possible that over time, lithic activities that occurred east of FB 1 shifted westward, centering within FB 1 and the area to the west during the Late/Mission period.

Outside FB 1—Nonburial Features

Several features outside FB 1 were excavated, and lithic artifacts from 12 nonburial features were analyzed. The 12 nonburial features include an artifact concentration, 8 rock clusters, a hearth, a pit, and an activity area. In total, 743 lithic artifacts were recovered from these 12 nonburial features and comprised 3.4 percent of the total analyzed lithic collection recovered from LAN-211 (see Tables 41–44). The collection consisted of flaked stone (80.7 percent), unshaped stone (16.1 percent), and ground and battered stone (3.3 percent) (see Appendixes B.70–B.72). Although flaked stone dominates the collection, the relative frequencies of the three lithic categories show a slightly greater variation than that of other LAN-211 contexts (see Table 41). This variability is largely due to the higher frequencies of FAR and lower frequencies of debitage recovered from features outside FB 1.

Artifact Concentration

Feature 2 is an artifact concentration situated to the east of FB 1 and within a large excavation block. The artifact concentration dated to between the late Intermediate and Late periods and consisted of concentrations of faunal bone and shell, including numerous stacked shells. The lithic-artifact collection includes 165 artifacts constituting 18.5 percent of the total analyzed lithic collection recovered from features outside FB 1 (see Appendixes B.70–B.72). Feature 2 contained a high frequency (97 percent) of flaked stone artifacts, made up mostly of debitage (99.4 percent). A cobble chopper was the only other artifact in the flaked stone category. The unshaped-stone category consisted of 4 pieces of FAR and a fragment of ocher. No ground and battered stone artifacts were recovered (see Appendixes B.70–B.72). Considering the relatively low frequencies of fire-affected lithic artifacts and the absence of evidence for in situ thermal alterations, Feature 2 likely represents subsistence-, hearth-cleanout-, or refuse-deposit-related activities.

Rock Clusters

Eight of the analyzed features outside FB 1 are rock clusters that yielded low to moderate concentrations of cobbles and FAR in addition to faunal bone and shell. Burned faunal bone was recovered from each of the rock clusters; only Feature 52 had evidence of in situ thermal activities. The rock clusters (except Feature 52, perhaps) most likely represent hearth cleanouts. With the exception of Feature 52, located adjacent to the feature block, the rock clusters were located away from FB 1.

The eight rock clusters yielded 462 lithic artifacts comprising more than half (62.9 percent) of the total analyzed lithic collection recovered from features located outside the feature block (see Appendixes B.70–B.72). Approximately 80 percent of the lithic artifacts were flaked stone, followed by unshaped stone (16.6 percent) and ground and battered stone (3.4 percent). Although debitage (79.3 percent) made up the bulk of the collection, rock clusters contained a variety of different types of flaked stone, including a Cottonwood Triangular concave-base projectile point, 2 bifaces, and an edge-modified piece. Compared to other feature types, rock clusters yielded most of the ground and battered stone artifacts, which include fire-altered vessels (61.9 percent), in addition to lower frequencies of ground stone fragments, a mano, an anvil, and an indeterminate vessel fragment. Rock clusters also yielded relatively high frequencies of FAR, as well as the only tarring pebbles and cobble hammerstone identified in features outside FB 1.

Lithic frequencies within the eight features ranged from 7 to 255, and overall, the collection from each rock cluster consisted primarily of debitage. Feature 52 was the only rock cluster with evidence of in situ thermal alterations. Burned materials included faunal bone and charcoal in addition to fire-altered ground stone fragments, vessel fragments, and a cobble hammerstone. Compared to other rock-cluster features, Feature 52 also yielded relatively high frequencies of ground and battered stone artifacts and 44 pieces of FAR, which is the highest frequency recovered from any of the features located outside FB 1. In addition to a concentration of debitage, the Feature 52 flaked stone collection included a Cottonwood Triangular concave-base point and 2 bifaces. Features 52 and 46 dated to the Late and Mission periods, and Features 15, 29, 30, and 39 dated to between the Intermediate and late Intermediate periods. Chronology could not be determined for Feature 53 because of its lack of datable materials.

Hearth

Feature 31 is located approximately 23 m northeast of FB 1, adjacent to the northern edge of a large excavation block. The hearth, dating to between the Late and Mission periods, consisted of a small concentration of FAR in addition to faunal bone, shell, and debitage. There was evidence for in situ thermal activities.

Feature 31 contained two lithic types: debitage (89.3 percent) and FAR (10.7 percent) (see Appendixes B.70–B.72). The low lithic-artifact frequency, totaling 28 lithic artifacts, as well as the relatively low lithic diversity, indicates that lithic-related activities were not likely the primary activities associated with Feature 31—as expected for a hearth used primarily for food preparation.

Pit

Feature 11, a pit adjacent to FB 1, consisted of what appeared to have been a clay-lined roasting pit containing faunal bone, approximately 40 percent of which had been burned, and lithic artifacts. Analysis included a total of 68 lithic artifacts comprising 7.6 percent of the total analyzed lithic collection recovered from features outside FB 1. The collection was composed entirely of flaked stone artifacts and was made up of debitage (98.5 percent) and 1 biface (see Appendix B.70). The pit, dating to the Intermediate period, may have been contemporaneous with one or more of the rock-cluster features.

Activity Area

An activity area was identified approximately 30 m northeast of FB 1 and designated as Feature 40. The feature, dating to between the Late and Mission periods, yielded 11 lithic artifacts: 1 debitage flake, 2 ground stone bowls spaced about 1 m apart, a phallic andesite pestle with use wear on the tapered end only, and 7 pieces of FAR. Faunal remains, including shell and bone fragments, were scattered around the bowls (see Appendix B.71). Based on the collection, it is clear that the feature did not have any associated lithic-maintenance and –production activities; instead, it was associated with food preparation.

Summary of Features outside FB 1

Overall, the analyzed lithic collection from features outside FB 1 was relatively small compared to the collection from the control units and contexts within FB 1 (discussed below). The collection is composed of 12 different lithic types in addition to artifacts in other categories. Flaked stone artifacts accounted for the bulk (80.7 percent) of the collection and represented the greatest artifact diversity. Ground and battered stone artifacts were recovered in low frequencies and consisted of utilitarian items; the unshaped-stone category consisted mostly of FAR.

With a few exceptions, the lithic collections recovered from the five different feature types were relatively similar, considering that they were composed mostly of debitage and lower frequencies of FAR and that ground and battered stone artifacts were largely absent. Considering the relatively low lithic frequencies, low lithic-artifact diversity, overall similarity in lithic collections from the different feature types, and relatively high frequencies of unworked faunal bone and shell, it would appear that lithic artifacts were not likely the focus of activities associated with most of these feature types. The exceptions include the rock-cluster features and activity-area Feature 40, which were largely defined based on lithic artifacts. Rock-cluster features were composed of concentrations of lithic artifacts consisting of relatively high frequencies of FAR and debitage. Feature 52 varied from the other rock features in that it contained ground stone vessel fragments, including fragments that had been altered by fire. In the case of activity-area Feature 40, the activity area was largely defined based on a concentration of ground and battered stone implements, including two bowls and a phallic pestle.

Based on the artifact types (distinct from other features outside FB 1) and the corresponding Late to Mission period date, Feature 40 may have been associated with activities carried out in FB 1 (discussed below). In general, the features located outside FB 1 were dated to between the Intermediate and Mission periods. Of the three features containing ground and battered stone artifacts, activity-area Feature 40 and rock-cluster Feature 52 both dated to the Late/Mission period, whereas chronology was indeterminate for the third feature, rock-cluster Feature 53. Whether this indicates an emphasis on ground-/battered-stone-related activities or a wider range of lithic-related activities during the Late/Mission period cannot be determined from the small sample.

Inside FB 1

Artifacts recovered from several features inside FB 1 were analyzed. In addition, a sampling strategy was implemented for the excavation units within FB 1, which involved analysis of all items recovered from excavation units within FB 1 and analysis of all lithic artifacts recovered from the checkerboard units within FB 1 (please refer to Chapter 1, this volume, for discussion of the FB 1 checkerboard sampling). In total, 782 lithic artifacts were recovered from 18 features within FB 1, 196 items were recovered from the excavation units, and 17,060 lithic artifacts were recovered from excavation units (see Table 41).

Excavation Units: Items and Full Analysis

Excavation units located within FB 1 were selected for analysis. The units, excavated in a checkerboard pattern across the feature block, yielded a total of 17,060 analyzed lithic artifacts (see Table 41). Analysis methods varied between the excavation units and entailed full analysis of the complete collection of lithic artifacts from 102 excavation units and analysis of (only) select lithic artifacts (items) from 244 excavation units. The full analysis collection, totaling 16,864 lithic artifacts, was considerably larger than the itemized collection, which consisted of 196 lithic items. This pronounced variation in frequencies is not indicative of prehistoric behavior; instead, it reflects the sampling strategy, in particular the analysis of only select artifacts in every other excavation unit. Typically, these select artifacts (items) included artifacts that were relatively unusual for the excavation level, easily identifiable in situ, deemed noteworthy by excavators, or a combination of these.

By far, the majority (95.6 percent) of the analyzed lithic artifacts from FB 1 contexts were recovered from excavation units. The excavation-unit lithic collection was, overall, similar to collections recovered from LAN-211 control units as well as excavation-unit contexts at LAN-62. FB 1 excavation units contained mostly flaked stone (93 percent) in addition to lower frequencies of unshaped stone (5 percent) and ground and battered stone (2 percent) artifacts (see Table 41). The itemized excavation-unit subset (select artifacts) varied from this overall distribution; ground and battered stone contributed slightly higher (43.4 percent) frequencies than did unshaped stone (29.1 percent) and flaked stone (27.6 percent). These relative frequencies within the itemized collection likely reflected excavators' in situ selection preferences rather than behavioral patterns.

A variety of tools and artifacts associated with tool-stone manufacturing made up the flaked stone collection from the excavation units in FB 1 (see Table 42). Debitage dominated (97.2 percent) the collection, in a pattern similar to those identified for contexts outside the feature block. The remaining artifacts composing the flaked stone category occurred in relatively low frequencies, each constituting less than 1 percent of the collection. Stone tools included 128 bifaces and 120 projectile points, which included 97 straight- and concave-base Cottonwood Triangular, 18 leaf-shaped triangular, 1 Desert Side-notched, and 4 Marymount points. Additionally, the flaked stone collection included 68 cores, 104 edge-modified pieces, and other categories consisting of choppers and hammerstones.

The ground and battered stone collection from the excavation units inside FB 1 is represented by a combination of utilitarian and decorative artifacts (see Table 43). The utilitarian artifacts are associated with food preparation and the processing of other materials, such as pigments. These artifacts included predominately ground stone fragments (65.2 percent); fire-altered vessels, manos, pestles, *comales*, a metate, a pendent, a bead, and items in the "other" category were recovered in lower frequencies. Collectively, approximately 82 percent of the ground and battered stone artifacts were fire-affected. Considering the proximity to hearths and rock-cluster features within FB 1 (discussed below), these artifacts probably were thermally altered during activities associated with the nearby features. One of the 15 manos is very small and may have been a toy or was used for non-food processing activities. The dorsal surface of another mano retained a small asphaltum stain; it was unclear whether the asphaltum was attributable to a decorative inlay or was residue from processing other materials. One of the 12 pestles exhibited evidence for intentional breakage, a pattern noted in some pestles in LAN-62, Loci A and G, burial features and burial-area contexts.

Decorative ground stone artifacts included 9 chlorite schist stone beads, 1 of which was a tubular bead; the remaining were disks and a sandstone pendant. The pendant, broken at the top of the perforation, retained ocher residue. A variety of different types of ground and battered stone artifacts composed the "other" category, including 21 indeterminate vessel fragments, 3 steatite shaft straighteners, 2 sandstone pipes, a netherstone (i.e., a stone used as a base to grind or work another object), and 2 lithic artifacts of unknown function. One of the shaft straighteners is a recycled edge of a *comal* fragment. Only 1 of the 2 stone pipes was complete; the other, a fragment, had a deeply incised line along its dorsal surface. One of the lithic artifacts of unknown function consisted of a sandstone slab that had been flaked on the distal, or wider, edge and ground on both faces as well as on three edges. The tapered end on the ventral surface had a V-shaped decorative incision across the entire width of the narrow face, with lines radiating outward toward the wider end. Overall, the slab was similar in appearance to slabs used by the Tongva as grave markers. It was recovered from EU 127, adjacent to hearth Feature 12 (discussed below). The other lithic artifact of unknown function, recovered from EU 417, adjacent to hearth Feature 42, was a limestone slab that was flaked and abraded on two edges and had multidirectional scratches on both faces.

The unshaped-stone category included 853 lithic artifacts, nearly half of which were FAR; lower frequencies of manuports (36.3 percent), tarring pebbles (11.7 percent), and cobble hammerstones (2.1 percent) were found (see Table 44). The "other" category included 4 pieces of ocher and a quartz crystal. The manuports primarily included steatite fragments and a few limestone and sandstone fragments. One steatite manuport was a possible vessel fragment. Another manuport, of indeterminate material type, was a cobble with wormholes.

Lithic frequencies in excavation units ranged from 1 to 881. The high lithic frequencies were from EU 391, in the western half of the feature block, and are attributed predominately (93 percent) to debitage. In general, units with high and low frequencies were interspersed throughout FB 1, but there was a propensity for excavation units with high lithic frequencies to be located within the western portion of the feature block. This distribution may be due, in part, to the clustering of features within the western portion of the feature block, which would indicate that lithic-related activities occurred adjacent to features.

Nonburial Features within FB 1

FB 1, defined as a large activity area, was composed of a cluster of features concentrated within the western portion of LAN-211. For the most part, features consisted of rock clusters and hearths, all dating between the Late and Mission periods. Feature analysis entailed full analysis of lithic artifacts from 7 features and analysis only of lithic items from 11 features. Collectively, the 18 features, composed of 4 rock clusters and 14 hearths, yielded 782 lithic artifacts and accounted for 3.6 percent of the LAN-211 analyzed lithic collection (see Appendixes B.70–B.72). Nonburial features within FB 1 yielded slightly higher frequencies than did those located outside the feature block. Flaked stone composed the bulk of the analyzed collection, followed by unshaped stone (9.5 percent) and ground and battered stone (5.4 percent). The following is a discussion of analysis results according to feature type and analytical methods.

Rock Clusters: Full Analysis

Full analysis of lithic artifacts recovered from two rock clusters, Features 5 and 13, was conducted. These two features were approximately 9 m apart, near the southern and eastern portions of FB 1, and both were located adjacent to hearths. In general, the two rock clusters consisted of concentrations of FAR and cobbles along with faunal bone and shell fragments, many of which were burned. In situ thermal alterations were noted in both features. Carbonized botanical seeds were recovered from the feature matrix of Feature 13 and included a European domesticate seed—Old World barley, which indicates that the feature likely dated between the Protohistoric and Mission periods.

In total, 118 lithic artifacts were recovered from the two features and accounted for 7.9 percent of the total analyzed lithic collection from FB 1 features. The collection consisted mostly of debitage (80.5 percent); lower frequencies of FAR (15.3 percent) were collected. No other flaked stone artifacts were recovered. Ground and battered stone artifacts were absent (see Appendix B.71). Most of the lithic artifacts were in the unshaped-stone category, composed of FAR (78.3 percent), manuports (13 percent), cobble hammerstone (4.3 percent), and tarring pebbles (4.3 percent) (see Appendix B.72). With the exception of FAR, which was recovered from both features, the remaining unshaped-stone artifacts were recovered from Feature 13. Overall, Feature 13 yielded higher lithic frequencies as well as greater lithic diversity.

Rock Clusters: Items from Features

Only select lithic items from two rock clusters were analyzed (see Appendixes B.70–B.72). Features 24 and 25 were located adjacent to hearth features within the eastern and southwestern portions of the feature block, respectively. In general, the two features consisted of small clusters of FAR and fire-affected ground stone, and faunal bone was also recovered from Feature 25.

The two features yielded a total of nine lithic items and the overall lithic-artifact diversity was relatively low. A single piece of debitage was collected from Feature 24, and Feature 25 yielded a single unshaped stone, a piece of FAR (see Appendixes B.70–B.72). The ground and battered stone category contained most (55.6 percent) of the lithic artifacts and consisted of ground stone and vessel fragments, all of which were altered by fire. The absence of evidence of in situ thermal alterations within the rock clusters indicates that the ground stone fragments and the piece of FAR were thermally altered prior to their deposition in the feature. The features likely represent hearth-cleanout or discard areas.

Hearths: Full Analysis

All lithic artifacts recovered from the five hearths were analyzed, resulting in identification of 585 artifacts comprising 39.3 percent of the analyzed lithic collection recovered from FB 1 features. The hearths included Features 4, 14, and 51 in the western portion of FB 1; Feature 8 in the southern portion; and Feature 21 in the central portion. All of the hearths were adjacent to rock clusters, hearths, or a combination of the two. In general, the features were small to moderate-sized hearths composed of FAR, fire-affected ground and battered stone, and faunal bone and shell. Features 14 and 21 also yielded carbonized seeds. All of the features exhibited evidence of in situ thermal activities.

Compared to rock clusters, hearth features yielded considerably higher frequencies of lithic artifacts as well as greater lithic-artifact diversity (see Appendixes B.70–B.72). Hearths mostly contained flaked stone (93.7 percent); lower frequencies of unshaped (3.9 percent) and ground and battered (2.4 percent) stone artifacts were recovered. Although most (97.3 percent) of the flaked stone represented toolmaking, processing, and debris, several finished tools were also recovered, including five projectile points and four bifaces in addition to four edge-modified pieces, some of which may have been used as expedient tools. Five projectile points were recovered from two hearths: Features 4 and 21 (see Table 41). Feature 4 yielded three points: one indeterminate-base Cottonwood point, one straight-base Cottonwood Triangular point, and one concave-base Cottonwood Triangular point. Two concave-base Cottonwood Triangular points were recovered from Feature 21.

Ground and battered stone artifacts were recovered from all of the features, with the exceptions of Features 8 and 21. All of the ground and battered stone artifacts were fire-affected. Half of the collection consisted of ground stone fragments in addition to three vessels, two manos, and two pestle fragments. Most (64.2 percent) of the ground and battered stone artifacts were recovered from Feature 14.

Of the three lithic categories, unshaped stone contained the greatest artifact diversity, with five different types of artifacts. The collection primarily included FAR (69.6 percent) and lower frequencies of manuports as well as a single tarring pebble, a cobble hammerstone, and a piece of ocher, the last three composing the "other" category. Unshaped-stone artifacts were not present in Features 8 and 51.

Most of the analyzed lithic artifacts were recovered from Feature 4 (48 percent), and Features 14 (27.2 percent) and 21 (24.1 percent) yielded relatively moderate lithic frequencies. Collections recovered from Features 8 and 51 were relatively small and limited to low frequencies of flaked stone and ground and battered stone artifacts, respectively. Feature 4 had a dense concentration of artifacts, including lithic artifacts. Of note was the collection of formal lithic artifacts, including projectile points and bifaces as well as ground stone. The presence of numerous fire-altered ground stone tools and vessels within a hearth was unusual. The hearth also contained concentrations of unworked faunal shell and bone in addition to a few shell beads and tools. If the feature was in fact domestic in function, the ground and battered stone may have simply been discarded within the fire, perhaps intentionally or inadvertently, providing additional stone fragments used to heat and cook items.

Hearths: Select Items from Features

A total of 70 lithic-artifacts was selected from nine hearths for analysis. These nine hearths were located throughout FB 1; Features 6 and 12 were in the southern portion of the feature block, Features 16 and 18 were in the northeastern portion, Feature 19 was in the center, Features 26 and 41 were in the western portion, and Features 42 and 50 were in the southwestern areas (see Table 41). These hearths were composed of clusters of FAR; low frequencies of lithic artifacts and faunal-shell and -bone fragments occurred.

Frequencies of lithic items recovered from hearths ranged from 1 (Feature 18) to 21 (Feature 26). Feature 21 yielded the highest lithic frequencies and artifact diversity. Although no single lithic category comprised the bulk of the collection recovered from features, unshaped stone occurred in higher frequencies (38.6 percent), followed by flaked stone (31.4 percent) and ground and battered stone (30 percent) (see Appendixes B.70–B.72). Concentrations of FAR (35.7 percent) contributed to the higher frequency within the unshaped-stone category. Other items within the unshaped-stone category included a tarring pebble (Feature 26) and a cobble hammerstone (Feature 6).

The flaked stone category consisted primarily of debitage (72.7 percent) and included low frequencies of cores, edge-modified pieces, and choppers, the latter composing the "other" category. The hearths yielded considerable quantities of fire-affected ground and battered stone, including 17 ground stone fragments and 2 fire-altered manos. A *comal* was recovered from Feature 16, and an anvil was recovered from Feature 50. Both features were situated near other hearths. The *comal*, manufactured from steatite, appeared to have been intentionally broken and exhibited percussion marks on the dorsal surface. The anvil consisted of an andesite waterworn cobble with pitting concentrated in two areas on the dorsal surface. Additional wear was noted on three edges of the dorsal surface and around the perimeter, indicating concurrent use as a pecking stone.

Summary of Features inside FB 1

FB 1 consisted of a large activity area composed of mainly hearth and rock-cluster features and largely attributable to domestic activities. Lithic artifacts recovered from rock clusters and hearths located within the feature block highlighted a range of lithic-related activities, including tool-stone production, food preparation and processing, and heating and warming. Based on the lithic artifacts recovered from the rock clusters and hearths, these features are most likely remnants of thermal activities, hearth cleanouts, discard areas, or a combination of these. In general, features within FB 1 were similar to those in the outlying area, indicating that similar lithic-related activities took place in these two areas, though slightly more concentrated within the feature block. With the exceptions of a few artifacts, most of the lithic artifacts identified in features outside FB 1 were also recovered from features within the activity area. For example, stone bowls were not recovered from within FB 1, whereas cores, *comales*, and manuports were not recovered from outside FB 1 (Table 45). Nearly twice as many ground and battered stone artifacts were recovered from features within FB 1 as from features in the outlying area (see Table 45). This disparity was due, in part, to the recovery of nearly six times as many ground stone fragments from within FB 1 (see Appendix B.71). This has functional connotations, in that ground and battered stone are typically associated with food preparation, and their higher frequencies within FB 1 suggest a focus on subsistence activities inside the feature. Also of note was the lower frequency of unshaped stone inside FB 1, attributable to the nearly twice as many pieces of FAR recovered from features outside the feature block. Overall, relative frequencies of the three lithic categories within the two areas were similar; flaked stone contributed the highest counts, and the ground and battered stone category yielded the lowest frequency, although it contained the greatest variety of lithic-artifact types.

Comparisons of flaked stone collections in FB 1 rock clusters and hearths revealed markedly different lithic types and frequencies. The flaked stone collection was limited to debitage in rock clusters, but a variety of lithic types were deposited in hearths, including formal tools as well as lithic artifacts associated with flaked stone production and processing (see Appendix B.70). This pattern for hearths was similar to distributions identified for rock clusters outside FB 1. In fact, hearths within FB 1 were more similar in overall lithic composition to rock clusters than to hearths in the outlying

Table 45. Comparison of Lithic Artifacts Recovered from Nonburial Features outside and inside FB 1, LAN-211

Artifact Category, by Type	Outside FB 1		Inside FB 1		Total	
	n	Within Context (%)	n	Within Context (%)	n	%
Flaked stone						
Core	—		2	0.3	2	0.1
Debitage	586	79.8	645	82.5	1,231	81.2
Projectile point	1	0.1	5	0.6	6	0.4
Biface	3	0.4	4	0.5	7	0.5
Edge-modified piece	1	0.1	6	0.8	7	0.5
Other	1	0.1	4	0.5	5	0.3
Subtotal	592	80.7	666	85.2	1,258	83.0
Ground/battered stone						
Ground stone[a]	5	0.7	29	3.7	34	2.2
Mano	1	0.1	4	0.5	5	0.3
Pestle	1	0.1	2	0.3	3	0.2
Bowl	2	0.3	—		2	0.1
Vessel	13	1.8	5	0.6	18	1.2
Comal	—		1	0.1	1	0.1
Other	2	0.3	1	0.1	3	0.2
Subtotal	24	3.3	42	5.4	66	4.4
Unshaped stone						
FAR	113	15.4	60	7.7	173	11.4
Cobble hammerstone	1	0.1	3	0.4	4	0.3
Tarring pebble	3	0.4	3	0.4	6	0.4
Manuport	—		7	0.9	7	0.5
Other	1	0.1	1	0.1	2	0.1
Subtotal	118	16.1	74	9.5	192	12.7
Total	734	48.4	782	51.6	1,516	100.0

[a] Including indeterminate ground stone.

area, which may be a factor of the small sample size of hearths located outside FB 1 rather than differences in activities between the two areas.

In general, FB 1 features contained considerably lower lithic frequencies as well as lithic-artifact diversity than did excavation units within the feature block, indicating that lithic-related activities likely occurred adjacent to the features rather than within the features themselves. This lithic distribution and area of focus seems likely, considering that rock clusters and hearths consisted of thermal, hearth-cleanout, and discard areas.

Of note was the deposition of complete lithic tools in FB 1 hearths and rock clusters. None of the incomplete artifacts recovered from features were associated with conjoining pairs, indicating that they were deposited as fragments. The complete artifacts recovered from features, consisting of projectile points, hammerstones, cobble choppers, and an anvil, were presumably still usable. Their presence in the FB 1 features may represent contexts in which tools were no longer needed, inadvertent deposition, or perhaps the need to heat the rocks for tool-stone processing or to heat other substances (e.g., food or water). It is also possible that some of these artifacts may have been deposited as part of nondomestic activities (such as ritual), as was the case for many nonburial and burial features identified in LAN-62, Loci A and G. Whether the focus was on domestic or ritual activities or a combination of the two, FB 1, dating between the Protohistoric and Mission periods, was contemporaneous with the most-intensive use of LAN-62, Loci A and G. Consequently, activities at the two sites were likely associated.

Summary Discussion of Lithic Artifacts from LAN-211

The large collection of 21,269 stone artifacts recovered from LAN-211 provides insight into temporal, spatial, and contextual trends in human behavior as it relates to lithic production, maintenance, and use. The collection is dominated by flaked stone (93 percent); ground stone (2 percent) and unshaped stone (5 percent) occurred in considerably lower frequencies (see Appendix B.73).

The Protohistoric/Mission period deposits in the control units yielded the highest lithic frequencies and densities, and overall, lithic density and frequency increased over time between the Intermediate and Protohistoric/Mission periods. Distributions of artifacts in the control units suggest that lithic activities shifted westward over time and became centered within FB 1 and the western part of the site during the Protohistoric and Mission periods. Lithic production, maintenance, and use were significantly more pronounced during the Protohistoric to Mission period at the site than during the Intermediate and Late periods. For example, 67.1 percent of the lithic-artifact collection was recovered from the Protohistoric to Mission period deposits, compared to 1 percent from Late period deposits and 32 percent from Intermediate period deposits (Table 46). This is reflected in the lithic-artifact-density data from the control units; for example, Protohistoric to Mission period deposits have densities of up to 2,675 lithic artifacts per cubic meter, whereas Intermediate period deposits range between 62 and 488 lithic artifacts per cubic meter.

In addition to the chronostratigraphic associations of lithic artifacts, several time-sensitive stone tools provide insight into temporal association of deposits at LAN-211. The majority of

Table 46. Lithic Artifacts from LAN-211, by Temporal Period

Artifact Category, by Type	Protohistoric to Mission		Late		Intermediate		Total
	n	%	n	%	n	%	
Flaked stone							
Core	3	50.0	—		3	50.0	6
Debitage	1,821	53.4	38	1.1	1,548	45.4	3,407
Projectile point	9	100.0	—		—		9
Biface	10	71.4	—		4	28.6	14
Edge-modified piece	13	68.4	1	5.3	5	26.3	19
Other	1,602	89.5	2	0.1	185	10.3	1,789
Subtotal	3,458	65.9	41	0.8	1,745	33.3	5,244
Ground/battered stone							
Ground stone[a]	53	89.8	2	3.4	4	6.8	59
Mano	5	100.0	—		—		5
Pestle	3	100.0	—		—		3
Bowl	2	100.0	—		—		2
Vessel	19	100.0	—		—		19
Comal	1	100.0	—		—		1
Bead	1	100.0	—		—		1
Other	2	100.0	—		—		2
Subtotal	86	93.5	2	2.2	4	4.3	92
Unshaped stone							
FAR	146	74.9	5	2.6	44	22.6	195
Cobble hammerstone	3	75.0	—		1	25.0	4
Tarring pebble	48	100.0	—		—		48
Manuport	15	83.3	—		3	16.7	18
Other	10	90.9	—		1	9.1	11
Subtotal	222	80.4	5	1.8	49	17.8	276
Total	3,766	67.1	48	0.9	1,798	32.0	5,612

Note: Only contexts with the strongest chronostratigraphic data are included in this table.
[a] Including indeterminate ground stone.

the 129 projectile points recovered were Cottonwood Triangular points (82 percent), including 86 concave-base points, 18 straight-base points, and 2 indeterminate-base Cottonwood Triangular points. The remaining 23 points include 18 Cottonwood Leaf-shaped points, 4 Marymount points, and 1 Desert Side-notched point. Chronologically, the Marymount points are typically associated with the late Intermediate period. By contrast, the Cottonwood Triangular points are generally viewed as dating to after about 700 years ago (Thomas 1981:15). However, Koerper, Schroth, et al. (1996) suggested that Coastal Cottonwood points date to as early as 1350 B.P. (600 A.D.), providing a convenient indicator of the end of the Intermediate period. Desert Side-notched points are associated with Late and Protohistoric period occupations.

Spatially and contextually, FB 1 provides ample data from the midden and the distinct features (hearths and rock clusters) to address human behavior and activities as they relate to lithic artifacts. Confined to stratigraphic layers 10–30 cm thick and used within a span of 400 years or less, FB 1 offers a unique opportunity to examine site use during the Protohistoric to the Mission period. Given the high quantities of faunal and floral remains recovered from FB 1 (see Chapters 12–14, this volume), this composite feature is the remnant of a large and complex food-processing and -consumption area. In exploring the spatial and contextual distributions of lithic artifacts, focus is placed on the distribution of artifacts within and outside FB 1 and the character of the FB 1 lithic-artifact collection.

There is a pronounced spatial and temporal dichotomy between the lithic-artifact collections from within FB 1 and those from outside FB 1 (Tables 47–50). Temporally, FB 1 dates to the Protohistoric to Mission period, whereas the areas outside FB 1 include both Intermediate and Protohistoric to Mission period contexts. As discussed earlier, the Intermediate period deposits and features yielded lower frequencies of lithic artifacts than did later deposits.

Cores were recovered only from inside FB 1, primarily from the FB 1 midden (excavation units) (97 percent). No cores were recovered from the Intermediate period features; the only cores from the Intermediate period were those recovered from the midden area sampled in CUs 274 and 359. Projectile points and bifaces were recovered in higher frequencies from inside FB 1 (primarily from the midden) (95 percent for both artifact types). No projectile points were recovered from Intermediate period feature contexts. Furthermore, the four Marymount points (typically associated with Intermediate period) were recovered from the Protohistoric to Mission period levels of FB 1. Their recovery from later deposits suggests postdepositional displacement or, more likely, reuse of the points by the Protohistoric to Mission period inhabitants of LAN-211. The low frequencies of debitage, edge-modified flakes, and bifaces in Intermediate period deposits and features indicate that lithic manufacture and maintenance were limited at the site during the earlier period.

Ground/battered stone was not recovered from Intermediate period contexts; unshaped stone was recovered in higher relative percentages. FB 1 features (Protohistoric to Mission period) yielded higher frequencies of ground/battered stone than did the FB 1 midden, indicating that these artifacts were more often associated with features. The ratio of ground stone to flaked stone shows an interesting association, with 1 ground stone to 44 flaked stone artifacts in Protohistoric to Mission period contexts inside FB 1 and 1:16 in Protohistoric to Mission period contexts outside FB 1. This distribution indicates that ground stone was used more frequently outside FB 1 during the Protohistoric to Mission period. Behaviorally, this implies that food processing through the use of ground/battered stone occurred away from the main

Table 47. Comparison of Contexts inside and outside FB 1, LAN-211, by Analytical and Excavation Context

Temporal Period	Flaked Stone		Ground/Battered Stone		Unshaped Stone		Total
	n	Within Context (%)	n	Within Context (%)	n	Within Context (%)	
				Features outside FB 1			
Protohistoric to Mission[a]	387	80.1	24	5.0	72	14.9	483
Intermediate[b]	205	81.7	—	0.0	46	18.3	251
				Midden (Excavation Units) inside FB 1			
Protohistoric to Mission[c]	15,874	93.0	333	2.0	853	5.0	17,060
				Features inside FB 1			
Protohistoric to Mission	666	85.2	42	5.4	74	9.5	782
Subtotal, inside FB 1	16,540	92.7	375	2.1	927	5.2	17,842
Total	17,132	92.2	399	2.1	1,045	5.6	18,576

[a] Features 2, 40, 46, 52, and 53.
[b] Features 11, 15, 29, 30, 31, and 39.
[c] Assumed to be Mission period.

Table 48. Comparison of Flaked-Stone-Artifact Distributions inside and outside FB 1, LAN-211, by Analytical and Excavation Context

Temporal Period	Core	Debitage	Projectile Point	Biface	Edge-Modified Piece	Other	Total
			Features outside FB 1				
Protohistoric to Mission[a]	—	388	1	2	—	1	392
Intermediate[b]	—	198	—	1	1	—	200
			Midden (Excavation Units) inside FB 1				
Protohistoric to Mission	69	15,427	120	128	104	26	15,874
			Features inside FB 1				
Protohistoric to Mission	2	645	5	4	6	4	666
Subtotal, inside FB 1	71	16,072	125	132	110	30	16,540
Total	71	16,658	126	135	111	31	17,132

[a] Features 2, 40, 46, 52, and 53.
[b] Features 11, 15, 29, 30, 31, and 39.

Table 49. Comparison of Ground-/Battered-Stone-Artifact Distributions inside and outside FB 1, LAN-211, by Analytical and Excavation Context

Temporal Period	Ground Stone[a]	Mano	Metate	Pestle	Bowl	Fire-Altered Vessel	*Comal*	Pendant	Bead	Other
					Features outside FB 1					
Protohistoric to Mission[b]	5	1	—	1	2	13	—	—	—	2
Intermediate[c]	—	—	—	—	—	—	—	—	—	—
					Midden (Excavation Units) inside FB 1					
Protohistoric to Mission	217	15	1	12	—	46	3	1	9	29
					Features inside FB 1					
Protohistoric to Mission	29	4	—	2	—	5	1	—	—	1
Subtotal, inside FB 1	246	19	1	14	—	51	4	1	9	30
Total	251	20	1	15	2	65	4	1	11	32

[a] Including indeterminate ground stone.
[b] Features 2, 40, 46, 52, and 53.
[c] Features 11, 15, 29, 30, 31, and 39.

Table 50. Comparison of Unshaped-Stone-Artifact Distributions inside and outside FB 1, LAN-211, by Analytical and Excavation Context

Temporal Period	FAR	Cobble Hammerstone	Tarring Pebble	Manuport	Other	Total
			Features outside FB 1			
Protohistoric to Mission[a]	81	1	3	—	1	86
Intermediate[b]	32	—	—	—	—	32
			Midden (Excavation Units) inside FB 1			
Protohistoric to Mission	420	18	100	310	5	853
			Features inside FB 1			
Protohistoric to Mission	60	3	3	7	1	74
Subtotal, inside FB 1	480	21	103	317	6	927
Total	617	23	116	330	9	1,095

[a] Features 2, 40, 46, 52, and 53.
[b] Features 11, 15, 29, 30, 31, and 39.

food-preparation and -consumption area (FB 1). For example, food-processing activities prior to food preparation, such as pounding and grinding of plant materials (seeds, roots, leaves, or shoots) and pulverization of animal meat and bones, occurred outside FB 1, and more-minimal processing was conducted within FB 1 immediately before other stages of food preparation and cooking. This is further supported by the ratio of informal to formal ground stone artifacts, which is higher inside FB 1 (Table 51). In other words, there are more formal than informal ground stone artifacts outside FB 1. The formal ground stone artifacts include manos, metates, pestles, bowls, vessels, and *comales*. The presence of *comal* fragments and corn kernels in FB 1 suggests that a form of tortilla may have been cooked. Both *comales* and corn were introduced during the Mission period (Harrison 1965:163; Hudson and Blackburn 1981:196–197).

Although FAR was recovered in higher frequencies from inside FB 1, the ratio of FAR and non-FAR lithic artifacts is higher outside FB 1 for both Protohistoric to Mission and Intermediate period contexts (see Tables 48–50). In other words, although frequencies of FAR are lower outside FB 1, a greater percentage of the lithic artifacts is fire-affected. This pattern indicates that FAR was discarded outside FB 1 during the Protohistoric to Mission period, perhaps because the FB 1 area was the primary area for habitation. Trash (such as FAR) was intentionally removed from the habitation area.

Other artifact associations that are noteworthy include tarring pebbles and manuports; both were recovered primarily from the FB 1 midden. The tarring pebbles indicate that waterproofing of baskets and/or canteens with asphaltum took place within FB 1. Baskets may have been used as part of fish-collecting or cooking activities. In general, the FB 1 midden had higher frequencies of lithic artifacts than did FB 1 features. The features were the focus of the activity, but by-products from the activity were not included in the feature. For example, debitage from tool maintenance is in lower frequencies in the features than in the midden (note that this contrasts with the LAN-62 nonburial features, which were filled with midden debris). Tool production and maintenance took place away from the features (but within the FB 1 area). Alternatively, because the features were used regularly and there was little disuse during site occupation, they were kept clean of tool-manufacture and -maintenance debris to maximize efficiency of the features. Note, though, that the FB 1 features have high quantities of organic trash (faunal and floral remains), which suggests that cooking by-products and consumption discards were not cleaned out in a similar fashion. Furthermore, none of the incomplete lithic tools recovered from FB 1 features were associated with conjoining pairs, indicating that they were deposited as fragments. The complete artifacts recovered from features, consisting of projectile points, hammerstones, cobble choppers, and an anvil, were presumably still usable. Their presence in the FB 1 features may represent inadvertent deposition or perhaps the need to heat the rocks for tool-stone processing or the heating of other substances (e.g., food and water) (among other explanations).

The FB 1 midden contained a large number of arrow points (n = 120), accounting for 93 percent of all projectile points recovered from the site. If FB 1 was, in fact, a food-processing locale, the arrow points could have been brought to the area embedded in the bodies of hunted animals. Approximately 18.3 percent of the arrow points had been subjected to bend breaks on their distal ends, perhaps as a result of being pried from animal carcasses prior to butchering. In addition, over half of the biface fragments were tips or distal portions, and many exhibited bend or snap breaks.

The 110 edge-modified flakes, 22 choppers, and 132 bifaces from FB 1 could have functioned very well as butchering implements. Replication studies have demonstrated the effectiveness of flakes in cutting the hides of large game animals, as well as for defleshing and dismembering them

Table 51. Ratios of Artifacts inside and outside FB 1, LAN-211

Context	Temporal Period	Ground Stone to Flaked Stone	Ground Stone to Formed Ground Stone[a]	FAR to Non-FAR
Inside FB 1	Protohistoric to Mission	1:44	2.8:1	1:36
Outside FB 1	Protohistoric to Mission	1:16	1:3.4	1:5
Outside FB 1	Intermediate	0:205	0:0	1:7

[a] Includes manos, metates, *comales*, pestles, bowls, and vessels.

(Schick and Toth 1993:162–169). Edge-modified flakes would also have served as excellent tools for shucking shellfish and filleting fish. It would have been imperative to have fresh, sharp tools readily on hand as implements became dull or lost. Cores and hammerstones were present to replenish the supply of flakes. Of the 71 cores, 62 percent were multidirectional, indicating that their purpose was to produce flake tools. The full spectrum of flaked stone production was represented at FB 1, from tabular bifacial cores specially prepared for the production of bifaces to early-stage bifaces, to finished tools. In fact, 43.4 percent of the debitage from FB 1 is the product of biface reduction, suggesting that more than just retouch for tool refurbishing took place at this locale. FB 1 yielded a range of nonlocal material types, such as petrified wood from the Mojave Desert, obsidian from Casa Diablo, fused shale, and Historical period bottle glass. The green-glass projectile point attests to the continuation of traditional technology during the Mission period despite the introduction of new materials.

In summary, four main trends and patterns were identified in the lithic collection from LAN-211. First, there is little evidence for Intermediate period activities at LAN-211. The four Marymount points (indicative of Intermediate period occupation) were recovered from Protohistoric to Mission period deposits and probably either were scavenged/heirloomed or are in secondary contexts. Second, different food-processing activities occurred inside and outside FB 1 during the Protohistoric to Mission period. In particular, there was a spatial segregation of food processing and other stages of food preparation and cooking; initial processing took place primarily outside FB 1, and later stages took place inside FB 1. Third, features within FB 1 were kept relatively clean of lithic debris, indicating that they were in regular use. Was this a conscious effort prompted by lithic-raw-material shortage or a function of maintaining efficient use of these features? The last observation is related to the function of FB 1 at LAN-211. The density of the FB 1 deposit suggests food processing and consumption on a large scale. However, the precise nature of these activities has remained unresolved. Was LAN-211 an intensive habitation locale or an area for short-term feasting associated with mortuary activities at LAN-62? Is FB 1 the product of feasting events or an intensively occupied domestic area? The lithic-artifact data and the distribution of artifacts within and outside FB 1 suggest activities related to intensive habitation activities. The artifacts are primarily related to food processing and preparation and were found in association with high densities of faunal and floral remains in thermal features. Alternatively, certain objects with ritual connotations (such as pipes, quartz crystals, waterworn pebbles, and ocher) were recovered from both the burial area at LAN-62 and FB 1, which may imply that ritual activities occurred at both locales. FB 1 and the burial area at LAN-62 are also the only contexts in the PVAHP that yielded shaft straighteners and stone pendants and high frequencies of shell and glass beads. Objects with ritual connotations were recovered in much lower frequencies from FB 1 than from the burial area at LAN-62. The two sites were contemporaneous; thus, it is very likely that FB 1 occupants had interaction with populations involved in the mortuary activities at LAN-62. However, whether FB 1 at LAN-211 is associated with feasting related to LAN-62 burial and mortuary events cannot be discerned from lithic artifacts alone. Multiple lines of evidence are required to elucidate the function of FB 1 and its relationship to the burial and mourning activities at LAN-62.

Runway Sites

The "Runway sites" include LAN-1932, LAN-2676, and SR-24. They were created from archaeological sites at the base of the bluff and used as fill in the construction of the runway by the Hughes Aircraft Company during the late 1940s and early 1950s. LAN-1932 is located near the western end of the Hughes runway, approximately a mile east of the intersection of Jefferson and Lincoln Boulevards and south of Jefferson Boulevard. Excavations at LAN-1932 revealed a prehistoric deposit that was shallow and redeposited, most likely during the Hughes era, as part of construction of the runway. The prehistoric site material is likely from LAN-211 (see Altschul et al. [2005] for details of prehistoric artifacts recovered). The site also demonstrated considerable mixing of materials and likely derived from multiple sources and numerous episodes of disposal. LAN-2676 is located southeast of the intersection of Lincoln and Jefferson Boulevards. Data recovery at LAN-2676 revealed that the site was not intact but, instead, was redeposited, based in part on the discovery of modern construction material beneath the midden deposit. Although it was recognized that these materials were redeposited and were no longer in situ, limited analyses were undertaken to determine their source. The overall objective was to see what these redeposited materials could inform us about the sites from which they derived.

LAN-1932

LAN-1932 yielded the lowest quantities of lithic artifacts (n = 483) of the sites in the PVAHP (Table 52) and is believed to be redeposited material from LAN-211 that was mechanically moved for runway fill by the Hughes Aircraft Company (Rosenthal and Hintzman 2003:237). Technological analysis was conducted on 483 stone artifacts collected from LAN-1932 and is presented in Appendix B.74. The 483 artifacts were recovered from 20 excavation units and include 479 flaked stones, 3 ground stones, and 1 unshaped stone (Table 53).

Table 52. Summary of Lithic Artifacts from Analyzed Contexts at LAN-1932 and LAN-2676

Site	Flaked Stone	Ground/ Battered Stone	Unshaped Stone	Total
LAN-1932	479	3	1	483
LAN-2676	2,183	13	4	2,200
Total	2,662	16	5	2,683

Table 53. Summary of Lithic Artifacts from LAN-1932 and LAN-2676

Artifact Type	LAN-1932	LAN-2676	Total
Core	5	7	12
Debitage	454	2,106	2,560
Projectile point	3	7	10
Drill	1	1	2
Biface	7	10	17
Edge-modified flake	9	52	61
Indeterminate ground stone	1	—	1
Indeterminate vessel	1	1	2
Mano	—	8	8
Metate	—	3	3
Bead	1	1	2
Cobble hammerstone	—	1	1
Anvil	—	1	1
FAR	1	—	1
Tarring pebble	—	2	2
Total	483	2,200	2,683

LAN-2676

LAN-2676 is redeposited material from LAN-62 that was mechanically moved for runway fill by the Hughes Aircraft Company. Technological analysis was conducted on 2,200 stone artifacts collected from LAN-2676 and is presented in Appendix B.75. The 2,200 artifacts were recovered from 16 excavation units and include 2,183 flaked stones, 13 ground stones, and 4 unshaped stones.

Summary of Lithic Artifacts from the Runway Sites

LAN-1932 may represent redeposited material from LAN-211. The Cottonwood Triangular arrow points recovered from LAN-1932 suggest that the sites are contemporaneous. LAN-2676 is redeposited material from LAN-62. Elko series darts and Cottonwood Triangular arrow points were collected from both LAN-2676 and LAN-62, indicating a Millingstone to Late period assemblage. Significantly, no evidence of Mission period occupants was found, suggesting that this material did not derive from LAN-62, Locus A. Locus B may have been a more likely candidate as no Mission period occupation was found during early investigations by Peck.

Summary of the Lithic Collection

Archaeological sites in the PVAHP yielded a diverse collection of lithic materials and artifact types. Overall, the lithic collection shows both continuity and change in the 7,000-year period of occupation in the Ballona. The flaked stone tool kit was composed primarily of portable hunting and food-processing equipment, including bifaces and projectile points as well as more expedient edge-modified flakes. Milling stones consisted of tools for grinding (i.e., manos and metates) and pounding (i.e., mortars, pestles, and anvils). Unshaped stones included hammerstones and tarring pebbles for waterproofing canteens and baskets. The bulk of the raw materials for all tool types (flaked, ground, and unshaped) was derived from readily accessible alluvial cobbles and pebbles.

In addition to the subsistence-related tool kit, a distinct collection of ritual-related stone artifacts was recovered from the burial area and FB 3 (possible mourning context) at LAN-62. The range of materials and artifact types was slightly greater in mortuary contexts than in domestic contexts. The collection from burial and mourning contexts included objects that were made especially for ritual (i.e., effigies and figurines), but the majority of burial goods were tools that very likely served utilitarian functions (i.e., *comales* and shaft straighteners) before their use as burial or mourning-ceremony offerings.

The by-products of stone-tool manufacturing reflect a complicated process involving various aspects of technological organization. These components include the selection of raw materials, stone-tool production, and tool use, maintenance, discard, and, in some cases, recycling. These artifacts, therefore, provide a unique perspective on how foraging groups coped with the changing conditions of living in coastal settings (Binford 1973, 1977, 1983; Hayden et al. 1996; Nelson 1991; Odell 2004; Torrence 1989). The following discussions address four main patterns in the lithic-artifact data from the PVAHP and their implications: raw-material procurement, lithic technology and tool maintenance and use, site function, and temporal change.

Raw-Material Procurement

The "lithic landscape" included a diversity of materials that were readily available to the inhabitants of the Ballona, either directly or through fluvial transport from the mountains surrounding the Los Angeles Basin. With restricted access to some raw materials, such as Coso obsidian, the residents of the Ballona sought comparable materials that were more locally available, such as fused shale and previously discarded tools. Scavenging was prevalent primarily to acquire materials for both utilitarian (broken ground stone for FAR) and ritual (darts in Late and Mission period interments) purposes.

Local Resources

Cobbles gleaned from alluvial sources were suitable for the production of choppers, cores, potato flakes, manos, pestles, anvils, hammerstones, and FAR. Waterworn pebbles were employed as tarring pebbles, talismans, and cores for bipolar reduction. Waterworn cortex was noted on a large number of tools, cores, and pieces of debitage from all sites in the PVAHP, indicating a reliance on secondary alluvial contexts for tool stone. Materials retaining waterworn cortex include andesite, porphyritic andesite, basalt, vesicular basalt, chalcedony, chert, diabase, diorite, gneiss, granite, limestone, quartz, quartzite, rhyolite, porphyritic rhyolite, sandstone, shale, siltstone, slate, and rhyolitic tuff. All of these materials would have been "locally" available in pebble or cobble form in Ballona and Centinela Creeks. Sandstone, siltstone, shale, chert, chalcedony, limestone, rhyolitic tuff, and vesicular basalt may have been transported from the Transverse Ranges by the Los Angeles River and carried into the Ballona when the river followed the Ballona Creek channel. Basalt, rhyolite, porphyritic rhyolite, granite, gneiss, diorite, and quartz are found in the San Gabriel Mountains to the northeast of the Los Angeles Basin, and clasts of these materials also would have been carried into the Ballona by the Los Angeles River. Finally, quartzite, slate, andesite, porphyritic andesite, and diabase can be found to the southeast of the Los Angeles Basin in the alluvial deposits of the Santa Ana River and its tributaries.

Chert, particularly Monterey chert, dominated the flaked stone collections at nearly all of the sites investigated by the PVAHP. Represented by at least half of the flaked stone at most sites, chert was carried to the Ballona in various forms, including as waterworn pebbles that could be reduced by bipolar percussion and tabular pieces with primary geologic cortex that could be shaped into bifacial cores. These may have been procured from the coastal zones, from the bedded formations of the Santa Monica Mountains about 13.4 km (8.3 miles) north of the Ballona, or from the Palos Verdes Hills 19.3 km (12 miles) to the south. By contrast, quartzite dominated the flaked stone collections at LAN-54 and in CU 534 at LAN-62 (Locus A), which date to the Intermediate and Late periods, respectively; it is unclear why those materials were selected over chert in those two locations.

The nearest asphaltum seep is 10.9 km (6.77 miles) northeast of the PVAHP, at the La Brea Tar Pits. This resource was utilized by residents of the Ballona to repair tools, decorate stone vessels, and waterproof baskets with tarring pebbles covered with asphaltum.

Obsidian and Fused Shale

Until the end of the Late period, the Coso volcanic field was the predominant source of obsidian for southern California groups (Jackson and Ericson 1994:397). Fused shale and Obsidian Butte glass are two high-quality-material alternatives that have been proposed as having replaced Coso obsidian at that time.

Obsidian does not occur locally and was imported over great distances. Four sources of obsidian were used by residents of the Ballona, as indicated by geochemical trace-element analysis (see Appendix B.1). These include the Coso volcanic field, Casa Diablo, and Mount Hicks sources, 228.9–478.2 km (142.2–297.1 miles) to the north, and Obsidian Butte, 277.4 km (172.4 miles) to the south. Additionally, obsidian from Mono Glass Mountain has been recovered from the bluff-top site of LAN-63 (Hull 2005:8.54). Obsidian Butte, located in Imperial County, lies between 40 and 70 m below sea level and was unavailable for exploitation when Lake Cahuilla was present, during parts of the Late and Historical periods; the last three submersions of the source occurred between A.D. 1200 and 1700 (Laylander 1997:64–68; Love and Dahdul 2003; Waters 1983; Wilke 1978:57). Artifacts from Obsidian Butte appear to have been exchanged down the line as complete tools. Obsidian was likely brought to the PVAHP sites in the form of finished tools and scavenged materials. Obsidian debitage consists predominantly of biface-reduction flakes, although one bipolar core from burial Feature 594 at LAN-62 and a few bipolar percussion flakes from LAN-54 and LAN-62 indicate some transport of small nodules.

Fused shale was used by coastal populations of southern California as a more locally available alternative to obsidian. Fused shale is a natural glass produced by spontaneous subsurface combustion metamorphism wherein the high organic content of the shale burns, becomes molten, and recrystallizes rapidly (Bentor and Kastner 1976; Demcak 1981:13–14). Fused-shale sources are limited to Grimes Canyon and Happy Camp Canyon in Ventura County and Lompoc in Santa Barbara County (see Figure 25) (Demcak 1981:26; see also Appendix B.1). Fused shale likely was imported to Playa Vista as finished tools; it is represented by projectile points, bifaces, and biface-reduction flakes. Almost all of the fused-shale debitage represents biface-rejuvenation flakes, and the edge-modified flakes (less than 3 cm in length) found at LAN-211 easily could have been made from broken tools. Only two Stage 3 bifaces of fused shale, from FB 1 at LAN-211, indicate the possibility that preforms of fused shale were brought to the site.

Contrary to expectations, in the PVAHP, artifacts made of obsidian obtained from Butte (in northern California) were used from the Millingstone and Intermediate periods. Subsequently, obsidian tools made from obsidian obtained from the Coso volcanic field, a source area in Central California), dominated until the end of the Late period. As long-distance exchange waned between the coast and inland sources in the eastern Sierra Nevada by the Mission period (Jackson and Ericson 1994:397), Obsidian Butte artifacts began to dominate assemblages in San Diego County (Hughes and True 1985), whereas Late period sites within Orange County have documented an increase in the use of both fused shale (Demcak 1981; Hall 1988) and Obsidian Butte material (Koerper et al. 1986:53).

By contrast, Obsidian Butte does not appear to have reemerged as an important source of material in the Ballona during the Late period. Instead of Obsidian Butte glass, fused shale was imported down the coast to the Ballona during the Late period. Finished tools of fused shale likely were traded along with Chumash artifacts (as suggested by the concurrent increase in steatite artifacts at LAN-62). Gabrielino control of the Santa Catalina Island steatite source probably resulted in strong Chumash trading ties. Chumash-style steatite artifacts deposited in Gabrielino mortuary contexts imply that trading ties not only were economic but also involved political and ceremonial connections.

More-Distant Materials

The acquisition of nonlocal materials implies cultural exchange or group mobility through distant territories. For example, the single jadeite bead recovered from FB 3 at LAN-62 implies trade, because the nearest jadeite source is in San Luis Obispo County (McKee 1962). Steatite was surely imported in finished form from quarries on Santa Catalina Island (Heizer and Treganza 1944:302; Williams and Rosenthal 1993:27), about 65 km (40 miles) across the channel from the Ballona.

Santa Catalina Island was also the potential source of other distinctive lithic materials, including serpentine, chlorite schist, dacite porphyry, gneiss, andesite, basalt, and limestone. The bead from LAN-1932 and the shaft straighteners, bead, and anthropomorphic figurine from the burial area at LAN-62 may have been made of Santa Catalina Island serpentine. Chlorite schist beads may have been produced on Santa Catalina Island, where the only known source is on the western shore of the island (Williams and Rosenthal 1993:30). Alternatively, they may have been manufactured locally; Peck (1947:3) observed that tabular pieces of chlorite schist are commonly found along the beach to the south and north of the PVAHP.

FB 1 at LAN-211 yielded three flakes of petrified wood. The nearest known source of petrified wood is in the Mojave Desert, 100.4 km (62.4 miles) northeast of the Ballona. A small number of European-manufactured-glass flakes were recovered from LAN-62, LAN-211, LAN-2768, and LAN-2676 in addition to a green-bottle-glass projectile point from FB 1 at LAN-211. This small sample demonstrates incorporation of newly introduced materials while maintaining technological continuity during the Mission period.

In summary, procurement of raw materials for lithic-tool production included both local and nonlocal sources. Local sources were alluvial—the San Gabriel and Santa Monica Mountains and the Palos Verdes Hills, all within 100–150 km of the Ballona. These local sources, especially from alluvial contexts, were likely available quite readily (in terms of distance and accessibility). In other words, there would have been minimal ownership issues for Ballona populations to contend with. The more-distant resources, such as obsidian from Obsidian Butte and the Coso volcanic field, fused shale from Grimes and Happy Camp Canyon, and steatite and chlorite schist from Catalina Island, would have entailed exchange or group mobility. Given that tools made from obsidian, fused shale, and steatite were brought into the Ballona primarily as finished tools, logistically planned trade and exchange would have occurred during seasonal movements. The trade and exchange for some of these more-distant raw materials (such as obsidian) were very likely very complex and could have involved several episodes of exchange over the great distances between the sources and the Ballona.

Lithic Technology and Tool Maintenance and Use

The term *reduction trajectory* refers to the stage-like sequence of stone-tool manufacturing, beginning with the preparation of the core and ending with the completion of a finished retouched tool (see Bradley 1975; Collins 1975; Inizan et al. 1999; Van Peer 1992). Flint knappers produced a variety of by-products during the stone-tool-manufacturing process that provide clues to the specific techniques used to produce stone tools (Andrefsky 2001; Shott 1994; Whittaker 1994).

In addition, the finished lithic tools often underwent a series of transformations during their use lives that was typically based on how the tools were intended to be used, in addition to multiple uses or evolving uses. Prehistoric toolmakers modified tools to serve particular tasks in a certain context and then later modified them again for other tasks. An array of techniques is evident in the lithic technology of the Ballona, attesting to the variety of raw materials and various activities conducted at the sites. The following discussion will highlight these through patterns observed in flaked-stone-tool and ground-stone-tool production, maintenance, and reuse.

Flaked-Stone-Tool Production

Dependence on alluvial and bedrock sources for the procurement of lithic raw materials limited tool size as well as reduction strategies. Therefore, several different tactics were used to reduce these materials, and most of the tactics were designed to produce core flakes. Because an acute (less-than-90°-angle) platform is necessary to strike off a controlled flake from a parent piece, rounded clasts from alluvial deposits posed a challenge for knappers. The most common technique for reducing cobbles involved creating a fresh platform by breaking the cobble. This controlled technique is illustrated by the split cobbles recovered from LAN-62. Oval, waterworn cobbles were halved and then quartered, or simply quartered, resulting in wedge-shaped pieces with cortex on the dorsal face (Figure 55).

Basalt, limestone, siltstone, and granite cobbles were reduced in this manner. One specimen that had been split in half exhibited etching 0.5 mm deep around its circumference, just 2.5 mm from the broken edge, indicating that cobbles were first scored in order to direct the force of a blow. Splitting might have been accomplished through indirect percussion, wherein a punch was set on the scored line for more precise placement of the angle and direction of the strike. Flake blanks obtained from these cobbles could be used to produce a variety of retouched tools or simply used without any further modification. For example, "potato flakes" made of andesite, quartzite, and rhyolite were recovered from LAN-193, LAN-62, and LAN-211. These flakes exhibit cortex on their platforms and lateral edges and therefore create a naturally backed tool that is easy to hold in the hand.

Various reduction tactics were used to increase core use life prior to discard. That is, unidirectional cores were primarily still usable, bidirectional cores exhibit an equal mix of usable and exhausted items, and multidirectional cores primarily were exhausted when discarded. Overall, there are four times as many multidirectional cores as either unidirectional or bidirectional cores at the PVAHP sites. That is, most of the cores were probably exhausted when discarded. In addition, cores at LAN-62 were also recycled into hammerstones. This level of reduction intensity and reuse is presumably a by-product of the intensity, duration, and continuity of site occupations.

A bipolar technique was used for the reduction of pebbles. Bipolar-reduction flakes were found, albeit in low numbers, at all of the sites in the PVAHP. Additionally, bipolar cores were recovered from LAN-62, LAN-211, and LAN-193. Chert was the predominant material reduced in this manner. Chalcedony, quartz, quartzite, rhyolite, basalt, and obsidian were also flaked using the bipolar technique. A bipolar-reduction tactic is efficient at reducing smaller pebbles but is a relatively uncontrolled technique, compared to working platform cores. That is, larger and more standardized flake blanks can be produced from platform cores, whereas smaller and less standardized flake blanks are produced from bipolar cores. Nonetheless, both sets of blanks could be used to manufacture tools, given the size restraints. For example, both longer and thinner flakes and shorter and thicker flakes could be used for the production of different types of projectile points.

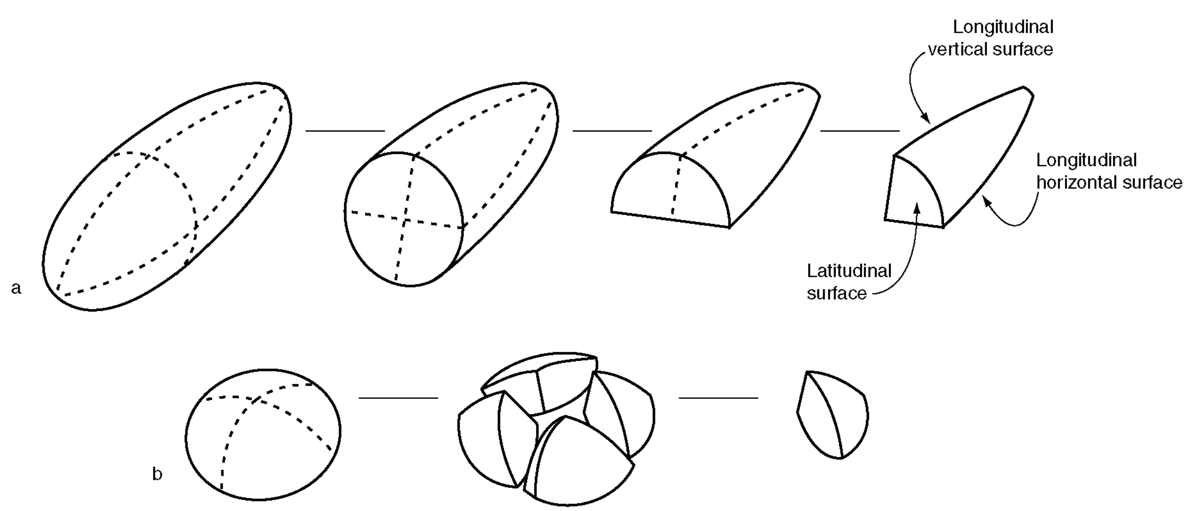


Figure 55. Split-cobble reduction sequence.

Primary sources of bedrock materials, likely from the nearby Santa Monica Mountains or Palos Verdes Hills, were also exploited for tool stone. The use of tabular chert required little to no thinning for the production of bifaces. Stage 2–5 chert bifaces recovered from FB 1 at LAN-211 and mortuary contexts at LAN-62 retained primary geologic cortex on both faces. Bifacial cores of chert, chalcedony, andesite, basalt, quartzite, and rhyolite were also recovered from these contexts. Tabular raw materials are most easily reduced using a bifacial technique. That is, the tabular pieces are too thin and therefore require that flakes be removed from opposing surfaces. Although the core may initially be used for flake production, it can also evolve into a biface that can be used for various purposes. Bifaces can be made from large flake blanks rather than biface blanks. This traditional tactic is represented for all periods at the PVAHP sites, whereas bifacial cores and tools made of tabular materials were most often recovered from Late to Historical period contexts.

Blade production was evidenced by a limited number of small quartzite, chert, chalcedony, obsidian, and basalt blades recovered from all of the sites in the PVAHP and a single basalt microblade core from burial Feature 426 at LAN-62. Blades were generally produced from standardized platform cores with ridges along the flaking surface. Blades could have been used as blanks for the production of microdrills, but it seems more likely that they were primarily used for other tools. Microdrills were recovered from LAN-47, LAN-61, and LAN-63, located along the edge of the lagoon (LAN-47) and on the bluff tops (LAN-61 and LAN-63), but none was recovered from the sites in the PVAHP. Indeed, the collection at LAN-61 was characterized by a microlithic technology that included microcores, bladelets, and microdrills.

Overall, the full spectrum of flaked-stone-tool production, from initial core reduction to primary shaping and final thinning of bifacial tools (Stages 2–5), occurred in the Ballona. Core-reduction flakes outnumbered biface-reduction flakes at all sites in the PVAHP, although at LAN-211, they were nearly equal in number, indicating that tool finishing and maintenance were significant on-site activities. LAN-62, LAN-211, LAN-2768, and LAN-193 yielded bulb-removal flakes indicative of initial thinning for biface manufacture. Percussion flaking dominated the entire collection from PVAHP sites, although pressure flakes were also recovered.

Overshot flakes, margin-removal flakes, and biface fragments with perverse fractures indicate that manufacturing errors occurred on-site at LAN-62, LAN-211, and LAN-193. Notching flakes from the final stage of production were identified, indicating that notched projectile points were manufactured at LAN-62, LAN-2768, and LAN-193, although notched projectile points, themselves, were recovered only from LAN-62. Notches would have facilitated attachment of arrow points to shafts with sinew. More commonly, points with tangs and convex or concave bases exhibited asphaltum as evidence of hafting. Asphaltum was noted on bifaces, arrow points, and dart points from LAN-62, LAN-211, and LAN-193, offering a rare glimpse of the materials used (Figure 56).

Ground-Stone-Tool Manufacture, Maintenance, and Reuse

Manos and metates were generally selected from locally available materials and used with little modification; use surfaces were prepared by pecking and later reworked when worn smooth. Angular hammerstones or recycled cores could have been used for this purpose. Otherwise, manos and metates reflect generalized seed-processing activities but nonetheless intensive use; manos commonly exhibited multiple grinding surfaces. Ground stone artifacts were commonly recycled as FAR. That is, exhausted items were reused as cooking stones. This pattern is similar to the reduction pattern represented by the cores. Both of these patterns of intensive artifact use and recycling are presumably due to the intensity, duration, and continuity of site occupations (Figure 57).

On-site ground stone manufacturing was evidenced by a granite bowl blank from Feature 690 at LAN-62, Locus G (Figure 58). The body appeared to have been roughed out of a natural boulder, with minimal pecking on the bottom to create a stable base. The interior had been minimally hollowed out, extending approximately one-third of the way into the vessel body. Waterworn cobbles of suitable size could have been made into tools with minimal shaping by pecking and grinding, which would leave no direct archaeological evidence. It is also quite likely that tools were traded in finished form, such as steatite vessels from Santa Catalina Island. Asphaltum was used as an adhesive to reconjoin broken pestles and bowl edges, as well as to attach shell inlays to bowl rims.

Site Function

The PVAHP sites represent reoccupied locales (i.e., palimpsests) that, over time, can exhibit complicated occupational histories with distinct and overlapping occupational episodes of varying intensity and duration (Bailey 2007; Schlanger 1992). In this case, the unique qualities of the local estuarine setting provided the attraction for the prehistoric occupants of the sites.

There is considerable variation in lithic-artifact densities between sites, in terms of both space and time (Table 54). For example, Millingstone period deposits at LAN-62 and LAN-193 have higher densities of lithic artifacts than at other sites. The Intermediate period deposits at LAN-193 have higher densities of lithic artifacts than other Intermediate period deposits. Late period deposits at LAN-62 have higher densities than those at LAN-211. On the other hand, the long-term pattern of occupational intensity appears to have varied. That is, Millingstone period deposits generally exhibited lower artifact density across the project area, with localized concentrations. This pattern may reflect the episodic and seasonal use of this estuarine setting during this early period. Alternatively, this pattern may suggest that the

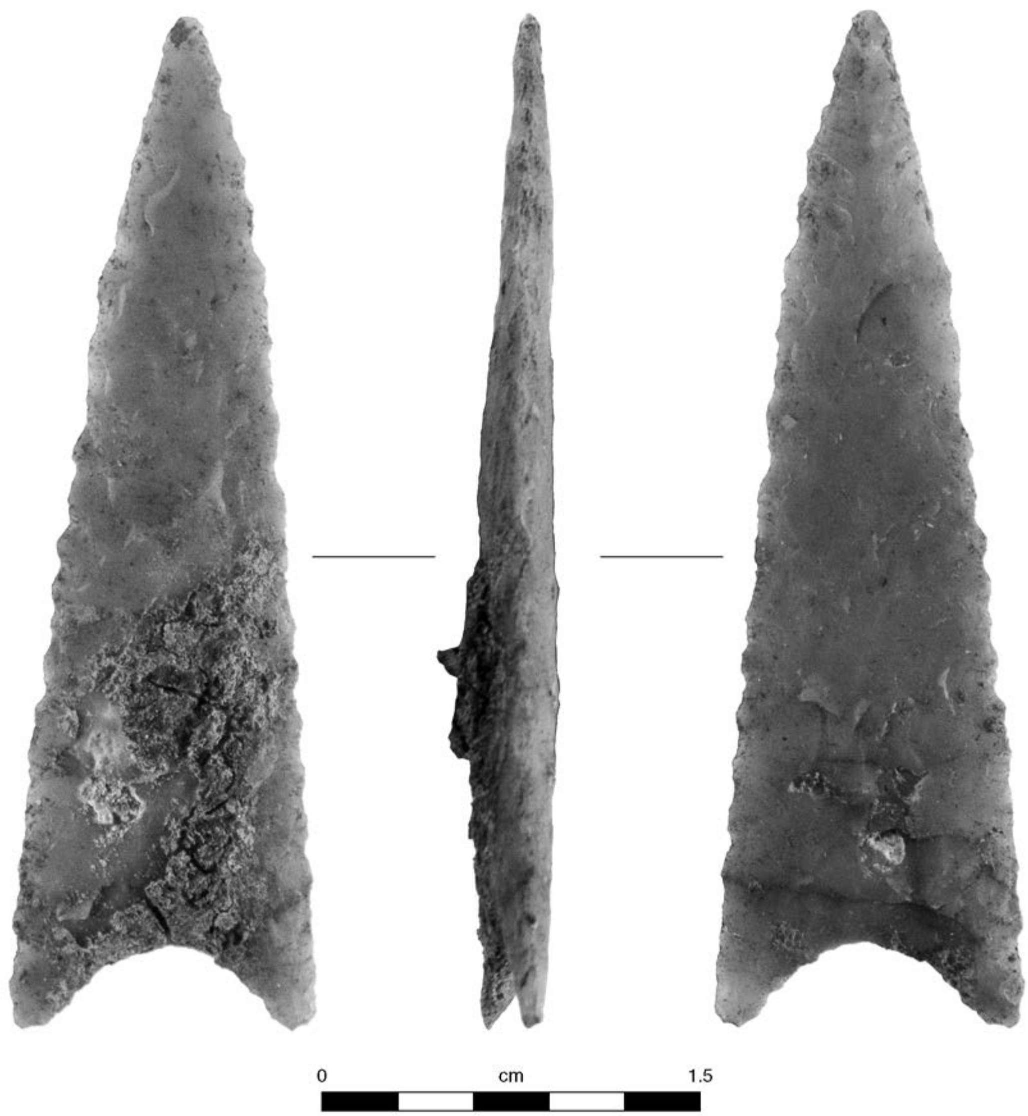


Figure 56. Elongated, concave-base Cottonwood Triangular arrow point with preserved wood adhered to the base, LAN-62, burial Feature 587.

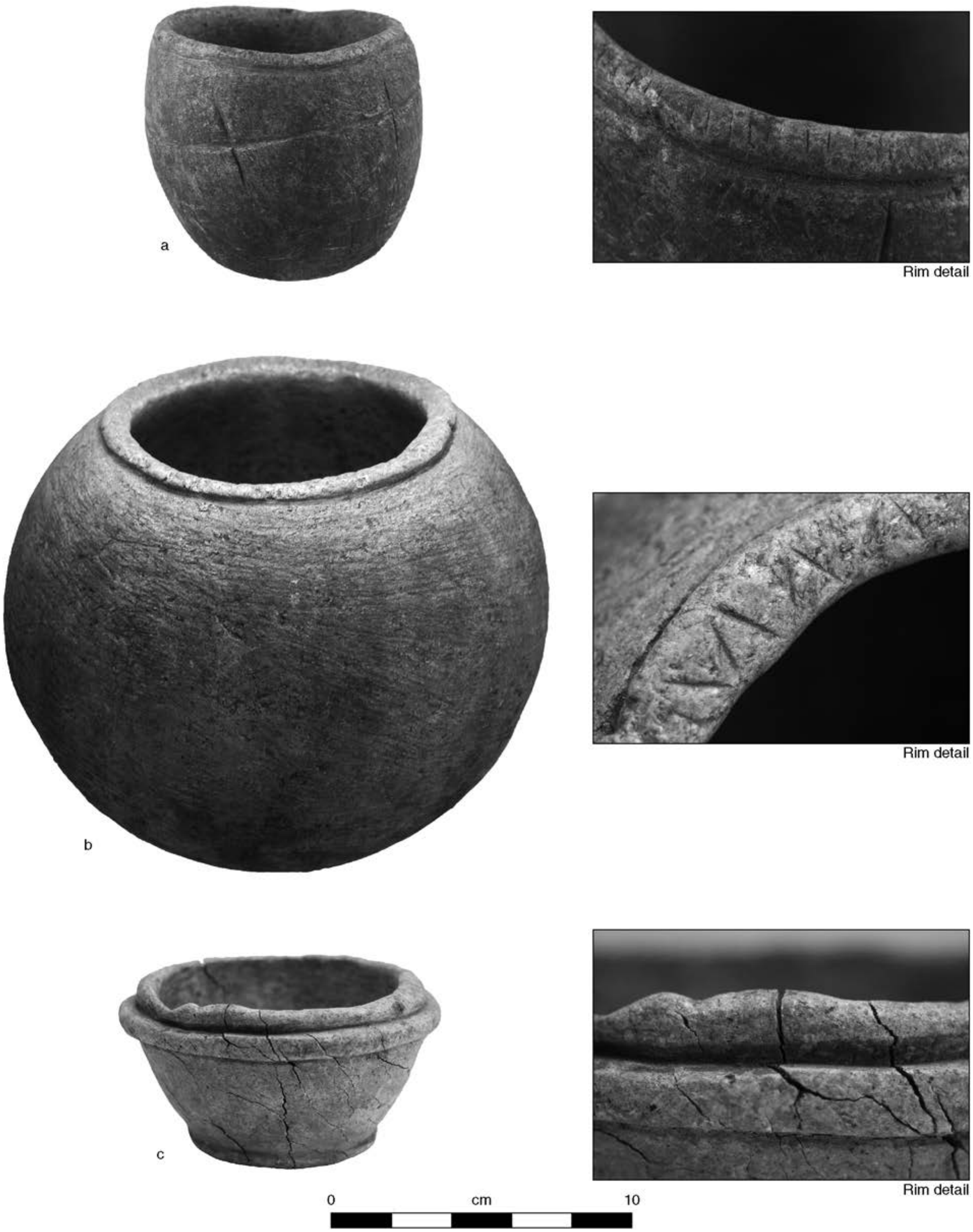


Figure 57. Bowl forms at LAN-62: (*a*) burial Feature 217, (*b*) burial Feature 370, (*c*) burial Feature 565.

Figure 58. Unfinished granite bowl blank from Feature 690 at LAN-62, Locus G.

Table 54. Lithic-Artifact Densities, by Site and Temporal Period, PVAHP

Temporal Period	Flaked Stone (n/m³)	Ground Stone (n/m³)	Unshaped Stone (n/m³)	Total (n/m³)
		LAN-54		
Early Intermediate	23.2	0.2	27.6	51
Late Millingstone	29	2	63.1	94
		LAN-193		
Intermediate	905.7	1.4	2.9	910
Early Intermediate	355.7	1.4	9.5	527
Late Millingstone	203.6	—	1.2	339
		LAN-2768		
Late Intermediate	15.6	1.5	241.4	259
Intermediate	110	4	309	423
Early Intermediate	296.1	1.5	66.3	364
Intermediate/ Millingstone	65.6	—	0.6	66
		LAN-62		
Protohistoric to Mission	223.8	18.9	39.9	282.6
Late	466.7	0.0	6.7	473.3
Intermediate	420.3	6.5	23.7	450.5
Millingstone	464.4	7.1	20.0	491.5
		LAN-211		
Protohistoric to Mission	642	27	65	335
Late	390	50	—	10
Intermediate	201	1	13	28

Millingstone period was not marked by an extensive use of ground stone across the board, except in particular situations, such as acorn- or seed-processing locales, as part of a seasonal round. By contrast, early to middle Intermediate period deposits generally have higher artifact densities across the project area and therefore reflect a more intense and long-term occupation. This changed during the late Intermediate and Late periods, when artifact density and occupational intensity declined, but was subsequently followed by a more intense occupation during the Mission period (part of the Historical period). These long-term changes reflect variations in occupational intensity, duration, and continuity as well as group size, group structure, and site function. The nature of past land use was dynamic, and the way that this estuarine setting was integrated into the annual cycle changed in response to a variety of natural and cultural factors.

One of the intriguing trends noted during the lithic analysis involves long-term changes in ground-stone-tool use. Millingstone period deposits typically have very low densities of ground stone, there is a general trend for a gradual increase in ground stone densities during the Intermediate period, and the highest densities occurred in the Late and Mission period deposits. This pattern presumably reflects a general increase in the importance of seed processing and possibly greater diet breadth, given similar levels of occupational intensity during the latter periods, but it contradicts the models of ground stone use proposed by many scholars (e.g., Basgall 1987; Fitzgerald and Jones 1999; Jones 2008; Wallace 1955; Warren 1967). These scholars have defined the Millingstone as a culture marked by extensive use of ground stone (milling stones). The ground stone data from the PVAHP Millingstone period deposits do not support this, and future research into

PVAHP lithic densities should explore the implications. In the following discussion, two main realms of artifact function are presented: (1) lithic artifacts and feature function and (2) the role of lithic artifacts in ritual contexts.

Lithic Artifacts and Feature Function

Association of lithic artifacts with particular feature types in varying frequencies at the PVAHP sites provides insight into feature function and, ultimately, site function. In the discussion of lithic artifacts and features, burials and nonburial features are addressed separately.

The lithic artifacts from 66 nonburial features from the five sites were analyzed (Table 55). The nonburial features included activity areas, artifact concentrations, hearths, pits, rock clusters, a structure, and a thermal feature, of which artifact concentrations (n = 28) and rock clusters (n = 24) were most common. Although the features with the highest densities are pits and rock clusters, there is no correlation between feature type and density (see Table 55). Similarly, there is no apparent correlation among density, feature type, and cultural period. For example, the four highest densities are in an early Intermediate period rock cluster from LAN-2768; a Protohistoric to Mission period pit from LAN-62, FB 3; an early Intermediate period hearth from LAN-2768; and early Intermediate period pits at LAN-2768. The four lowest densities are from an early Intermediate period activity area at LAN-193, rock clusters at LAN-193, artifact concentrations at LAN-54, and Protohistoric to Mission period pits in the burial area at LAN-62. There is no indication that certain types of lithic-related activities occurred during certain periods or contexts (feature types). The lower densities in particular features (or feature types) than in others need not necessarily indicate lack or lower intensity of lithic production/maintenance/discard, although it would appear that pits and rock clusters were often discard locations for lithic debris. Both contexts reflect the disposal of domestic refuse and presumably are indications of site maintenance. The maintenance of domestic space becomes important when sites are occupied for longer periods. The debris associated with normal household activities is commonly discarded in refuse areas (i.e., middens), abandoned features, or localized areas peripheral to a habitation area. In addition, a variety of other activities might also occur in these peripheral areas (Binford 1983:189, 1987; see also Clark 1991).

The Mission period occupation of FB 1 at LAN-211 provides a very good example of site structure and the use of space. Studies indicate distinctions between activities conducted within and outside FB 1. It appears that food-preparation activities occurred outside FB 1 and food-consumption activities occurred within FB 1. This is reflected in the presence of a variety of tools, including manos and metates, in conjunction with the by-products of tool-production/-maintenance activities found along the periphery of the habitation area. In addition, FAR was also discarded in these peripheral areas. By contrast, more informal tools and a general lack of tool maintenance were represented within the area of domestic space.

Distribution of lithic artifacts in burials was discussed earlier in this chapter, and two main patterns are highlighted again here. There is considerable variation in the distribution of lithic artifacts among the 301 burials that had lithic artifacts associated with them. Most of the burial features contained fewer than six lithic items each. The burials with higher lithic frequencies tended to have concentrations of flakes, FAR, or both. Whether these are grave items or midden constituents incorporated at the time of interment is unclear. Burial features with lithic artifacts are clustered in the southern, central, and western portions of the main burial area. For example, burial features containing more than 15 analyzed lithic artifacts are located in the southern and central areas of the main burial area, and those with 15 or fewer lithic artifacts are widely distributed across the burial area. In addition, there was some spatial clustering of certain artifacts; for example, although pipes were noted throughout the burial area, two concentrations occurred within the southwestern and northern portions. Whether these distributions reflect use of the burial area, particularly following the Late period; cultural traditions (status or ethnicity); or temporal markers needs to be resolved by incorporating other data (faunal, floral, and stratigraphic).

The Role of Lithic Artifacts in Ritual Contexts

Our understanding of Native American ritual practices during the Mission period has been greatly facilitated by the discovery of the burial area and FB 3 (a mourning-ceremony area) at LAN-62 and FB 1 (a dense concentration of cultural materials and a possible feasting area) at LAN-211. There are some noteworthy trends that cross-cut cultural periods. For example, a collection of ground stone representing what appears to have been a seasonal late Millingstone period occupation at LAN-54 is similar in kind (but not in scale or treatment) to the cluster of ground stone recovered from an early Intermediate period midden (FB 9), which appears to have been reused as FAR at LAN-193, and to the intentionally broken ground stone objects offered in Protohistoric and Mission period burials at LAN-62. This pattern presumably reflects an increase in occupational intensity during the Intermediate period. However, there were several observations regarding objects unique to specific contexts that are presented as foundations for a ritual assemblage for the Ballona. Charm stones, plummets, pipes, stone bowls, perforated steatite disks, steatite tablets, figurines, and effigies only appeared in the burial area at LAN-62. Additionally, clamshell effigies were exclusive to the mourning-ceremony enclosure

Table 55. Lithic Artifacts, by Site, PVAHP

Site	Feature Type	Features (n)	Temporal Period	Flaked Stone (n)	Ground/Battered Stone (n)	Unshaped Stone (n)	Total (n)	Density (n/m³)
LAN-54	artifact concentrations	6	early Intermediate	80	1	35	116	26.2
LAN-54	rock clusters	3	early Intermediate	67	5	312	384	600.0
LAN-54	pit	1	late Millingstone	31	—	36	67	223.3
LAN-193	activity area	1	early Intermediate	233	4	23	260	9.66
LAN-193	rock clusters	5	early Intermediate	45	9	18	72	11.28
LAN-2768	artifact concentrations	6	early Intermediate	38	9	166	213	49.0
LAN-2768	hearth	1	early Intermediate	9	7	146	162	810.0
LAN-2768	rock clusters	4	early Intermediate	63	—	38	101	3,033.3
LAN-2768	structure	1	early Intermediate	105	—	142	247	247.0
LAN-2768	pits	2	early Intermediate	2	—	47	49	816.7
LAN-62	artifact concentrations (burial area)	9	Protohistoric to Mission	141	69	90	300	596.4
LAN-62	pit (burial area)	1	Protohistoric to Mission	5	—	—	5	50.0
LAN-62	rock cluster (burial area)	1	Protohistoric to Mission	101	2	9	112	280.0
LAN-62	artifact concentrations (FB 3)	5	Protohistoric to Mission	533	7	25	565	60.9
LAN-62	rock clusters (FB 3)	3	Protohistoric to Mission	62	14	50	126	594.3
LAN-62	thermal feature (FB 3)	1	Protohistoric to Mission	6	—	—	6	600.0
LAN-62	pit (FB 3)	2	Protohistoric to Mission	106	—	1	107	2,229.2
LAN-62	artifact concentrations (FB 4)	2	Intermediate	6	—	—	6	176.5
LAN-62	rock cluster (FB 4)	4	Intermediate	140	4	50	194	428.3
LAN-62	activity areas (FB 4)	2	Intermediate	3	—	2	5	357.1
LAN-62	pits (FB 4)	2	Intermediate	7	—	2	9	29.0
LAN-62	rock clusters (FB 7)	4	Millingstone	35	—	15	50	877.2

(FB 3) and the burial area. FB 1 at LAN-211 and the burial area at LAN-62 are the only contexts in the PVAHP that yielded shaft straighteners and stone pendants. Note that Hull (2005:8.26) reported Millingstone period caches at LAN-63 (on the Westchester Bluffs, to the south of the Ballona) that included discoidals, cog stones, pelican stones, and large effigy pestles. These caches at LAN-63 represent an Intermediate period ritual assemblage that differs dramatically from the Mission period assemblage at LAN-62.

Determining whether an artifact has ceremonial or ritual function is a challenge. Traditionally, artifacts are classified by form, which is used to derive function, leaving only objects with no other obvious utility to be designated as ceremonial. In actuality, artifacts have complex use lives and multiple functions, and there are often very subtle differences between ritual and utilitarian assemblages (Brady and Peterson 2008). In the PVAHP, a ritual "assemblage" is defined primarily by context—for example, the association of artifacts with burials at LAN-62. However, many of the lithic artifacts (bifaces, milling stones, and tarring pebbles) deposited in mortuary contexts are also in utilitarian contexts and thus illustrate the substantial overlap between objects functioning in the utilitarian and ritual realms. The difficulty lies in identifying "ritual use" in multicomponent contexts. For example, Feature 478, a rock cluster at LAN-62, appears to represent a hearth cleanout with its FAR and burned faunal remains, but closer examination suggested that some components of this collection may have been deposited as offerings. Included in Feature 478 is an unburned pestle over 46 cm in length and made of steatite, a material unsuitable for heavy pounding. Striations from manufacture were still present on both the distal and proximal ends, indicating that it had not been used. Therefore, this pestle likely served a symbolic rather than a utilitarian purpose, one similar to that of the numerous large, unused pestles found in Intermediate period mourning features on the bluff tops. A tight cluster of 12 tarring pebbles, perhaps once contained in a bag, was discovered 20 cm away from the pestle. The tarring pebbles, covered with asphaltum, may have been used for waterproofing baskets or canteens before final deposition in this context. Similar to tarring pebbles in terms of context, waterworn pebbles, particularly elongate, flat, black stones and ovate, white pebbles (Figure 59), were included in 29 burial features at LAN-62, suggesting a possible ritual role. Though not exclusively found in ritual contexts, these unmodified pebbles may be ritual paraphernalia.

Can artifacts used solely for ritual purposes be identified in the PVAHP? There are six types of ground stone artifacts that only appeared in the burial area at LAN-62. These include charm stones, plummets, perforated steatite disks, steatite tablets, figurines, and effigies. Additionally, concretions that resemble clamshells in their white, chalky appearance and natural rings were recovered from the mourning-ceremony area and from the burial area. A calcareous siltstone concretion ground to mimic a clamshell was recovered from EU 175 in the burial area. EU 431, in the burial area, yielded an unmodified, ovate limestone concretion that also resembles a clamshell, and FB 3, the mourning-ceremony complex, contained a flaked-limestone-concretion shell effigy (see Figure 54).

Another indication that particular artifacts may not have been utilitarian is the ritual "killing" of objects that has been documented via conjoining fragments. For example, five fragments of a completely reconstructible "flowerpot" mortar (Figure 60) were recovered from burial Feature 9 and from adjacent EUs 144 and 155 in the burial area at LAN-62. Ocher was noted on the vessel interior as well as on the fractured edges, indicating that it was sprinkled over the mortar after it was broken. Other interments, such as burial Feature 38 (described previously), included intentionally broken objects (see Figures 37–39).

Temporal Changes

Stone tools are sensitive to changes in foraging strategies and, therefore, have often been used as chronological markers. The stone tools recovered from the PVAHP sites provide such insight into both continuity and change in stone-tool use. The PVAHP tool kit reveals that there was considerable continuity in technology and tool use over time that was interrupted by punctuated changes. Throughout the Millingstone period, there was continuity in stone-tool technology and use. The first major change did not appear until the early Intermediate period, with the transition from atlatl darts to bow-and-arrow technology. The first appearance of the arrow point is significant, because the timing of this event continues to be debated. The commonly accepted date for the widespread use of arrows is A.D. 500 (Justice 2002:55). Similarly, Van Horn (1990:33) indicated that Marymount arrow points, presumably the earliest arrow points in the Ballona, were primarily used in the Ballona during the late Intermediate period. Evidence from the PVAHP, though, suggests that the shift to arrows came between 200 and 1,500 years earlier. The next innovation did not occur until the Mission period, with the introduction of steatite *comales*. Interestingly, the introduction of metal tools during the Mission period did not appear to result in a decrease in stone tools. For example, projectile points and other stone tools were abundant in Mission period contexts, both in the burial ground and at LAN-211. The continuity of tradition in stone-tool production and use, punctuated with a few major developments, is explored in the following discussions of projectile points and *comales*.

Diagnostic Projectile Points

In total, 282 projectile points were recovered from the analyzed contexts at four sites in the PVAHP (Table 56). No points were recovered from the analyzed contexts at LAN-54. Only 9 dart points were recovered, all associated with pre-2000 B.P. cultures, and all of them were from LAN-62. Furthermore, 4 of them were recovered from four Mission

Figure 59. Waterworn pebbles from burial Feature 227 at LAN-62.

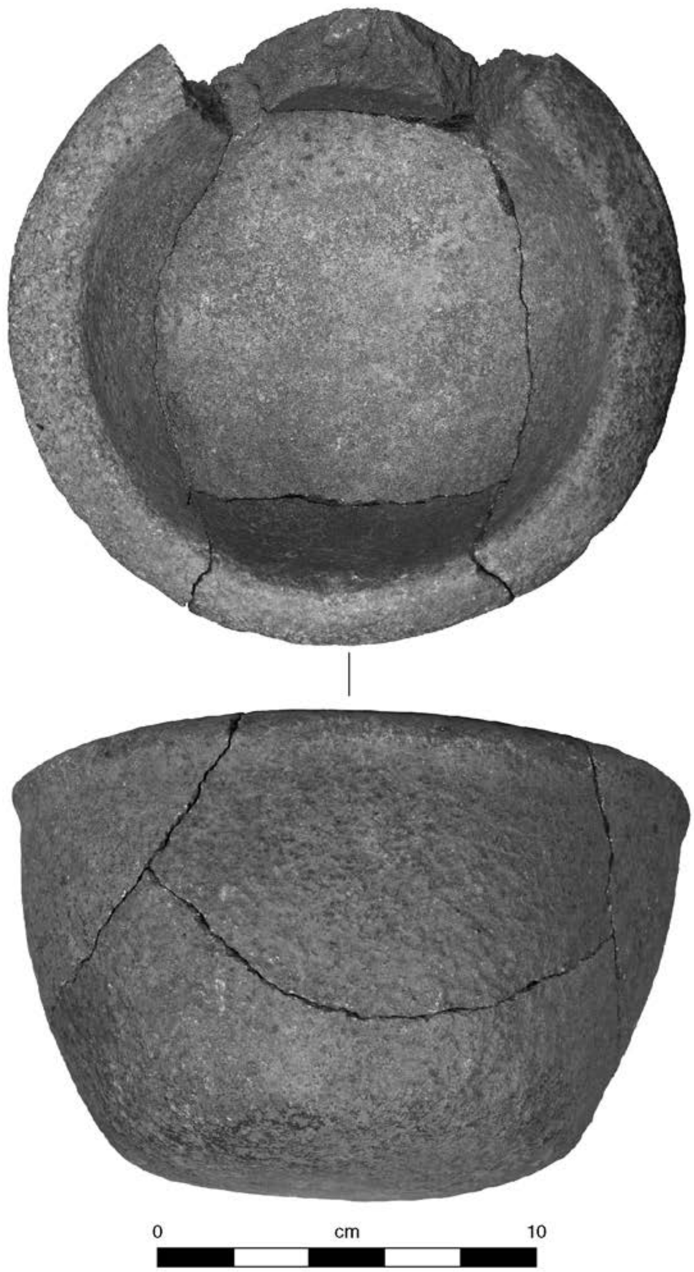


Figure 60. Reconstructible "flowerpot" mortar from burial Feature 9 and burial-area EUs 144 and 155 at LAN-62.

Table 56. Projectile Points Recovered from Analyzed Contexts in the PVAHP

Type, by Series	LAN-193	LAN-2768	LAN-62	LAN-211	Total	%
			Darts			
Silver Lake	—	—	1	—	1	0.4
Pinto series[a]	—	—	—	—	—	
Large side-notched	—	—	1	—	1	0.4
Humboldt[b]	—	—	—	—	—	
Large contracting-stem	—	—	4	—	4	1.4
Elko series						
Elko Corner-notched	—	—	1	—	1	0.4
Elko Eared	—	—	1	—	1	0.4
Indeterminate	—	—	1	—	1	0.4
Subtotal	—	—	*9*	—	*9*	3.2
			Arrow Points			
Marymount	1	—	2	4	7	2.5
Desert Side-notched	—	—	1	1	2	0.7
Cottonwood Triangular						
Concave base	1	—	32	86	119	42.2
Straight base	—	—	76	18	94	33.3
Leaf-shaped	—	1	27	18	46	16.3
Indeterminate base	—	1	2	2	5	1.8
Subtotal	2	2	140	129	273	96.8
Total	2	2	149	129	282	100.0

Note: No points were recovered from LAN-54.
[a] A single Pinto point was recovered from an unanalyzed context at LAN-62, Loci C and D (EU 937, Level 75) (Inventory No. 030015580).
[b] A single Humboldt point was recovered from an unanalyzed context at LAN-2768 (Stripping Unit 33) (Inventory No. 030037863).

period burials (burial Features 38, 96, 141, and 461): 2 large contracting-stem points, a Silver Lake point, and a large side-notched point. The Silver Lake dart point was recovered from burial Feature 461, was made of obsidian, and was covered with ocher. It also exhibited postdepositional dulling of the arêtes, indicating that it was likely an heirloom, perhaps wrapped in leather. The other large contracting-stem point was recovered from burial Feature 96; it was made of chert, was also covered with ocher, and exhibited some reworking of the blade. Three of these burials contained much younger materials, indicating that the dart points were heirlooms. Burial Feature 96 also contained glass beads, burial Feature 38 also contained a leaf-shaped Cottonwood Triangular arrow point, and burial Feature 141 had 2 Triangular Cottonwood concave-base arrow points. The fact that both dart points were covered in ocher suggests that they were intentionally deposited in the graves and were not accidentally incorporated from the surrounding midden. These dart points may have been scavenged from older sites in the Ballona. The remaining 5 dart points at LAN-62 (2 large contracting-stem points, 1 Elko Corner-notched point, 1 Elko Eared point, and 1 bipointed dart of indeterminate type) were recovered from the midden context at the site. Significantly, dart points were not recovered from any Millingstone or early Intermediate period deposits at any sites in the PVAHP, with the exceptions of a Humboldt point from LAN-2768 (from an unanalyzed context) (see Table 56) and an Elko point from LAN-62. The paucity of dart points in Millingstone and early Intermediate period contexts at PVAHP sites is intriguing, considering the extensive evidence of human occupation during these times in the Ballona. Vertebrate remains indicate mammal exploitation during the Millingstone period that increased and became more focused on mammals by the late Millingstone period (see Chapter 10, this volume). Based on vertebrate-faunal data, the early people of the Ballona clearly hunted animals but do not appear to have left many projectile points.

A review of the Millingstone period deposits from LAN-62 sheds some light on this issue. Most of the debitage from these deposits consists of core-reduction flakes (67 percent); there were fewer biface flakes (23 percent). A close inspection of the biface flakes indicates that most are percussion flakes.

Last, seven bifaces were recovered from these deposits: three Stage 2, three Stage 3, and only one Stage 5. The data appear to reflect an emphasis on core reduction; some biface production occurred, but there was little evidence for the manufacture of dart points. The single dart point recovered from these early deposits was the Elko Side-notched point. It would appear that a small number of dart points was being manufactured off-site and brought to the site as finished tools, thereby eliminating most evidence of final point production. If so, many of these points were presumably carried away by the site occupants after they abandoned their campsite.

The 273 arrow points recovered during the PVAHP included Marymount points, Desert Side-notched points, and four types of Cottonwood Triangular points (see Table 56). Chronologically, the Marymount points have been associated with the diffusion of the bow and arrow into coastal southern California about 1,500 years ago and the inception of the late Intermediate period (Van Horn 1990). Desert Side-notched points are associated with Late and Protohistoric period occupations. The Cottonwood Triangular points are generally viewed as dating to after about 700 years ago (Thomas 1981:15). However, Koerper, Schroth, et al. (1996) suggested that Coastal Cottonwood points were as early as 1350 B.P. (600 A.D.), providing a convenient indicator of the end of the Intermediate period and the beginning of the Late period.

Only seven Marymount points were recovered, and one of them was recovered from LAN-193, which has deposits dating to the early Intermediate period; it was found in association with a Cottonwood Triangular point in burial Feature 101. The two Marymount points from LAN-62 were recovered from burial Feature 359 and nonburial Feature 35, which has been dated to the Mission period. Burial Feature 359 also has a Cottonwood Triangular point. The four Marymount points from LAN-211 are all from FB 1, a Mission period activity area. The contexts of the Marymount points are not strong enough to make statements on the diffusion of bow-and-arrow technology in the Ballona.

A Cottonwood Triangular indeterminate-base arrow point and a Cottonwood Leaf-shaped arrow point recovered from Intermediate period contexts at LAN-2768 and dating between 1050 B.C.–A.D. 350 and 950 B.C.–A.D. 50, respectively, suggest that the introduction of bow-and-arrow technology may have occurred during the early Intermediate period in the Ballona—much earlier than previously modeled. Given the recovery of only two arrow points in these early contexts, statements on the earlier timing of bow-and-arrow technology should be considered with caution.

Variability in Cottonwood Triangular Points

The 264 Cottonwood Triangular points include three identifiable types: concave base, straight base, and leaf-shaped (Tables 57–59). The concave-base type accounts for 45.1 percent, and the straight-base (35.6 percent) and leaf-shaped (17.4 percent) types occurred in lower frequencies in this collection. Given the relatively high recovery of points, especially from coastal southern California, it is worthwhile to explore the nature of the technological expertise and the potential standardization of these points.

Measurements of the concave-base and straight-base Cottonwood Triangular points were compared, and the straight-base type was more uniform, especially in terms of length and thickness (see Tables 57–59; Appendixes B.76–B.78). On average,

Table 57. Cottonwood Triangular Points, Straight Base

Straight Base	Length (mm)	Width (mm)	Thickness (mm)
Average	17.2	11.7	3.9
Standard deviation	5.8	2.5	1.5
Median	15.5	11.3	3.5
Range	7.5–35.3	8–18.7	2.2–10.8

Table 58. Cottonwood Triangular Points, Concave Base

Concave Base	Length (mm)	Width (mm)	Thickness (mm)	Basal-Indentation Depth (mm)	Basal-Indentation Width (mm)
Average	18.2	11.2	3.7	1.7	7.8
Standard deviation	6.4	1.6	2.7	1	1.9
Median	13.9	10.1	3.7	1.5	7.7
Range	7.1–56.2	7.7–17.5	1.8–40.1	0.1–5.4	2.6–13

Table 59. Cottonwood Triangular Points, Leaf Shaped

Leaf-Shaped	Length (mm)	Width (mm)	Thickness (mm)	Length to Width Ratio	Length to Thickness Ratio
Average	23.3	12.8	4.7	1.8	4.9
Standard deviation	5.6	2.6	1.4	0.4	1.2
Median	21.9	12.6	4.2	1.8	4.9
Range	8.7–33.8	8.5–21.2	3–9.1	1–2.7	2.9–8.6

the straight-base Cottonwood points were shorter, wider, and thicker, and the concave-base Cottonwood points were longer, narrower, and thinner, although the standard deviations for these characteristics are high, particularly for the length and thickness of concave-base points, suggesting greater variation in these points (see Appendixes B.76–B.78). However, there is less variation in the width of the concave-base Cottonwood points (standard deviation of 1.6) than in the straight-base Cottonwood points. When length and width ratios are compared, there is considerable clustering among the concave-base and straight-base Cottonwood points (Figure 61) and more clustering among the concave-base Cottonwood points. These differences in point morphology could be related to the specific raw materials used for blank production. That is, the shorter, wider, and thicker straight-base points could have been manufactured on flakes removed from small pebbles. By contrast, the longer, narrower, and thinner concave-base points could have been manufactured on flakes removed from larger platform cores. These technological differences might also explain the variation in concave-base points, because of the potential for greater size variation among these core flake blanks. Differences in base shape presumably relate to hafting techniques and possible differences in hunting tactics. For example, thicker points are more durable than thinner points and are less likely to break on impact (Cheshier and Kelly 2006). The PVAHP evidence, however, suggests that variation in the types of points may be the product of the availability of raw materials selected for production; that is, the morphological differences may relate more to technological constraints than to functional or temporal considerations.

Considerable variability was also observed among the Cottonwood Leaf-shaped points (see Tables 57–59; Appendix B.78). The 46 Cottonwood Leaf-shaped points recovered from analyzed contexts in the PVAHP have relatively higher variability in length but much lower variability in width. Two interesting trends were noted when the length-to-width ratios of these points, recovered from LAN-62 and LAN-211, were compared (Figures 62 and 63). First, there is more variation in the lengths of the points from LAN-211. Second, there is clustering of the LAN-211 leaf-shaped points into three groups (small, medium, and large), whereas only two groups (medium and large) were observed among the LAN-62 points. The 11 Cottonwood Leaf-shaped points recovered from burial contexts at LAN-62 cluster in the medium size group. This presumably reflects some degree of standardization among this set of projectile points.

Historical Period Glass Projectile Point

Green-glass pressure flakes and a green-glass arrow point (Figure 64) were recovered from FB 1 at LAN-211. The apple-green glass with gas vesicles was probably scavenged from a Historical period liquor bottle (Goodman and Gilpin 2005:34). A similar arrow point made of green bottle glass was excavated at the Hugo Reid Adobe site north of the Mission San Gabriel in Arcadia (Wallace and Wallace 1958). Although these arrow points were manufactured from Historical

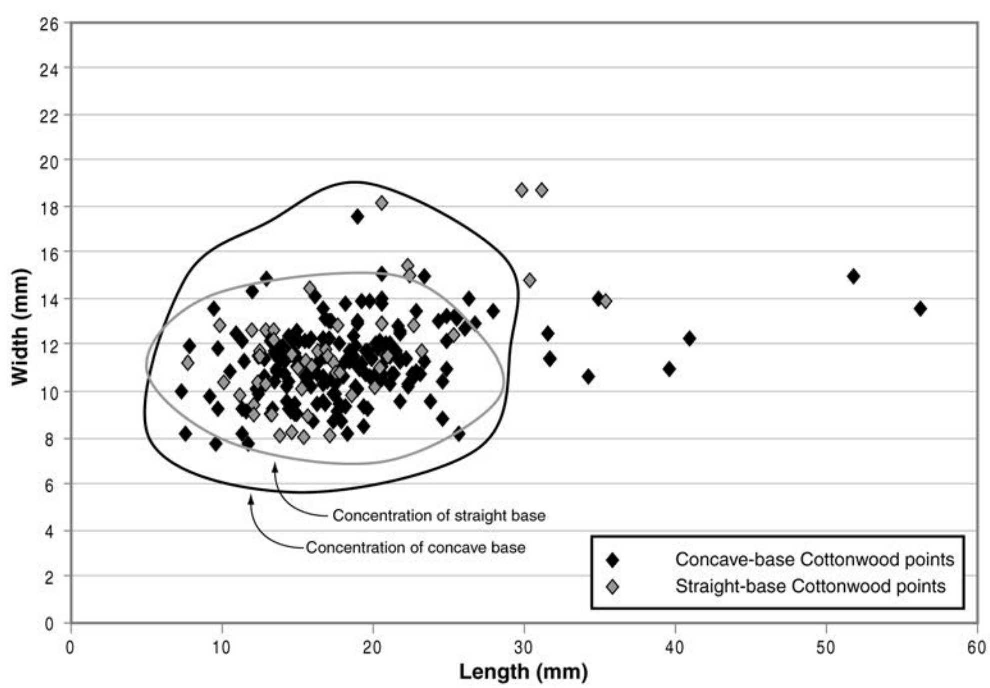


Figure 61. Length-to-width comparisons among Cottonwood Triangular points from the PVAHP.

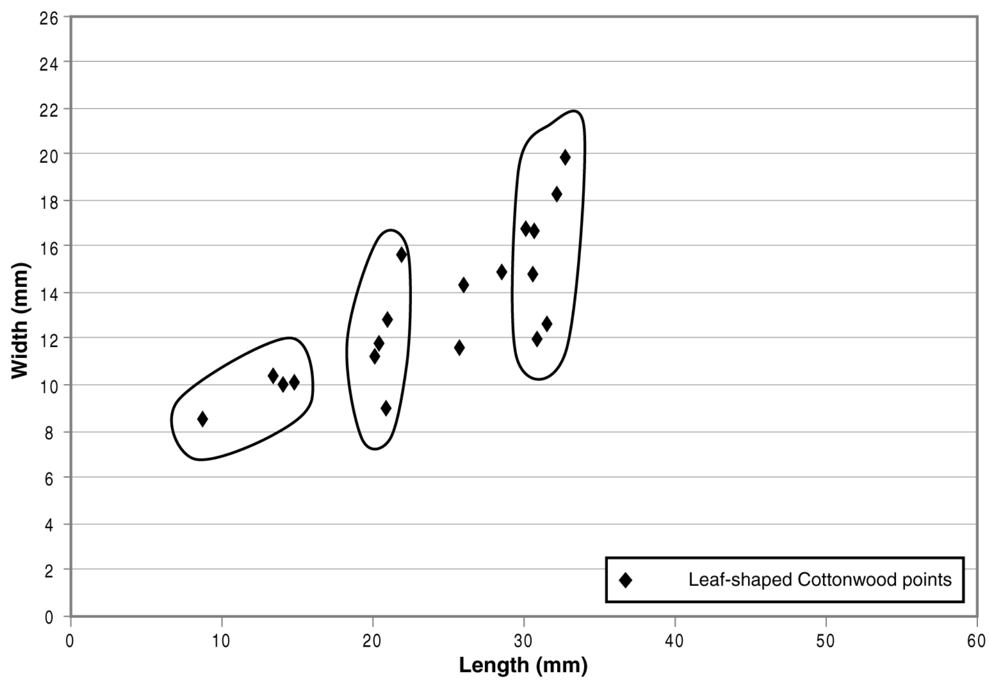


Figure 62. Distribution of leaf-shaped Cottonwood points from excavation units at LAN-211, according to length-to-width ratios.

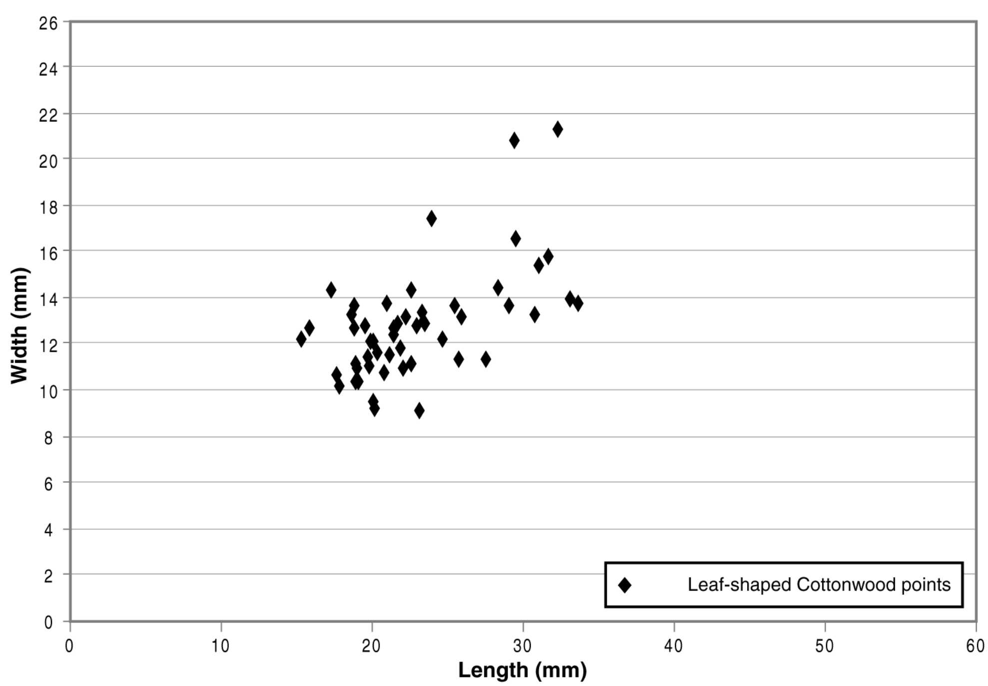


Figure 63. Distribution of leaf-shaped Cottonwood points from excavation units, nonburial and burial contexts at LAN-62, according to length-to-width ratios.

Figure 64. Historical-period green-glass arrow point from LAN-211, EU 183, Level 58.

period material, a traditional stone-knapping technique was employed in their construction.

Perhaps bottle glass was added to the repertoire of materials as a viable alternative to obsidian, which may have become less available during the Mission period as traditional exchange relationships between the desert and the coast were disrupted by the arrival of the Spanish. Alternatively, the green glass may have been selected because of its attractive color or the ease with which glass can be worked. Nonetheless, this small sample cannot be used as adequate evidence to argue for either material replacement or a significant economic change.

Introduction of *Comales*

The PVAHP data provide evidence that *comales* were introduced during the Mission period, as suggested by Harrison (1965:163) and Hudson and Blackburn (1983:196–197). At the Chumash village of Mikiw (SBA-78), steatite *comales* were almost exclusively from Mission period contexts (Harrison 1965:163). *Comales* (Figure 65) recovered in the PVAHP were all manufactured of steatite and were found only in the following contexts: FB 1 at LAN-211 (see Appendix B.73); excavation units, burial features, and nonburial features within the burial area and FB 3 at LAN-62; and CU 323 (Level 60) at LAN-62 (see Appendix B.52). Note that only a single *comal* fragment was recovered from CU 323.

Ethnographically, among the Chumash, *comales* were made of steatite and were used to cook tortillas and also to toast wheat, corn, and chia (Hudson and Blackburn 1983:196–197). It is important to note that *comales* were made of steatite, a material traditionally used for cooking vessels. *Comales* may have been imported in finished form or made of recycled vessel fragments, because they are generally small. Thus the concept of making tortillas on *comales* was introduced, but the *comales* themselves used traditional materials and vessel-construction techniques. The Spanish generally used iron griddles, whereas Indian groups who accompanied them from Mesoamerica or the Southwest typically used ceramic *comales*. The Spanish word *comal* is derived from the Nahuatl *comalli*. Chumash terms for *comales* were the same as the names given to boiling stones (Hudson and Blackburn 1983:196–197), again suggesting that this technology evolved from traditional cooking utensils. It is noteworthy that the only corn kernels recovered in the PVAHP were from FB 1, which also yielded *comal* fragments. Thus, it is very likely that the introduction of corn coincided with use of the *comal* in the Ballona.

Stone Artifacts and Cultural Adaptations: Future Directions

Over 60,000 lithic artifacts were recovered during excavations of the PVAHP, providing a wealth of data with which to study a variety of research issues. This chapter presented the results of the lithic analysis as it relates to raw-material procurement, lithic technology and tool maintenance and use, site function, and temporal change. The analysis and results informed inferences about past human behavior as it related to habitation, mortuary, and ceremonial activities. The PVAHP lithic artifacts provide a better understanding of the relationships among lithic artifacts and human societies in coastal southern California. Some of the specific findings include:

- The majority of the PVAHP lithic raw materials was obtained from local secondary deposits.
- It appears that the Millingstone period occupations reflect seasonal occupations.
- Finished obsidian tools were imported into the area during the Intermediate period and later times. This initial pattern involved materials made of Coso obsidian, and several other obsidian sources were added later, which indicates clear regional exchange networks, intergroup communication, status items, and access to resources between coastal and inland areas.
- The introduction of the bow and arrow has been documented in early Intermediate period contexts of the PVAHP, between 200 and 1,500 years earlier than previous evidence suggested.
- It was suggested that differences in the morphology of straight- vs. concave-base Cottonwood Triangular

Figure 65. ***Comal*** **from burial-area EU 181 at LAN-62.**

points may reflect the production of flakes from platform cores vs. pebbles. In addition, the thicker straight-base points were presumably more durable and less likely to fracture during impact.

- There appears to have been little change in stone-tool technology between the Millingstone and Mission periods, suggesting continuity in many aspects of traditional lifeways despite the dramatic changes caused by the arrival of Europeans.

- The PVAHP sites, together, represent a complex and long occupational sequence that included varying degrees of occupational intensity through time. Information regarding occupation duration, intensity, and continuity is reflected in the life histories of the stone-tool collection.

- Most of the burials contain few artifacts, many of which could have been derived from local midden deposits. On the other hand, there were some specialized items primarily segregated in certain sections of the site that reveal social structures and burial practices possibly in play during the Mission period.

- There are significant differences between ritual mortuary items from Intermediate period contexts and those from Mission period contexts. There are major differences in the kinds of artifacts deposited, suggesting an expansion and diversification of ritual behaviors, as well as some continuities (e.g., pestles and broken bowls and the use of ocher). The most dramatic difference is the context for the deposit of ritual items. In Intermediate period contexts, it appeared that ritual items were restricted to mourning ceremonies that probably involved the remembrance of multiple individuals; virtually nothing was deposited in individual graves. By contrast, Mission period graves contained numerous stone items, sometimes connecting several individuals (the broken *comales*) and, at other times, indicating individuals' roles and status in society, which may reflect an increase in the importance of the individual over the group.

Shell Beads and Other Worked-Shell Artifacts

Amanda C. Cannon

Introduction

The worked-shell collection from PVAHP sites included more than 93,000 specimens recovered from domestic, burial, and other contexts (Table 60). The collection provided a unique opportunity to examine the function, role, and significance of worked shell within domestic and nondomestic contexts spanning at least 3,000 years of occupation in the Ballona. The analyzed collection recovered from seven sites in the Ballona included shell beads and other worked-shell artifacts. The collection was made up of 94 shell-bead types and a variety of worked-shell artifacts reflecting a wide range of functions, including decorative, utilitarian, and different stages of artifact processing and manufacture. More than 95 percent of the shell artifacts were recovered from burial features and associated contexts at LAN-62, with the most-intensive use dating between the Late and Mission periods. The analyzed collection from LAN-211 highlighted shell-related domestic as well as possible ritual activities that, in part, may be associated with the main burial area at LAN-62. Collections from the other PVAHP sites had much lower frequencies of analyzed shell artifacts, indicating less-intensive use of worked shell. For additional information regarding the information presented in this chapter, please see Appendixes C.1–C.19 on the accompanying disk.

This chapter begins with a brief discussion of previous research on worked shell in the region, including studies focusing on artifact typologies and chronologies, and the role of shell beads and their exchange. A brief review of studies conducted at prehistoric and historical-period Chumash and Tongva burial sites are presented, providing insight into the cultural significance of worked-shell artifacts, as well as comparisons with the PVAHP collections. The focus is placed on studies of Chumash burial sites, because, to date, they are the primary sites that have yielded sufficient quantities of worked shell to develop the chronological and cultural typologies that are applicable to the PVAHP. For a detailed discussion of previous research, see Appendix C.1.

This chapter also presents the analytical methods implemented for shell beads and other worked-shell artifacts, followed by previously developed typologies and chronologies used to evaluate shell beads and other diagnostic shell artifacts. When relevant, ethnographic and ethnohistoric information regarding use of worked-shell artifacts is provided. The results of worked-shell analyses are presented by site.

Local and Regional Interactions

Shell beads were used throughout California, the Great Basin, and the American Southwest. In addition to their use for personal adornment and status markers, shell beads formed the basis of sociocultural and socioeconomic interactions that may have been particularly important during periods of environmental and social instability (Raab and Larson 1997; Walker and Lambert 1989). Shell beads from the genus *Olivella* (hereafter referred to as "olivella") recovered from archaeological contexts in the southwestern Great Basin provide evidence for long-distance trade dating to as early as 10,000 years ago (Fitzgerald et al. 2005). Early on, shell beads were likely an integral part of reciprocity exchange, which served mainly as a social means to reinforce kinship ties and lines of communication between neighboring and distant groups (Chartkoff 1989; Ericson and Earle 1982; Grenda 1992). As populations grew, down-the-line exchange likely served to connect distant groups and increase the flow of exotic materials. Later in prehistory and during the Historical period, shell beads were used as a medium in generalized exchange and may have also facilitated the accumulation of wealth and served as status markers.

The mainland Tongva, in part, participated in these exchange networks, trading with their mainland Chumash, Cahuilla, and Serrano neighbors, as well as groups on the Channel Islands, including Santa Catalina, San Clemente, and San Nicolas Islands

Table 60. Summary of Analyzed Shell Beads and Other Worked-Shell Artifacts from PVAHP Sites

Site No.	Locus	Shell Beads (n)	Other Worked-Shell Artifacts (n)	Total	Percent
LAN-2768	A	4	6	10	0.01
	B	2	—	2	<0.01
Subtotal		6	6	12	0.01
LAN-54		8	8	16	0.02
LAN-211[a]		2,687	83	2,770	2.95
LAN-62	A/G	90,586	255	90,841	96.80
	C	11	—	11	0.01
	D	1	—	1	<0.01
Subtotal		90,598	255	90,853	96.82
LAN-2676		144	4	148	0.16
LAN-1932		38	4	42	0.04
Total		93,481	360	93,841	100.00

[a] Includes testing phase of site (SR-13).

(Strong 1929:98). From the Serrano and Cahuilla to the east, the Tongva received acorns, seeds, obsidian, and deerskins in exchange for shell beads, steatite, fish, sea otter pelts, shells, and possibly salt (Bean and Smith 1978:547; Grenda 1998). In addition to exchange of shell beads for material items, the Tongva also participated in ritual exchange. Moieties or lineages gathered together as part of ritual congregations, reaffirming secular, socioeconomic, and ceremonial alliances. As part of these gatherings, shell beads, among other types of gifts, were offered in ritual exchange between members of the lineages, typically secular and spiritual leaders (Bean 1972). During and following the Late period, shell beads are believed to have been used in socioeconomic exchange in Chumash society and other southern California mainland and island groups, including the Tongva, Serrano, and Cahuilla (Bean and Smith 1978; Gibson 1992; King 1974, 1990a).

In addition to understanding the function of shell beads, studies have focused on identifying the source of shell-bead manufacture and tracing trade interactions from the source. Recent studies have involved stable oxygen and carbon isotope analysis of olivella bead types reportedly manufactured during and following the Late period, recovered from LAN-62, LAN-211, and an archaeological site located on San Nicolas Island, SNI-39 (Eerkens et al. 2008). Comparisons of these beads with modern olivella shells collected from nonarchaeological contexts and ancient whole olivella shells recovered from archaeological sites in California reveal that the shell beads were manufactured south of Point Conception (Eerkens et al. 2008).

Sourcing results correspond with prehistoric and historical-period shell-bead-manufacturing locations identified south of Point Conception, mainly on the Channel Islands. Shell-bead-making debris or detritus, bead blanks, and drills used to perforate beads have been identified on the Chumash-occupied northern Channel Islands and the Tongva-occupied southern Channel Islands. Although bead manufacture occurred on the mainland, the focus of manufacturing activities was largely on the islands owing to better access to an abundance of whole shells as well as better materials for manufacturing tools (e.g., drills). Trade interactions between the islanders and mainland neighbors enabled the islanders to exchange shell beads for a variety of locally unavailable resources, including deerskins, acorns and other seeds, and obsidian.

The extent and organization of shell-bead manufacture varied among the islands. On Santa Cruz Island, Arnold and Munns (1994) identified a specialized bead-manufacturing industry as evidenced, in part, by the high density of bead detritus and discrete workshop areas identified in archaeological deposits. Shell-bead manufacturing has also been identified in sites on San Nicolas Island, as evidenced by bead detritus, whole olivella shells likely intended for bead manufacture, and chert drills (Martz et al. 2000; see also Cannon 2006; Hintzman and Abdo-Hintzman 2006). Trade of shell beads would have enabled islanders to obtain a variety of goods, including soapstone from Santa Catalina Island and terrestrial resources from the mainland, such as seeds, deerskins, and meat (Cannon 2006).

Considering the established shell-bead-manufacturing industry on the northern Channel Islands as well as evidence of shell-bead making on the southern Channel Islands, the occupants of the Ballona may have obtained shell beads through trade from either of these island groups. Notably, a Serrano informant indicated that the mainland Tongva obtained shell beads from Santa Catalina Island (Strong 1929:95–96). Whether these beads were manufactured on the island or obtained through trade from San Nicolas Island or one of the northern Channel Islands, however, is unclear.

Site Comparisons

Site comparisons discussed here include three burial grounds located in ethnographically documented territories of the Chumash (LAN-243 and LAN-264) and Tongva (LAN-1575), as well as two sites in the Ballona (the Admiralty [LAN-47] and Del Rey [LAN-63] sites). Situated approximately 20 miles northwest of the PVAHP in the Santa Monica Mountains region, the Medea Creek burial ground (LAN-243) is located inland, whereas the Malibu burial grounds (LAN-264) are located along the coast. The Yabit/Yaanga burial ground (LAN-1575) is located inland approximately 15 miles northeast of the PVAHP. Spatial distributions of worked-shell artifacts within these three burial grounds provide insight into burial practices; other ritual and domestic practices; political and economic interactions; and social identity in terms of sex, age, and social status. Collectively, the sites provide important comparative data with the PVAHP sites.

Medea Creek Burial Ground (LAN-243)

Located in Agoura, California, the Chumash Medea Creek burial ground was used prior to and following Mission contact, between approximately A.D. 1500 and 1785. The burial area measured 20.1 by 9.5 m and contained approximately 397 primary and secondary interments and 28,000 associated artifacts. Shell and glass beads were found unevenly distributed within the burial area, with burials containing high frequencies of beads located in the western portion of the burial ground, whereas those with few to moderate frequencies were located in the central and peripheral areas. Linda King (1982) noted that although sex did not appear to be a discriminating factor in burials with high frequencies of beads, there was a tendency for children and infants or accompanying adults to be interred with large numbers of beads. King suggested that burial rituals for subadults may have reflected the status of the deceased child (L. King 1982).

Comparisons of beads within burials also reveal patterns of bead placements within the features. Clusters of beads were found at the sides of the head, indicating that the beads may have once been part of earrings, necklaces, or a combination of the two (L. King 1982). In general, burial features tended to contain mostly one or two types of beads, which suggest large-scale acquisitions rather than gradual accumulations (L. King 1982). That is, large quantities of one or two bead types would arrive inland from coastal areas, possibly during social and family events such as marriages connecting inland and coastal families.

Based on concentrations and types of artifacts in burials and assuming that the burials were relatively contemporary, Chester King (1974) differentiated the burial ground into three areas based on status. In the western portion of the burial area, King (1974) attributed caches of artifacts in subadult burials as evidence for inherited wealth or status. He posited this area was where secular leaders and their family members were buried. Based on the presence of deer-tibia whistles associated with *'antap* ritual activities and turtle-shell rattles also used in ceremonies (see Boscana 1978:42; Hudson and Blackburn 1978), King (1974) argued that spiritual leaders had been buried in the central portion of the burial ground. The eastern area was marked by individuals with lower or common status (King 1974). King (1974) noted differential distributions of bead types in the burial ground. Shell beads recovered from the western and central areas included Pismo clam (*Tivela stultorum*) tube and cylinder beads, olivella saucer beads, red abalone (*Haliotis rufescens*) epidermis disks, California mussel (*Mytilus californianus*) disks, and giant rock scallop (*Crassadoma gigantea*) tube beads. In general, King (1974) considered these to be higher-valued beads based on time-intensive manufacturing or their showy or colorful appearance. Considering the location of these beads within the western and central portions of the burial area, King (1974) interpreted the function of these beads as higher-status markers and their use in ritual exchange between spiritual leaders and chiefs (King 1974:89). By contrast, relatively time-intensive to manufacture but not particularly showy or colorful beads such as olivella callus and lipped beads were distributed throughout the burial ground. King (1974:88) suggested that these beads were used by members regardless of social class, likely as a medium for socioeconomic exchange (King 1974:88). Bead types and their sociocultural significance and functions are revisited in the discussion below reviewing bead types identified in the PVAHP collections.

Malibu Burial Grounds (LAN-264)

The Malibu burial grounds are located in the Santa Monica Mountains at the Chumash settlement of Humaliwo (LAN-264). Two main burial areas were identified at the site, approximately 30 m apart and separated by the Pacific Coast Highway. One burial ground, used between ca. A.D. 950 and 1150, measured roughly 7 by 15 m and contained 114 burials. The other main burial ground was used between A.D. 1775 and 1805 and contained approximately 137 excavated burials within a 10-by-10-m area (Gamble et al. 1996, 2001). Ethnographic and ethnohistoric information indicates Humaliwo was an important political center, and mission records show that villagers had extensive marriage ties with the neighboring Tongva, as well as inland Chumash areas (Gamble et al. 2001). Mission records also note that the chief of Humaliwo originally came from Catalina Island (King 1994:78).

As was the case at the Medea Creek burial ground, shell and glass beads were unevenly distributed in burials at the Malibu Late period and Historical period burial grounds. Assuming burials in each burial ground were relatively contemporaneous, Gamble et al. (2001) noted that burials containing large numbers of beads tended to be located in the central and southern portions of the prehistoric and Historical period burial grounds, respectively. Burials with few beads, less than 20, were widely distributed in both burial grounds. Overall, few burials contained large numbers of beads, and sex did not appear to be a discriminating factor. Gamble et al. (2001) interpreted this distribution as evidence that family membership was a defining factor in social status, rather than sex, age, and personal accomplishments. However, in both burial grounds, some subadults were found to be endowed with large quantities of beads. By contrast to L. King's (1982) interpretation of this pattern at Medea Creek, Gamble et al. (2001:196) suggested that this may reflect the overwhelming grief accompanying the loss of a child, as well as the ascribed status or projected adult social identity of the child.

In both Malibu burial grounds, bead concentrations were found mostly in the neck and skull regions—areas where bead wealth was commonly displayed (Simpson 1961). Gamble et al. (2001), however, suggested that bead frequency may not accurately reflect the wealth of the individual. They posited that burials containing few shell beads may not necessarily reflect an individual of low status. Instead, beads and other items could have been reserved for mourning ceremonies (Gamble et al. 2001:196). By contrast, burials with large quantities of beads and other items actually may reflect an individual of lower status, who was not expected to be honored with a later mourning ceremony. Alternatively, burials with higher quantities of beads may be due not to the lack of status for a mourning ceremony but, rather, may be due to the difficulties in conducting the ceremony during the Mission period because of constraints placed on native Californians in general. As a result, in this scenario, wealthy individuals would be buried with more of their personal items (Martz 1984; Patricia Martz, personal communication 2011). Based on ethnohistoric information, however, Arnold and Green (2002:764) have argued that although key possessions may have been reserved for mourning ceremonies, the deceased's property was not divided between interment and the mourning ceremony. For example, according to Reid's (1968:31) accounts of the Native peoples living in the Los Angeles area, the deceased's property and sometimes the home were burned; however, one item was always reserved for a mourning ceremony. He also noted that the deceased's social status influenced the amount and value of accompanying grave goods (Reid 1968 [1852]:31).

Although it is unclear whether bead frequency and status are directly correlated, Gamble et al. (2001) noted that, in general, much higher frequencies of beads were recovered from the Historical period burial ground compared to the Late period burial ground. This was likely due to the massive quantities of shell and glass beads available during the Mission period.

Yabit/Yaanga (LAN-1595)

Located in downtown Los Angeles, LAN-1595 is situated in the ethnographic territory of the Tongva. The burial ground may have been associated with the ethnographic village (Yaanga) reported to have been located in the area. Radiocarbon dates and artifact cross dating indicated that the burial ground was used between the Late and Mission periods, A.D. 950–1820 (Goldberg 1999). Individual burials and cremations ranged in time with most dating to the Mission period. Late and Protohistoric period burials were identified as well. Overall, the Yabit/Yaanga burials overlap in time with those identified for the PVAHP sites, as well as the Medea Creek and Malibu burial grounds.

The extent of the LAN-1595 burial ground was much smaller compared to the Medea Creek and Malibu burial grounds. As with the two Chumash burial grounds, however, olivella beads constituted the bulk of the LAN-1595 shell-bead collection. Other bead types included beads manufactured from red abalone and California mussel. In addition to beads, other worked-shell artifacts included a scallop (*Argopecten* sp.) pendant, one polished clamshell (probably *Saxidomus nuttalli*), and six fragments of cut or abraded red abalone and black abalone shell, in addition to two fragments of olivella bead-manufacturing debris or detritus.

Shell beads recovered from the burial area were types reportedly manufactured between the Late period and the Mission period and included varieties of olivella beads manufactured from the wall (disk) and callus (cupped, bushing, and lipped) portions of the shell. More than half (69.1 percent) of the shell beads were identified as olivella cupped and bushing beads, types reportedly used in socioeconomic exchange during the Late period. The collection also included incised beads, totaling approximately one-third of the shell-bead collection. Incised patterns included crosshatch, diagonal line, and Y designs.

As with the Malibu burial grounds, shell beads recovered from earlier interments at LAN-1595 were found in lower frequencies compared to later interments. However, only one burial, a child cremation, was recovered with relatively large numbers of beads (n = 226). Other features contained shell beads ranging in frequency from 1 to 34. Comparisons of artifact types and frequencies in burial features indicated that either social status was not reflected in the accompanying grave items or individuals buried at the LAN-1595 burial ground were members of lower or common social classes (Goldberg 1999:149). It is difficult, however, to attribute artifact quantities directly to indicators of social status due to differential preservation of status items such as sea otter capes, basketry, feathers, and other perishable objects (Patricia Martz, personal communication 2011).

Del Rey Site (LAN-63)

This Intermediate period site is located on the Westchester Bluffs above the southern edge of the prehistoric Ballona lagoon. Van Horn excavated the site in the 1980s, uncovering 5 olivella beads (Van Horn 1987a:268). Later work by SRI focused on Intermediate period features, which yielded 29 worked-shell artifacts, including 25 shell beads and 4 pendants (Douglass et al. 2005; Hull 2005). All shell beads and shell-bead fragments were manufactured from olivella shell.

Shell-bead types included olivella spire-lopped; end ground; tiny, normal, and oval saucers; and wall disks. Other worked-shell artifacts included four shell pendants, manufactured from scallop and venus clam shell. All of the shell beads and three of the four shell pendants were recovered from mortuary contexts, including a child burial and a mortuary feature consisting of a concentration of artifacts likely containing the remains of mourning-ceremony activities.

Admiralty Site (LAN-47)

Located on the edge of the prehistoric Ballona Lagoon in Marina del Rey, this Late period site was likely occupied seasonally by small groups drawn to the estuarine resources (Altschul, Homburg, et al. 1992). In 1961, Keith Johnson excavated the site, uncovering four burials and midden containing an extensive collection of artifacts (Dillon et al. 1988). The burials consisted of inhumations rather than cremations—the latter sometimes associated with desert cultural traditions (Altschul, Homburg, et al. 1992). Types of artifacts associated with the burials are unknown, as the 1961 excavations were not well documented, with efforts focusing on midden contexts.

A total of 448 shell beads, representing six different types, was recovered from the midden. Olivella cupped beads (39 percent) were the most common, in addition to olivella saucer (24.3 percent), abalone epidermis disk (21.0 percent), and cylinder (5.5 percent) beads. Most of the shell beads were dated to between A.D. 900 and the historical period, a range consistent with the radiocarbon dates. There was no evidence of shell-bead manufacturing at the site, indicating that they were likely imported in their finished states. Compared to stone (n = 11) and bone (n = 20) beads, shell beads appeared to be much more prevalent in the midden. The worked-shell collection also included 11 expedient tools consisting of what were likely scrapers manufactured from venus clam (*Chione* spp.) and Washington clam (*Saxidomus nuttalli*) that were ground, flaked, or a combination of the two. The prevalence of shell beads and the shell tools, along with the use of inhumation as a burial custom, suggest that by the Late period, residents of the Ballona demonstrated coastal cultural traditions.

Analytical Methods

The PVAHP collection included more than 93,000 analyzed shell beads and other worked-shell artifacts recovered from six sites: LAN-54, LAN-211, LAN-62, LAN-2768, LAN-2676, and LAN-1932 (see Table 60). Note that no worked-shell artifacts were recovered from LAN-193, one of the sites included in the PVAHP. For each site, a variety of contexts—control units, burial features (if present), nonburial features, and excavation units were selected for artifact analyses (see Volume 2 of this series for detailed descriptions of the analytical contexts by site). In some instances, excavation unit and feature contexts were grouped together as larger activity areas, or feature blocks, as well as areas associated with the LAN-62 burial area. A summary of analyzed excavation contexts is provided in the discussions of analysis results for each site (see Volume 2 of this series for detailed descriptions of field and laboratory processing procedures; Appendix C.2 provides a summary of screening methods used at each site).

In general, the analysis of shell beads and other worked shells began with recording the lowest possible taxonomic level for each specimen. Table 61 summarizes shell types

Table 61. Shell Taxa Identified in the Worked-Shell-Artifact PVAHP Collections

Scientific Name	Common Name
Acmaeidae	true limpets
Amiantis callosa	Pacific white venus
Argopecten spp.	scallop
Argopecten aequisulcatus	speckled scallop
Argopecten ventricosus	Pacific calico scallop
Megastraea undosa	wavy turban
Bursa californica	California frog shell
Cardiidae	cockles
Chione spp.	venus clam
Chione californiensis	California venus
Clinocardium nuttalli	Nuttall's cockle
Cypraea spadicea	chestnut cowrie
Dentalium neohexagonum	six-sided tusk
Fissurellidae	keyhole limpets
Haliotis spp.	abalone
Haliotis cracherodii	black abalone
Haliotis rufescens	red abalone
Crassadoma gigantea	giant rock scallop
Kelletia kelletii	Kellett's whelk
Lottia gigantea	giant owl limpet
Megathura crenulata	giant keyhole limpet
Mytilus californianus	California mussel
Ocenebra spp.	dwarf triton
Olivella biplicata	purple olive
Olivella dama	dama dwarf olive
Euspira lewisii	Lewis's moon snail
Tivela spp.	clam
Tivela stultorum	Pismo clam
Trachycardium quadragenarium	giant Pacific cockle
Tresus nuttallii	Pacific gaper

identified in the PVAHP collections. With few exceptions, discussed below, all artifacts were measured to the nearest tenth of a millimeter. For a detailed discussion of analysis and cataloging methods, as well as worked-shell-artifact classifications, typologies, chronologies, and ethnohistoric information, see Appendix C.3.

For the PVAHP, shell beads are classified according to Bennyhoff and Hughes's (1987) typology, whereas chronological information is derived from a combination of King's (1990), Gibson's (1992), and Bennyhoff and Hughes's (1987) overlapping classification schemes. Collectively, these chronologies reflect the current understanding of the temporal use of shell beads in southern California prehistory and history. Because they are based primarily on bead type seriations from the Santa Barbara Channel region, bead chronologies are likely slightly out of phase with the Los Angeles Basin. It is possible some bead types continued to be used in the Los Angeles Basin after their use was discontinued farther north, whereas use of other bead types may have begun earlier in the Santa Barbara Channel region and moved south.

Table 62 provides a summary of different shell-bead types identified in the PVAHP collection, including portions of the shell used to manufacture the bead, as well as purported dates, uses, and functions. Figure 66 shows dates for select bead types, and Figure 67 shows bead types dating between the Late and Mission periods. Examples of different bead types are shown in Appendixes C.4–C.15.

When possible, previously established typologies and chronologies developed by other researchers were used to classify other worked-shell artifacts. Shell ornaments were classified according to typologies defined by Gifford (1947) and chronologies developed and refined by King (1990a) and Scalise (1994) (Table 63). Strudwick's (1985) typologies were used to classify shell fishhooks.

In this chapter, chronologies previously defined for shell beads and other worked-shell artifacts have been adapted to fit within the PVAHP chronological framework. This framework was developed based on the results of chronostratigraphic analyses from a variety of PVAHP contexts, as well as local and regional chronologies (discussed in Chapter 3, Volume 2 of this series). All periods discussed in this chapter refer to the PVAHP chronological framework (Tables 64–66).

Summary of Worked-Shell Artifacts

The PVAHP shell beads and other worked-shell artifacts represent one of the largest collections recovered from southern California. More than 93,000 worked-shell artifacts constitute the PVAHP collection, which is composed of specimens from six different sites: LAN-2768, LAN-54, LAN-211, LAN-62, LAN-2676, and LAN-1932 (see Table 60). By far, shell beads (99.6 percent) make up the bulk of the collection. Although found in much lower frequencies, the diverse array of other worked-shell artifacts recovered in the PVAHP reflect a variety of domestic and ritual functions, highlighting food procurement, processing, and consumption; processing of other materials; ornamentation; ritual killing of artifacts; and ritual offerings. Considering the large data set, overall good preservation, and recovery from a range of contexts—burial features, probable mourning ceremony and other ritual areas, and domestic activity areas—the PVAHP worked-shell collection offers the opportunity to examine lifeways prior to, during, and following influence of the missions.

The following is a discussion of the results of worked-shell analysis by site. For each PVAHP site, the discussion begins with a summary of analytical contexts followed by the results of shell-bead analysis. The shell-bead section concludes with a summary and is followed by a discussion of other worked-shell artifacts. Summaries focus on descriptive and typological discussions. Research presented in other volumes of the PVAHP series focus on spatial patterns; site comparisons; refinement of artifact typologies and chronologies; local and regional social, political, and economic interactions; and interpretations of social status and cultural affiliation.

Shell Beads and Other Worked-Shell Artifacts from LAN-2768

LAN-2768 is situated between the base of the bluffs and the former route of Centinela Creek in the eastern end of the PVAHP area. Shell beads and other worked-shell artifacts were analyzed from Loci A and B. Both loci are located in the northern portion of the site, with Locus A situated in the northwestern section and Locus B located in the northeastern part. Based on chronostratigraphic analysis, LAN-2768, Locus A is reported to have been occupied during the early Intermediate period (discussed in Chapter 3, Volume 2 of this series). Analysis included a total of 12 shell beads and other worked-shell artifacts, 10 recovered from Locus A and 2 from Locus B. Analysis contexts consisted of control unit, excavation units, and features.

Compared to other PVAHP sites, the analyzed worked-shell collection from Intermediate period LAN-2768 was relatively small, totaling 12 shell beads and other worked-shell artifacts recovered from Loci A and B (see Table 65). The worked shell was identified in midden, with the exception of one specimen recovered from a possible prehistoric structure. Locus A contained 4 of the shell beads and all of the other worked-shell artifacts. The shell-bead collection consisted of nearly all olivella beads, with the exception of 1 red abalone epidermis disk. Based on the diameter and small central perforation (likely

Table 62. Shell-Bead Types in PVAHP Collections, by Bead Classification, Chronologies, Uses, and Functions

Shell Type	Bead Class	Bead Type	Manufacturing Portion of Shell	Approximate Temporal Range (Gibson 1992; King 1974, 1990a)	Uses	Possible Function (Gibson 1976, 1992; King 1974)
Olivella	simple spire-lopped	simple spire-lopped	whole shell with spire removed	all periods	strung	Widely used.
		simple spire-lopped, small				
		simple spire-lopped, medium				
		simple spire-lopped, large				
		oblique spire-lopped, small		1000 B.C.–A.D. 400	strung; appliqué	
		oblique spire-lopped, medium				
		appliqué spire-lopped	whole shell with spire removed and wall perforated	uncertain, 5500–600 B.C. and A.D. 1542–Mission period	appliqué	
		appliqué spire-lopped, large				
	end-ground	end-ground, small	whole shell with ground spire and canal	5500–600 B.C. and A.D. 1150–Mission period	strung	
		barrel, small		all periods		
		barrel, medium				
		barrel, large				
		cap, small		all periods with emphasis 3000–600 B.C. and A.D. 900–1500		
		spire		A.D. 1500–historical period		
	spit	split oval	wall	A.D. 900–1150		
		split end-perforated		A.D. 1050–1400		
		scoop		A.D. 900–1150		
	lipped	thin lipped	wall and callus	A.D. 1500–Mission period		Medium of exchange between individuals and households; widely used.
		round thin lipped		A.D. 1500–1600		
		oval thin lipped		A.D. 1500–1700		
		thick lipped		A.D. 1650–Mission period		
		full lipped				
		full lipped, lipless variant	wall			
		deep lipped	wall and callus			
		large lipped		Mission period		

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Shell Type	Bead Class	Bead Type	Manufacturing Portion of Shell	Approximate Temporal Range (Gibson 1992; King 1974, 1990a)	Uses	Possible Function (Gibson 1976, 1992; King 1974)
		full large lipped				
		deep large lipped		Mission period with emphasis A.D. 1771–1816		
		rough large lipped		A.D. 1771–1816		
		rough large lipped, normal variant	wall and callus	Mission period with emphasis A.D. 1771–1816		
		rough large lipped, small variant		Mission period with emphasis A.D. 1800–1816		
	saddle	round saddle	wall	uncertain, likely 600 B.C.–A.D. 1150		Unknown.
		square saddle		uncertain, likely 600 B.C.–A.D. 1250		
	saucer	tiny saucer		600 B.C–historical period	strung; decorative inlay	Used to validate spiritual and secular authority.
		very tiny saucer[a]		Mission period with emphasis post–A.D. 1782		
		normal saucer		600 B.C.–A.D. 1150	strung	
		ring		600–200 B.C.		
		oval saucer		600 B.C.–A.D. 1150		
		irregular saucer		uncertain, likely 1000 B.C.–A.D. 1150		
		irregular saucer, asymmetrical				
		irregular saucer, oval				
	disk	ground/semiground disk[a]		uncertain, likely A.D. 1771–1816	strung; broadcast offerings	Medium of exchange; used to validate spiritual and secular authority.
		ground disk		A.D. 1771–1800		
		ground disk, lipped[a]	wall and callus			
		ground disk, shelved[a]	wall and shelf			
		semiground disk	wall	A.D. 1800–1816		
		semiground disk, lipped[a]	wall and callus			
		semiground disk, shelved[a]	wall and shelf			
		rough disk	wall	A.D. 1816–1834		
		chipped disk		A.D. 1834–1900		

Shell Type	Bead Class	Bead Type	Manufacturing Portion of Shell	Approximate Temporal Range (Gibson 1992; King 1974, 1990a)	Uses	Possible Function (Gibson 1976, 1992; King 1974)
	wall disk	wall disk class		A.D. 1150–Mission period	strung	Used to validate spiritual and secular authority.
	callus	cupped	callus	A.D. 1150–1800	strung; decorative inlay	Medium of exchange between individuals and households; widely used.
		bushing		A.D. 1150–Mission period		Used for decorations; medium of exchange between individuals and households; widely used.
		cylinder		A.D. 1500–1800		Medium of exchange between individuals and households; widely used.
	thick rectangle	small thick rectangle, shelved	wall and shelf	600–200 B.C.	sequin and appliqué	Used to validate spiritual and secular authority.
	thin rectangle	normal sequin	wall	A.D. 1150–1782	sequin and appliqué; decorative inlay	Unknown; possible decorative function.
		wide sequin		A.D. 1150–1500		
		normal pendant				
		elongate pendant				
	whole shell	drilled whole shell, small	whole shell	A.D. 1150–Mission period	strung	
Abalone	disk	red abalone epidermis disk	epidermis	A.D. 1250–Mission period		Used to validate spiritual and secular authority; medium of exchange between individuals and households; used as jewelry; used for special occasions.
		red abalone small disk	epidermis and nacre	Mission period		
		black abalone epidermis disk	epidermis	600 B.C.–A.D. 400 and A.D. 1650–1782		
		abalone nacre disk	nacre	600 B.C.–A.D. 1050	strung; sequin; decorative inlay	
	cylinder	red abalone epidermis cylinder	epidermis	A.D. 1250–Mission period	strung	
	rectangle	red abalone rectangle	epidermis and nacre	4000 B.C.–A.D. 400	strung; sequin; decorative inlay	
California mussel	disk	disk	epidermis (nacre sometimes present)	A.D. 900–Mission period	strung	
	cylinder	cylinder		A.D. 1250–Mission period		

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Shell Type	Bead Class	Bead Type	Manufacturing Portion of Shell	Approximate Temporal Range (Gibson 1992; King 1974, 1990a)	Uses	Possible Function (Gibson 1976, 1992; King 1974)
Pismo clam	disk	disk		5500–200 B.C. and A.D. 1150–Mission period		
	cylinder	cylinder		1000–200 B.C. and A.D. 1150–Mission period		
	tube	tube		A.D. 1150–Mission period	strung; nose and ear ornaments	
		tube, normal variant				
		tube, beveled variant				
Clam	disk	disk		5500–200 B.C. and A.D. 1150–Mission period	strung	
	cylinder	cylinder		1000–200 B.C. and A.D. 1150–Mission period		
	tube	tube		A.D. 1150–Mission period		
Giant rock scallop	disk	disk		A.D. 1500–Mission period		
	cylinder	cylinder				
	tube	tube				
Gastropod	columella	columella, non-olivella	columella		nose and ear ornaments; pendant; strung	Widely used.
Six-sided tusk	tube	tube	whole shell with end(s) ground	all periods	strung; nose and ear ornaments	
Norris's top shell	disk	disk	epidermis (nacre sometimes present)	uncertain, possibly 3000–1000 B.C.	strung	Unknown.
	cylinder	cylinder				

[a] New bead subtype identified in the PVAHP shell-bead collection.

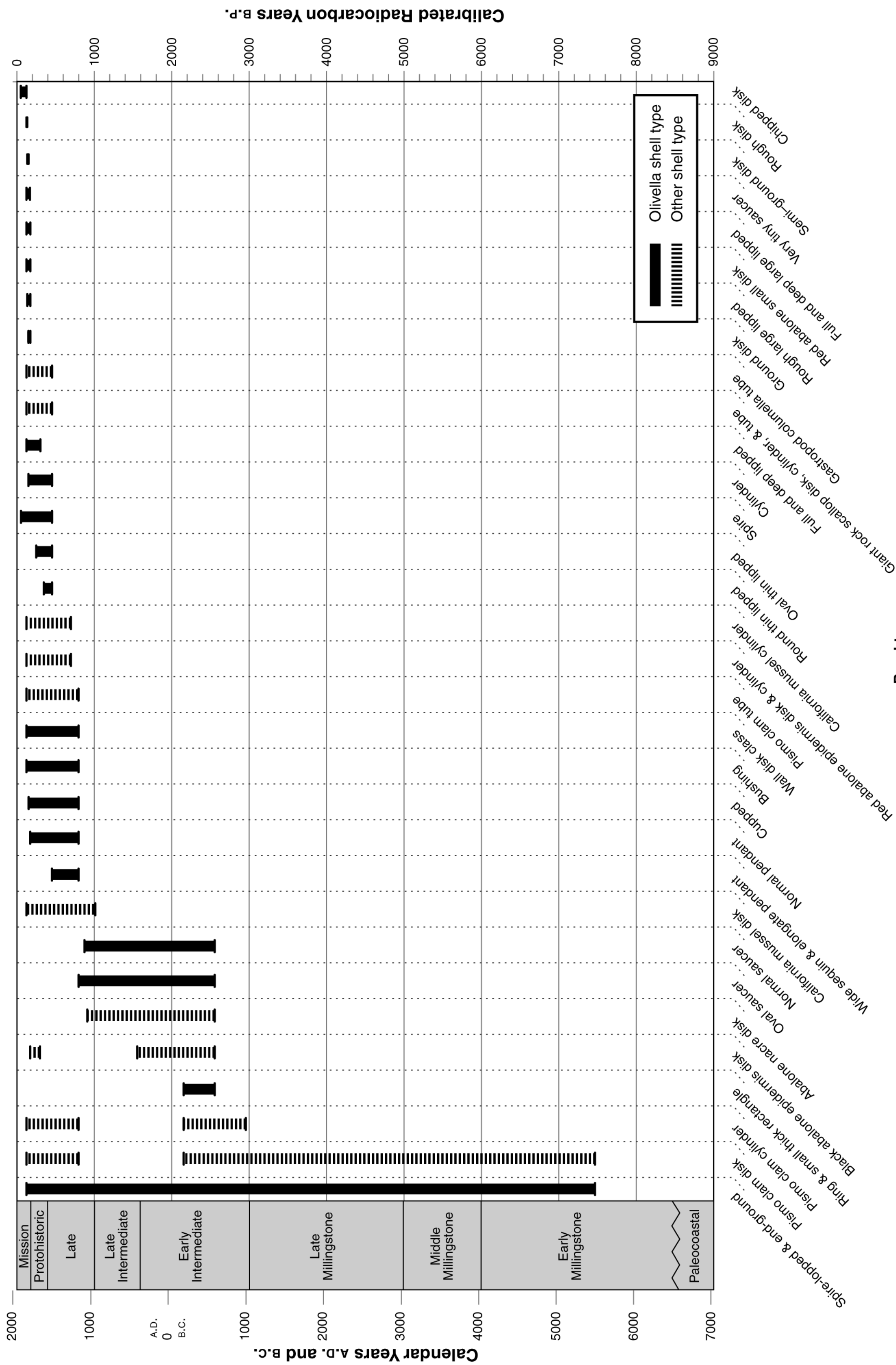

Figure 66. Time ranges for select shell-bead types.

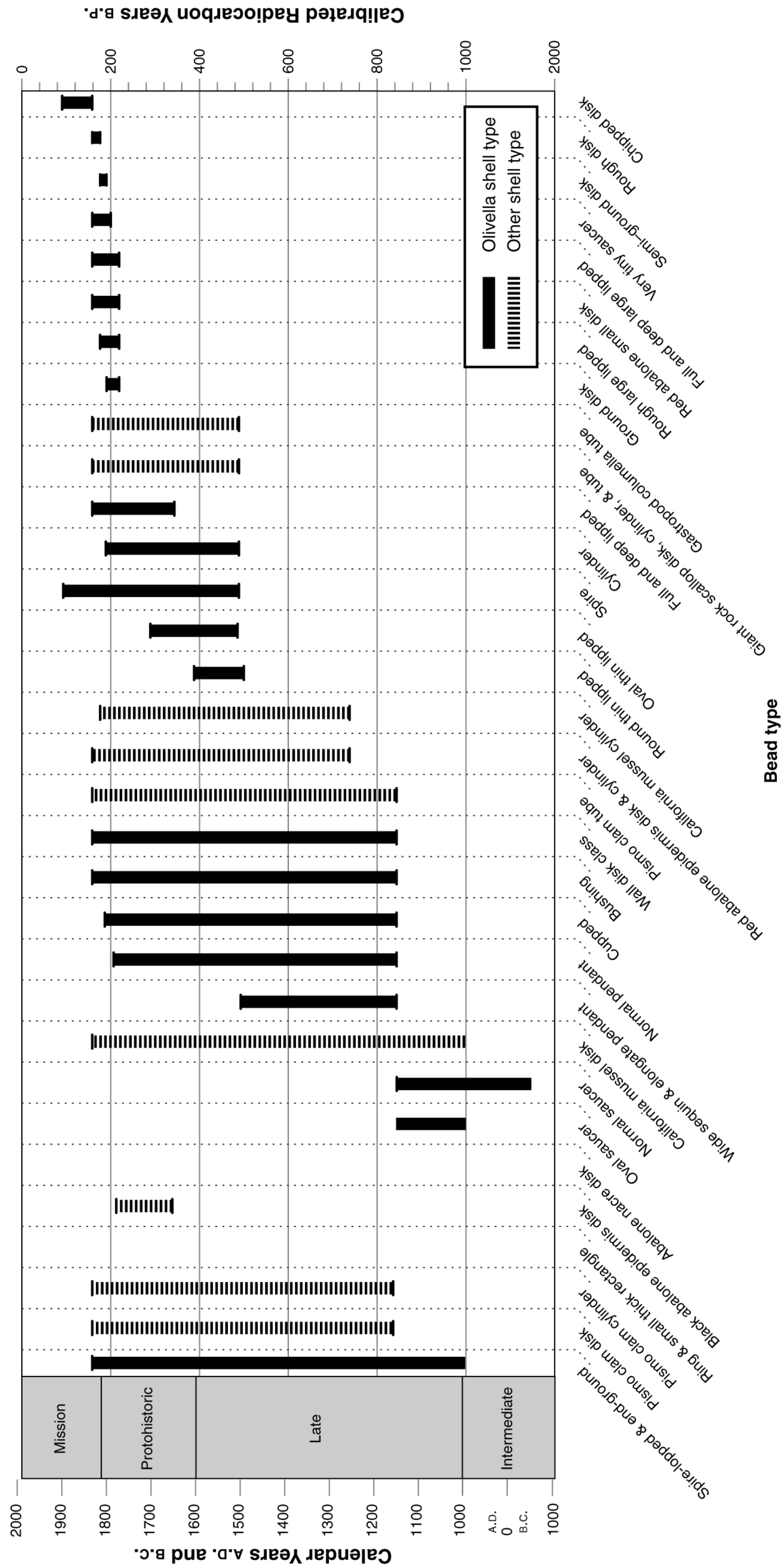

Figure 67. Late to Mission period shell beads.

Table 63. Shell Nonbead Ornaments in PVAHP Collections, by Gifford Type and Approximate Dates

Gifford (1947) Type (Abbreviation)	Shell Type	Description	Approximate Ornament Dates (Gifford 1947; King 1990a)
C1	chestnut cowrie	perforated wall	5500–200 B.C., A.D. 700–900, and A.D. 1500–1800
D	bivalve	perforated shell	unknown
D3	bivalve	perforated shell	unknown
F	univalve	top removed	unknown
H	univalve	natural shell opening	unknown
H2aI	giant keyhole limpet	plain ring	600–200 B.C. and A.D. 700–1650
H2aII	giant keyhole limpet	ring with offset	A.D. 400–700
J2	abalone	artificial shell ring, unperforated	all periods
J7aI	abalone	offset ring with single perforation	A.D. 1500–1816
K	abalone	perforated disk	unknown
K1	abalone	disk with single perforation	4000 B.C.–A.D. 1000 and A.D. 1150–1816
K1a	abalone	disk with single perforation and plain edge	4000 B.C.–A.D. 1000 and A.D. 1150–1816
K1b	abalone	disk with single perforation and incised edge	unknown, likely A.D. 300–700 and A.D. 1250–1816
K3	abalone	disk with two nearly central perforations	4000 B.C.–A.D. 200, A.D. 400–1150, and A.D. 1650–1816
K3aI	black abalone	disk with two nearly central perforations	4000 B.C.–A.D. 200, A.D. 400–1150, and A.D. 1650–1816
L1f	Pacific white venus	unperforated disk/oval/teardrop/fusiform shape	unknown
S	abalone	rectangular ornament	200 B.C.–A.D. 1050 and A.D. 1150–1816
S2aII	abalone	rectangular with single perforation on short side plain edge	200 B.C.–A.D. 1050 and A.D. 1150–1816
S5bII	abalone	rectangular ornament with single perforation and incised edge	200 B.C.–A.D. 1050 and A.D. 1150–1816
S6aIII	abalone	rectangular double-perforated plain edge	unknown
U	abalone	triangular ornament	600 B.C.–A.D. 1816
U2aI	abalone	single perforation near base with plain edge	600 B.C.–A.D. 1816
W1	bivalve	triangular-shaped with broad base	600 B.C.–A.D. 400
Z	abalone	sausage shaped	1000 B.C.–A.D. 100 and A.D. 1150–1816

Table 64. PVAHP Chronological Framework

Period	Subperiod	cal B.P.	B.C./A.D.
Millingstone	early	8500–6000	6550–4050 B.C.
	middle	6000–5000	4050–3050 B.C.
	late	5000–3000	3050–1050 B.C.
Intermediate	early	3000–1600	1050 B.C.–A.D. 350
	late	1600–1000	A.D. 350–950
Late		1000–408	A.D. 950–1542
Protohistoric		408–179	A.D. 1542–1771
Mission	early	179–150	A.D. 1771–1800
	late	150–134	A.D. 1800–1816
	terminal	134–116	A.D. 1816–1834
Historical		179–9	A.D. 1771–1941

Table 65. Shell Beads and Other Worked-Shell Artifacts, by Type and Period, LAN-2768

Artifact Type	Locus	Excavation Context	Level	Artifact Description	Count	Approximate Temporal Range[a]	Period
Beads	A	EU 6	12	olivella small normal saucer	1	600 B.C.–A.D. 1150	Intermediate–Late
		EU 7	3	red abalone epidermis disk	1	A.D. 1770–1834	Mission
		EU 51	3	olivella small normal saucer	1	600 B.C.–A.D. 1150	Intermediate–Late
		EU 57	3	olivella small normal saucer	1	600 B.C.–A.D. 1150	Intermediate–Late
	B	EU 516	21	olivella small oblique spire-lopped	1	1000 B.C.–A.D. 400	Intermediate
		CU 524	8	olivella full lipped	1	A.D. 1650–Mission period	Protohistoric–Mission
Subtotal					6		
Other worked-shell artifacts	A	EU 6	4	Pismo clam asphaltum covered shell	1	unknown	unknown
		EU 19	1	Pismo clam indeterminate worked fragment	1	unknown	unknown
		EU 30	5	Pismo clam bead blank	2	unknown	unknown
		EU 55	1	scallop disk pendant	1	unknown	unknown
		Feature 24		Pacific calico scallop asphaltum-coated shell	1	unknown	unknown
Subtotal					6		
Total					12		

Key: CU = control unit; EU = excavation unit.
[a] Dates based on Gibson 1992; King 1974, 1990.

Table 66. Shell Beads and Other Worked-Shell Artifacts, by Type and Period, LAN-54

Artifact Type	Excavation Context	Level	Artifact Description	Count	Approximate Temporal Range[a]	Period
Beads	CU 11		olivella wall disk	1	A.D. 1150–Mission period	Late to Mission
	CU 11	7	Pismo clam cylinder	1	1000–200 B.C. and A.D. 1150–Mission period	Intermediate and Late to Mission
	CU 11	7	Pismo clam tube	2	A.D. 1150–Mission period	Late to Mission
	CU 11	8	black abalone epidermis disk	1	600 B.C.–A.D. 400 and A.D. 1650–1782	Intermediate and Protohistoric–Mission
	CU 11	10	olivella small, simple-spire lopped	1	all periods	Millingstone–Mission
	EU 20	7	Pismo clam disk	1	5500–200 B.C. and A.D. 1150–Mission period	Millingstone–Intermediate and Late to Mission
	EU 58	2	olivella medium, simple-spire lopped	1	all periods	Millingstone–Mission
Subtotal				8		
Other worked-shell artifacts	CU 11	5	Pismo clam ornament blank	1	unknown	unknown
	EU 19	2	abalone indeterminate worked fragment	1	unknown	unknown
	EU 57	2	abalone ring pendant (Gifford Type J2)	1	all time periods	Millingstone–Mission
	Feature 3	1	scallop ornament (Gifford Type D)	1	unknown	unknown
	Feature 16	1	Pacific gaper asphaltum-coated shell	1	unknown	unknown
	Feature 33	1	Pismo clam asphaltum-coated shell	1	unknown	unknown
	Feature 33	4	California mussel indeterminate worked shell	1	unknown	unknown
	Feature 36	1	speckled scallop asphaltum-coated shell	1	unknown	unknown
Subtotal				8		
Total				16		

Key: CU = control unit; EU = excavation unit.
[a] Dates based on Gibson 1992; Gifford 1947; King 1974, 1990.

drilled with an iron needle), the red abalone epidermis disk dates to post–A.D. 1781 (Gibson 2000:14). This is much later compared to the other bead types, which were dated between the Intermediate and Late periods. In general, olivella bead varieties in Locus B differed from those identified in Locus A, all identified as normal saucers. Additionally, Locus B beads were dated slightly earlier and later than those from Locus A.

LAN-2768, Locus A, also yielded several other worked-shell artifacts. All were recovered from excavation unit contexts, with the exception of a Pacific calico scallop shell coated with asphaltum identified in Feature 24. The Intermediate period feature, a possible prehistoric house floor, was lined with a cobble lens of mostly unshaped FAR. Scattered among the cobbles were flaked stone debitage and unworked-shell and faunal bone fragments. Approximately half of the faunal bones were burned. This evidence, as well as the recovery of small quantities of charcoal and carbonized seeds suggests that thermal activities occurred in the feature. Cordage or fiber impressions were noted in the asphaltum on the scallop's dorsal and ventral surfaces. The cordage likely had been wrapped around the shell and secured with asphaltum. The scallop shell did not appear to be burned, indicating that it was likely deposited following thermal activities.

The worked-shell collection's two Pismo clam bead blanks suggest localized bead manufacture at LAN-2678. A third fragment of Pismo clam exhibited evidence of having been drilled and may also represent a bead blank. Considering evidence for onsite Pismo clam–bead production, the absence of finished Pismo beads is striking. Pismo clam–bead production may have been limited, or beads may have been transported off the site. The small sample size, however, precludes drawing definite conclusions.

With the exception of olivella, the worked-shell collection consisted of local taxa that were also identified in the LAN-2768 unworked invertebrate collections (discussed in Chapter 13, this volume). Following consumption of the shellfish meat, the shells could have been easily reserved for other uses, such as ornament manufacture and processing of other materials, as may be the case for the shells coated with asphaltum. Overall, the worked-shell collection indicates that, by the Intermediate period, the Ballona residents' use of shells was part of cultural traditions. This use, though limited, entailed both domestic and decorative functions.

Shell Beads and Other Worked Shell Recovered from LAN-54

Fifteen worked-shell artifacts were identified at LAN-54, which was occupied between the late Millingstone and early Intermediate periods. The collection consisted of eight shell beads and eight other worked-shell artifacts recovered from midden, three artifact concentrations (Features 16, 33, and 36), and one human burial (Feature 3) (see Table 66).

For the most part, LAN-54 shell-bead types were markedly different from those identified at LAN-2768. Half of the LAN-54 beads were identified as Pismo clam disk, cylinder, and tube varieties, which were absent from the LAN-2768 collections. CU 11 contained most (n = 6) of the shell beads in addition to a Pismo clam bead blank. The association of finished and in-production Pismo clam beads in the control unit suggests localized bead production and retention of the beads. CU 11 also yielded a black abalone epidermis disk, commonly manufactured between 600 B.C. and A.D. 400, as well as later between A.D. 1650 and 1782. The former date range is more likely, considering late Millingstone and early Intermediate occupation at LAN-54. Collectively, dates for the shell beads range between the Millingstone period and the Intermediate period and during and following the Late period. The latter period may represent occasional visits to the site.

In addition to the shell beads, the collection of other worked-shell artifacts consisted of a variety of nonbead shell ornaments and artifacts that may have been associated with artifact manufacture and processing. These artifacts were recovered from excavation and control units in midden and features. Excavation units contained an abalone ring ornament fragment (Gifford Type J2) and a trapezoidal-shaped indeterminate worked black abalone fragment with four cut sides and a ground dorsal surface. The indeterminate fragment may be a shell artifact blank or manufacturing debris associated with shell artifact production.

Human burial Feature 3, located in the southwest portion of the site and adjacent to an artifact concentration (Feature 16), contained a scallop ornament fragment. In general, the burial (a 35–39-year-old female) contained few associated artifacts. The scallop ornament fragment, classified as Gifford Type D (perforated valve), consisted of what was once a whole shell with a perforation punched near the lower margin. The ornament, found near the human cranium, may have been an earring or pendant.

Three artifact-concentration features contained worked shell. Feature 16 was made up of a concentration of lithics and unworked-shell and bone fragments, whereas Feature 33 consisted of a pit containing lithics, FAR, and relatively high frequencies of burned shell and bone. Feature 36 was identified as an FAR concentration and an abalone shell overlying a cluster of clam and scallop shells. Each of the nonburial features contained shell fragments coated with asphaltum. The fragments reflected a range of taxa, including Pismo clam, speckled scallop, and Pacific gaper. Asphaltum may have been intentionally applied to these shells as part of processing activities or became inadvertently adhered when the shells were discarded. If asphaltum was intentionally applied, the shells could have functioned as asphaltum containers or applicators. Feature 33 also yielded a perforated California mussel hinge fragment. The fragment was drilled from the ventral side near the shell edge. The worked shell may reflect an early stage of bead or other ornament production.

In general, the low frequency of worked-shell artifacts does not indicate a strong coastal adaptation during the late Millingstone and early Intermediate periods, particularly when compared to the much higher frequencies recovered from Late through Mission period contexts in the Ballona. Shell ornaments, however, were incorporated into early burial practices, as evidenced in burial Feature 3. The absence of shell beads in the burial is striking and brings into question whether shell beads were not available at the time of interment, or perhaps shell beads were not a favored burial offering in the Ballona during the late Millingstone and early Intermediate periods. The overall low frequencies of shell beads, however, does not appear to be due to a preference for stone beads, considering the latter were absent from LAN-54 lithic collections.

Shell Beads and Other Worked-Shell Artifacts Recovered from LAN-62

Almost all of shell beads and other worked-shell artifacts from the PVAHP were recovered from LAN-62 (n = 90,586; 96.8 percent). The large collection of shell beads and other worked-shell artifacts from LAN-62 attests to the intensive use of this area over time, particularly within ritual and ceremonial contexts associated with the human burial area. The following is a discussion of analysis results, grouped by Loci A/G and C/D at LAN-62. For each locus grouping, the discussion begins with the results of shell-bead analyses by analytical context. Other worked-shell artifacts recovered from control units and features also containing shell beads are briefly described as well. The results of shell-bead analyses are then summarized and discussed in terms of descriptive and typological patterning. Following the main section on shell beads, the results of other worked-shell analyses are presented and summarized, along with an examination of descriptive and typological patterning. The discussion of LAN-62 concludes with a sitewide summary.

LAN-62 A/G Shell-Bead Sampling Strategy

In terms of shell-bead frequencies and types, the LAN-62 A/G shell-bead collection is the largest and most diverse of the PVAHP collections (Table 67). In the following discussion of analysis results for the analyzed shell beads, data from the control units are presented first, followed by burials, nonburial features and excavation units in the main burial area; FBs 3, 4, and 7; and sitewide feature and excavation-unit contexts. The feature blocks were identified as areas of concentrated activities and include features and adjacent excavation units.

Control Units

Shell beads were analyzed from control units, which were widely distributed across the site, and therefore provide spatial comparisons and characterizations of different areas of the site. Eleven control units within LAN-62 A/G were selected for analysis. Of these, 10 yielded 478 shell beads and 11 other worked-shell artifacts (Tables 68–70). All 10 of these control units were located in Locus A, whereas the one control unit selected for analysis in Locus G did not yield shell beads. Data from the 10 control units offer insight into areas located within and adjacent to the main burial area and FB 7, as well as areas outside of the main burial area and feature blocks. Detailed discussions of distribution of artifacts in each control unit are discussed in Appendix C.16.

Overall, control units yielded a moderate frequency of shell beads, as well as 21 different shell-bead types. Most of the control units were excavated in sitewide or general midden contexts, whereas a few were located in the main burial area or feature blocks. Sitewide or midden contexts contained more than half (54.8 percent) of the beads (see Table 69). This distribution, however, is likely a factor of the greater number of control units excavated in general midden context rather than an accurate gauge of intensity of activities adjacent to the main burial area. Shell-bead densities were highest for CUs 141 and 186, which were located in the main burial area (see Table 68).

Olivella disk beads (42.2 percent) composed the bulk of the collection, whereas lipped varieties made up nearly one-third (30 percent) of the collection (see Table 69). Overall, beads manufactured from shell other than olivella were relatively uncommon (5.9 percent). Shell-bead dates for control units, in general, ranged from the Intermediate period to the Mission period, though CU 141, located in the main burial area, contained shell beads dating from the Millingstone to the Mission period. For all of the control units, shell-bead time ranges corresponded with the results of chronostratigraphic analysis for the upper levels (see Table 70). Shell-bead ages and chronostratigraphy, however, did not correspond in the lower levels of most units. Beads recovered from these lower levels were typically dated much later than the chronostratigraphy results indicated. These later-dated beads were likely displaced from overlying levels, possibly as a result of bioturbation or other ground disturbance, including reuse of the site during and following the Mission period. Chronostratigraphy and shell-bead dates corresponded, however, throughout the levels in three control units: CU 186 located in the main burial area and CUs 316 and 609 excavated in the sitewide or general midden contexts.

Compared to shell beads, other worked-shell frequencies were relatively low, totaling 11 artifacts recovered from 5 control units. The other worked-shell artifact collection was largely utilitarian in function, with the exception of a fossil Lewis's moon snail ornament from CU 853 and a possible olivella bead blank, represented as a whole olivella shell, from CU 323/321. The remaining collection included miscellaneous ground shell fragments, asphaltum-coated shell, and an abalone rim tool. Most of the other worked-shell artifacts were recovered from sitewide contexts (n = 8); however, a few were recovered from the burial area (n = 2) as well as immediately adjacent to the burial area (n = 1).

Table 67. Summary of Excavation Contexts and Shell-Bead Frequencies, LAN-62 A/G

Provenience	Excavation Context	Count	Percent
Control units		478	0.53
Burial features	features	65,397	72.19
Burial area	excavation units	16,597	18.32
	nonburial features	1,371	1.51
FB 3	excavation units	475	0.52
	features	758	0.84
FB 4	excavation units	45	0.05
	features	3	<0.01
FB 7	excavation units	2	<0.01
	features	—	
Sitewide	excavation units	5,287	5.84
	features	173	0.19
Total		90,586	100.00

Table 68. Shell Beads and Other Worked-Shell Artifacts in Control Units, by Frequencies and Densities, LAN-62 A/G

Control Unit No.	Cultural Period (Based on Chronostratigraphic Analysis)	Shell Beads (n)	Other Worked Shell (n)	Total Shell Artifacts (n)	Excavation Volume (m^3)	Shell-Bead Density (per m^3)	Other-Worked-Shell Density (per m^3)	Total Shell-Artifact Density (per m^3)
26	Late to Mission	14	3	17	0.5	28.0	6.0	34.0
	early Intermediate	1	—	1	0.5	2.0	—	2.0
	late Millingstone	9	2	11	1.3	7.0	2.0	8.0
Subtotal		24	5	29	2.3	10.0	2.0	13.0
119	Late to Historical	3	—	3	0.5	6.0	—	6.0
	early Intermediate	6	—	6	0.8	8.0	—	8.0
Subtotal		9	—	9	1.3	7.0	—	7.0
141	fill	65	—	65	0.2	325.0	—	325.0
	Late to Historical	21	—	21	0.3	70.0	—	70.0
	late Intermediate–Late	14	—	14	0.5	28.0	—	28.0
	Intermediate	5	—	5	0.3	17.0	—	17.0
	early Intermediate	1	—	1	0.1	10.0	—	10.0
Subtotal		106	—	106	1.4	76.0	—	76.0
186	Late to Historical	74	2	76	1.5	49.0	1.0	51.0
306	Late to Historical	122	—	122	0.9	136.0	—	136.0
	late Intermediate–Late	4	—	4	0.3	13.0	—	13.0
	Intermediate	1	—	1	0.7	1.0	—	1.0
	late Millingstone	2	—	2	0.8	3.0	—	3.0
Subtotal		129	—	129	2.7	48.0	—	48.0
316	Late to Historical	16	—	16	0.7	23.0	—	23.0
	early Intermediate	2	—	2	0.6	3.0	—	3.0
Subtotal		18	—	18	1.3	14.0	—	14.0
323/321	Late to Historical	77	1	78	0.7	110.0	1.0	111.0
	early Intermediate	7	1	8	1.1	6.0	1.0	7.0
	late Millingstone	1	—	1	0.4	3.0	—	3.0
Subtotal		85	2	87	2.2	39.0	1.0	40.0
609	Late to Historical	23	—	23	1.3	18.0	—	18.0
682	Late	1	—	1	0.2	5.0	—	5.0
	early Intermediate	3	1	4	1.3	2.0	1.0	3.0
Subtotal		4	1	5	1.5	3.0	1.0	3.0
853	Late to Historical	4	—	4	0.3	13.0	—	13.0
	early Intermediate	2	1	3	0.7	3.0	1.0	4.0
Subtotal		6	1	7	1.0	6.0	1.0	7.0
Total		478	11	489	16.5	29.0	0.7	29.6

Table 69. Shell-Bead Types Identified in Control Units by Location within LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	General Provenience: Sitewide (CUs 26, 306, 316, 323/321, 853)	FB 7 (CU 119)	Burial Area (CUs 141, 186)	Near Burial Area (CUs 609, 682)	Total	Percent within Each Bead Type	Percent of all Shell Beads
Olivella	spire-lopped	simple spire-lopped	2	—	—	—	2	0.44	0.4
	lipped	lipped class	22	—	2	—	24	5.33	5.0
		round thin lipped	32	3	3	5	43	9.56	9.0
		oval thin lipped	21	3	2	2	28	6.22	5.9
		thick lipped	40	1	1	3	45	10.00	9.4
		full large lipped	1	—	—	—	1	0.22	0.2
		rough large lipped	4	—	—	—	4	0.89	0.8
Subtotal (lipped)			120	7	8	10	145	32.22	30.3
	saucer	tiny saucer	9	1	1	—	11	2.44	2.3
		normal saucer	8	—	1	—	9	2.00	1.9
Subtotal (saucer)			17	1	2	—	20	4.44	4.2
	disk	ground disk	—	1	—	—	1	0.22	0.2
		semiground disk	55	—	142	4	201	44.67	42.1
Subtotal (disk)			55	1	142	4	202	44.89	42.3
	callus	cupped	53	—	—	10	63	14.00	13.2
		bushing	7	—	5	—	12	2.67	2.5
		cylinder	2	—	1	2	5	1.11	1.0
Subtotal (callus)			62	—	6	12	80	17.78	16.7
	unknown	unknown	1	—	—	—	1	0.22	0.2
Subtotal (olivella)			257	9	158	26	450	100.00	94.1
Abalone	disk	red abalone epidermis disk	5	—	11	—	16	94.12	3.3
		black abalone epidermis disk	—	—	—	1	1	5.88	0.2
Subtotal (abalone)			5	—	11	1	17	100.00	3.6
Pismo clam	cylinder	*Tivela* cylinder	—	—	7	—	7	63.64	1.5
	tube	*Tivela* tube	—	—	4	—	4	36.36	0.8
Subtotal (Pismo clam)			—	—	11	—	11	100.00	2.3
Total			262	9	180	27	478		100.0

Key: CU = control unit.

Table 70. Summary of Shell Beads in Analytical Contexts, by Cultural Stratum and Corresponding Cultural Period, LAN-62 A/G

General Provenience	Excavation Context	Cultural Period and Corresponding Cultural Stratum							Total
		Late to Mission			Early Intermediate	Intermediate	Millingstone	Indeterminate	
		V	V/IV	IV	IV/III	III	II	Other	
Control units (sitewide)		60	—	386	1	19	10	2	478
Burial features	features	—	—	65,382	—	11	—	4	65,397
Burial area	excavation units	1,377	417	14,621	—	—	—	182	16,597
	nonburial features	—	—	1,217	—	—	—	154	1,371
FB 3	excavation units	—	13	462	—	—	—	—	475
	features	—	—	758	—	—	—	—	758
FB 4	excavation units	—	—	45	—	—	—	—	45
	features	—	—	3	—	—	—	—	3
FB 7	excavation units	—	—	—	—	1	1	—	2
	features	—	—	—	—	—	—	—	—
Sitewide	excavation units	472	88	4,491	—	33	3	200	5,287
	features	—	—	171	—	2	—	—	173
Total		1,909	518	87,536	1	66	14	542	90,586
Percentage			99.31[a]		<0.01	0.07	0.02	0.60	100.00

[a]Percentage for all Late to Mission period cultural strata.

Burial Features

LAN-62 A/G is characterized by the large burial area located in the southern portion of the site. The burial area measured roughly 46 by 26 m. Most of the burials were concentrated, however, within a 10-by-10-m area—similar in size to the historical-period Malibu burial ground. This dense portion of the burial area contained numerous pieces of whale bone, possibly used as markers to delineate the burial ground boundary (see Chapter 8, Volume 2 of this series; for osteological and demographic details on burial features discussed in this chapter, see Volume 4 of this series; and for a discussion of artifacts other than worked shell recovered from burial features, see other chapters in this volume). With respect to worked shell, nearly half of the burials contained shell beads. In this study, a total of 65,397 shell beads and 110 other worked-shell artifacts were analyzed from 307 burial features. Because of the large number of burial features containing shell beads and the wide range in shell-bead frequencies in each burial feature, burial features were grouped into seven categories for discussion purposes: Group 1 (with bead frequencies greater than 4,600), Group 2 (1,501–4,600), Group 3 (701–1,500), Group 4 (301–700), Group 5 (101–300), Group 6 (26–100), and Group 7 (1–25) (Table 71; Figure 68; Appendix C.17).

These shell-bead-frequency range groups were identified using a combination of visual inspection of frequency data and spatial clustering of features within the burial area. The former involved examination of a continuous bar chart showing the distribution of burial features by shell-bead counts grouped in arbitrary intervals of 25 beads (0–25, 26–50, 51–75, etc.) (see Shennan 1997:25–27). The spatial distribution of burial features within these bead-count interval groups was then examined for horizontal clustering within the main burial area. Based on clustering of frequency data and spatial distribution, the bead-count interval groups were then inductively smoothed, combining burial features into seven groups.

Burial features comprising Group 1 were located in the west-southwest portion of the main burial area and adjacent to Group 2 features. Collectively, these two groups formed a ringed cluster in the west-southwest portion of the main burial area. Most of the burial features situated within the center of the ringed cluster consisted of Group 5 features. Group 3 and 4 burial features were located adjacent to the Group 5 burials, within the central and southwest portions of the main burial area. For the most part, Group 6 burial features surrounded Groups 1–5 burial features, within the central portion of the main burial area. Burial features comprising Group 7 were much more widely dispersed; however, they were mostly located in the central and northern portions of the burial area.

The following is a discussion of the results of shell-bead analysis by the seven burial groupings. Other worked-shell artifacts recovered from the burial features are discussed here as well. Few burial features contained more than 1,500 beads; consequently, these features are discussed in more detail. Numerous features, however, contained 500 beads or fewer and are discussed in general terms, highlighting feature locations within the burial area; unusual beads types; and patterns relating to sex and age of the burial individual, stringing patterns, and artifact associations. Additionally, for Groups 3–7, the burials are grouped spatially within each group, and discussed accordingly.

Burial Feature Group 1 (Bead Counts >4,600)

Group 1 is composed of four burial features yielding shell-bead frequencies greater than 4,600 beads each (Table 72; see also Table 71) The features were located in a 3-by-3-m area in the west-southwest portion of the main burial area (see Figure 68).

Burial Feature 14

This feature was located in the western portion of the main burial area and consisted of four individuals, including a 40–55-year-old possible male interred fully flexed on the left side and oriented to the southeast with the head facing southwest. In addition to this primary individual, three other inhumations of indeterminate sex were identified: one individual 2–4 years of age, one 15–25 years of age, and another individual of unknown age.

A total of 13 varieties of beads was recovered from this burial feature (see Table 72). By far, semiground disks (85 percent) composed the bulk of the collection. Almost half

Table 71. Summary of Human Burial Features Grouped by Shell-Bead-Frequency Ranges, LAN-62 A/G

Human Burial Group	Analyzed Shell Beads per Human Burial Feature (n)	Number of Human Burial Features	Total Analyzed Shell Beads in Human Burial Feature Group	Percent
1	>4,600	4	23,582	36.06
2	1,501–4,600	6	16,944	25.91
3	701–1,500	8	10,567	16.16
4	301–700	13	7,023	10.74
5	101–300	21	3,739	5.72
6	26–100	43	2,304	3.52
7	1–25	206	1,238	1.89
Total		301	65,397	100.00

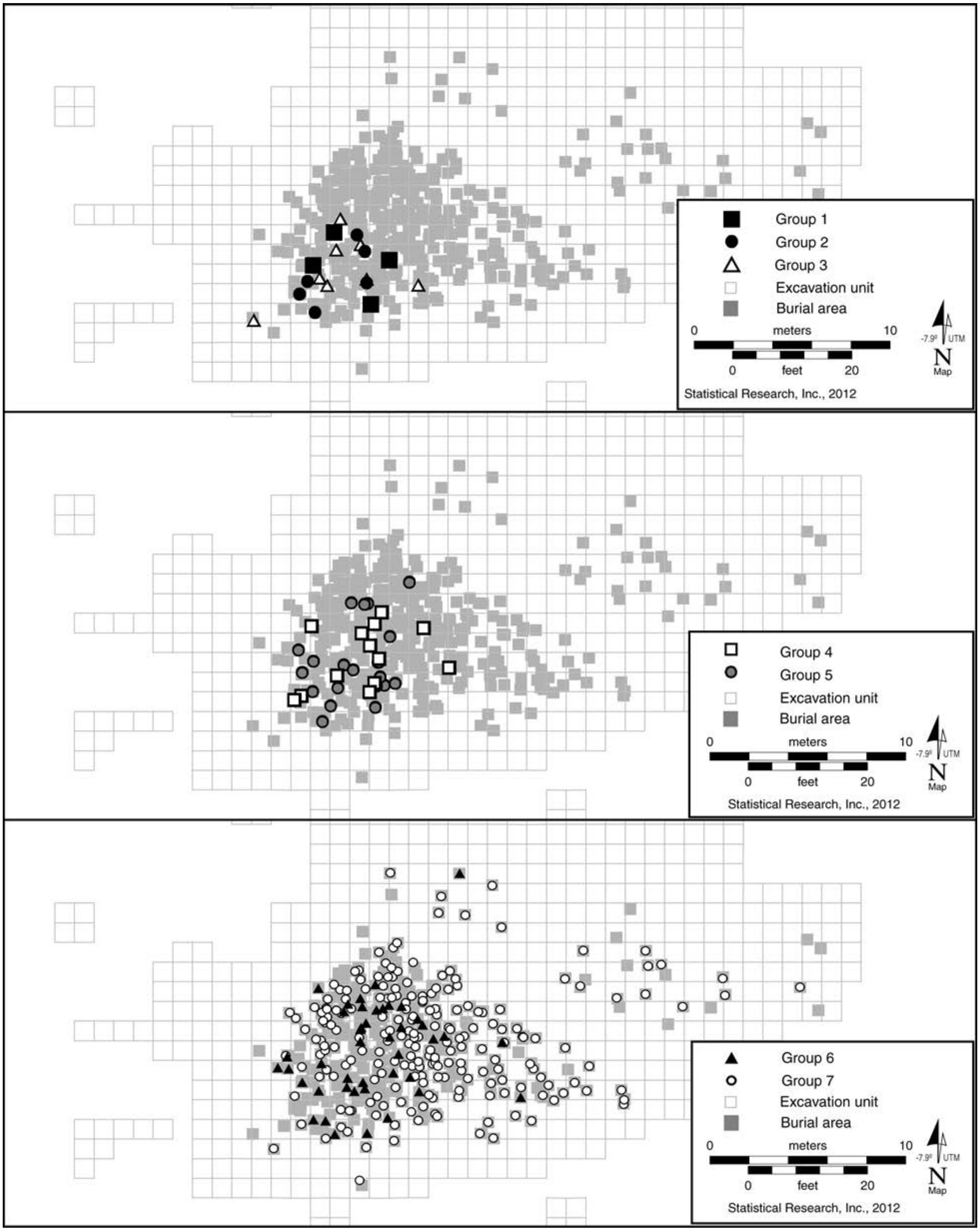

Figure 68. Burial feature groups by shell-bead frequency, LAN-62 A/G.

Table 72. Summary of Shell Beads in Human Burial Feature Group 1, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Burial Feature No. 14	38	76	408	Total	Percent within Each Shell Type	Percent of All Shell Beads
Olivella	spire-lopped	simple spire-lopped	—	65	—	—	65	0.3	0.3
	end-ground	spire	4	4	3	—	11	<0.1	<0.1
	lipped	thin lipped	5	2	—	—	7	<0.1	<0.1
		thick lipped	—	1	—	—	1	<0.1	<0.1
		rough large lipped	—	—	1	—	1	<0.1	<0.1
Subtotal (lipped)			5	3	1	—	9	<0.1	<0.1
	saucer	tiny saucer	1	—	—	—	1	<0.1	<0.1
		normal saucer	—	—	1	—	1	<0.1	<0.1
Subtotal (saucer)			1	—	1	—	2	<0.1	<0.1
	disk	disk class	96	1,805	4,254	—	6,155	27.2	26.1
		ground/semiground disk	20	24	3	—	47	0.2	0.2
		ground disk	203	209	81	4	497	2.2	2.1
		semiground disk	4,042	3,476	1,148	6,044	14,710	65.0	62.4
		rough disk	4	108	10	—	122	0.5	0.5
		chipped disk	—	1	—	—	1	<0.1	<0.1
		subtotal	4,365	5,623	5,496	6,048	21,532	95.1	91.3
	wall disk	wall disk	4	60	9	—	73	0.3	0.3
	callus	bushing	—	—	1	1	2	<0.1	<0.1
	thin rectangle	wide sequin	—	—	1	—	1	<0.1	<0.1
	unknown	unknown	7	520	411	1	939	4.1	4.0
Subtotal (olivella)			4,386	6,275	5,923	6,050	22,634	100.0	96.0
Abalone	disk	red abalone epidermis disk	233	320	343	11	907	99.3	3.8
		black abalone epidermis disk	3	2	—	—	5	0.5	<0.1
Subtotal (disk)			236	322	343	11	912	99.9	3.9
	cylinder	red abalone epidermis cylinder	1	—	—	—	1	0.1	<0.1
Subtotal (abalone)			237	322	343	11	913	100.0	3.9
California mussel	disk	disk	—	1	—	—	1	100.0	<0.1
Pismo clam	cylinder	cylinder	—	—	2	—	2	11.1	<0.1
	tube	tube	—	12	4	—	16	88.9	0.1
Subtotal (Pismo clam)			—	12	6	—	18	100.0	0.1
Clam	disk	disk	1	1	—	—	2	100.0	<0.1
Unknown	unknown	unknown	2	12	—	—	14	100.0	0.1
Total			4,626	6,623	6,272	6,061	23,582		100.0

(48.4 percent) of the beads were associated with the primary individual, including 9 different types of olivella beads, as well as red and black abalone epidermis disks, a red abalone epidermis cylinder, and clam disks. Clusters of beads and bead strands were recovered from the primary individual's mandible area, near the mandible and vertebrae, at the base of the cranium, and around the vertebrae. These contexts indicate that at the time of interment, clusters and/or strands of beads were likely placed on and near the head and around the neck. Because of degradation, however, the total number of bead strands originally present could not be determined. Nevertheless, a minimum of at least two strands were present. Based on bead types found fused side by side, the following bead types were strung together, though not in order of sequence: red abalone epidermis disks, red abalone epidermis disks strung with olivella ground disks, ground disks, and semiground disks. In addition to shell beads, an abalone shell was found immediately southwest of the cranium of the primary individual. No modifications were noted to the shell; however, considering the proximity to the head, the shell was likely used as a container for mortuary offerings.

The remaining 2,385 beads were scattered throughout the matrix surrounding Feature 14. They may have been strung at one time, placed in clusters, or perhaps broadcast over one or more of the individuals. Association with particular individuals is unclear. For the most part, bead types found in the matrix were similar to those associated with the primary individual. Olivella spire beads, however, were found only in the neck region of the primary individual.

Time ranges for beads found in the burial matrix are identical to those found with the primary individual. Bead types with narrow time ranges, including those recovered from the feature matrix, consisted of ground disks (early Mission period), semiground disk (late Mission period), and rough disks (terminal Mission period). The abundance of semiground disks provides strong evidence for a late Mission period date. Nevertheless, the range in bead dates indicates this portion of the site may have been used on various occasions during the Mission period. A total of 247 glass beads was also recovered from the burial matrix (see Chapter 6, this volume), further supporting interment some time during the Mission period. Unfortunately, because of a lack of direct association, it is unclear whether some of the glass beads were strung together with the shell beads.

Burial Feature 38

This feature is located in the southwestern portion of the main burial area and consisted of five individuals. The primary inhumation is a female 20–30 years of age; she was interred semiflexed on her left side and oriented to the east with her head facing south. The second primary inhumation is an individual of indeterminate sex, aged between 20 and 30 years, interred fully flexed on the left side and oriented to the east with the head facing south. Additional individuals include what appears to be a female, aged 20–30, a possible male aged 16–22, and an adult at least 18 years of age or older of indeterminate sex.

Within the Group 1 burials, burial Feature 38 contained the highest frequency of shell beads, totaling 6,623 shell beads representing 20 different varieties (see Table 72). This high frequency may be a function, in part, of the multiple inhumations identified in the burial feature. Slightly more than half (51 percent) of the beads were identified as semiground disks. Burial Feature 38 had at least 60 bead-strand fragments; however, because of degradation, it is unclear how many strands were originally present as well as their associations with particular individuals in the burial pit.

Approximately 2,600 shell beads were directly associated with the female primary inhumation. Almost 1,000 beads were found near the individual's mandible. These beads consisted of a variety of different types, including mostly semiground disks in addition to lesser quantities of red abalone epidermis disks, ground disks, simple spire-lopped, and Pismo clam tube beads. Similar to burial Feature 14, low frequencies of spire beads were recovered from this area as well.

Approximately 600 beads were also recovered from the abdominal area of the primary individual. Bead types found in this area were similar to those found in the neck region with the exception of simple spire-lopped and spire beads, which were found only near the neck. Nearly 1,000 beads were recovered from the knee area of the female primary individual. As with the mandible and abdominal areas, olivella semiground and ground disks, including lipped varieties, rough disks, and red abalone disks, were recovered from this area. Of note, olivella disks recovered from this area of the burial exhibited a wide range in the degree of finish, including some with margins uniformly ground and others that were partially ground or simply chipped.

The primary individual appears to have been buried with at least two bead strands. Given the high frequency of beads in the mandible region, additional bead strands may have been present. Stringing patterns are not entirely clear; however, based on beads found fused side by side, the following types appeared to have been strung together: simple spire-lopped beads, semiground disks strung with red abalone epidermis disks, semiground disks, and red abalone epidermis disks. Glass beads were also found with the primary individual in locations similar to where clusters of shell beads were identified: the head, abdomen, and knee regions. It is unclear, however, whether glass and shell beads were strung together. Dates for beads found with the primary individual ranged from the Millingstone period through the Mission period. Most of the beads, however, were commonly used in the Mission period, particularly the latter portion of the Mission period.

The burial pit in which the indeterminate primary individual was identified contained 2,800 shell beads. Most of these beads were recovered from the burial matrix and cannot be directly associated with the individual. Only 50 of these beads were found in direct association and included Pismo clam tube beads, semiground disks, and red abalone epidermis disks. The latter two bead types appear to have been part of a strand. Beads found with the secondary individuals suggest a chronology ranging from the Late period to the Mission period, particularly the late Mission period. Interment of the primary and secondary individuals was likely contemporaneous.

The remaining beads, about 1,000, were found in the matrix surrounding the burial and are not clearly associated with particular individuals. These beads were similar to types found with the primary and secondary individuals. In addition to shell beads, one black abalone perforated disk ornament was recovered from the feature. Perforated abalone disks were used widely through time, beginning as early as the Millingstone period. Similarly, dates for shell beads recovered from burial Feature 38 ranged from the early Millingstone to the terminal Mission period and possibly as late as the A.D. 1830s. Bead types with narrow time ranges, including those recovered from the feature matrix, consisted of ground disks (early Mission period), semiground disk (late Mission period), rough disks (terminal Mission period), and chipped disks (ca. A.D. 1834–1900). These shell-bead types, along with the recovery of glass beads provide strong evidence for a Mission period date.

Burial Feature 76

This feature is located in the west-central portion of the main burial area. The primary inhumation was a 23–30-year-old possible male, who was interred fully flexed on the left side and oriented to the east with the head facing west. Isolated remains of at least two other individuals were identified. The first was a 20–25-year-old individual of indeterminate sex, and the second was a 20–30-year-old female.

Burial Feature 76 contained a total of 6,272 shell beads; the second highest frequency of the Group 1 burial features (see Table 72). Beads consisted of 16 different types. As with the burials discussed above, olivella spire beads were present, though in low frequencies. Additionally, the burial feature contained an olivella wide sequin, a relatively uncommon bead type in the LAN-62 A/G collection.

Most of the beads, nearly 4,000, were found with the primary individual. Bead types included olivella ground and semiground disks, as well as lipped and shelved varieties, spires, rough disks, and red abalone epidermis disks. Approximately 3,800 beads were found on top of the cranium, consisting of mostly heavily degraded olivella disks in addition to lower frequencies of semiground disks, including lipped and shelved varieties, red abalone epidermis disks, and two spire beads. Many of these beads were fused, indicating that some were once likely part of strands. Beads found fused side by side suggest the following beads were strung together: olivella disks strung with olivella spire and red abalone epidermis disks, red abalone epidermis disks, red abalone epidermis disks strung with olivella disks, and semiground disks. Glass beads were also recovered from the cranium area; however, it is unclear whether they were strung together with shell beads. Overall, bead types were similar to those found with one of the primary individuals in burial Feature 38, which consisted of the remains of a female of similar age.

Shell beads were also recovered from the chest region of the primary individual. Approximately one dozen olivella disks and red abalone epidermis beads were found in this area strung with glass beads. The stringing pattern consisted of one shell bead followed by five glass beads of alternating red and blue color. Additionally, a small cluster of shell beads was found near the left foot. Bead types were similar to those found near the cranium and chest. Overall, dates for the bead types found with the primary individual range from the early Intermediate period to the terminal Mission period, most occurring during the Mission period.

A Pismo clam tube bead was located next to the cranium of the second individual. Nearly 500 olivella disk beads were found in proximity to the second individual, as well as lower frequencies of red abalone epidermis disks and Pismo clam tubes located in the vicinity of the second individual. Direct association of the beads with the second individual, however, is tenuous. The time range for the second individual may date to the Mission period and as early as the Late period.

The remaining shell beads, approximately 1,900, were found in the burial matrix and were not clearly associated with any individuals. Bead types were similar to those found with the primary individual and in proximity to the second individual, with a few exceptions. These exceptions include an olivella wide sequin, rough large lipped, and rough disk. These bead types commonly occurred during the Late period, the Mission period, and the terminal Mission period, respectively. Considering that burial Feature 76 appears to intrude into other burials, the Late period wide sequin bead may have originated from one of these earlier burials. In general, bead types with narrow time ranges, including those recovered from the feature matrix, consisted of a normal saucer (between Intermediate and early Late periods), wide sequin (Late period), ground disks (early Mission period), semiground disk (late Mission period), and rough disks (terminal Mission period). The abundance of semiground disks provides strong evidence for a late Mission period date. Nevertheless, the range in bead dates indicates this portion of the site may have been used sometime during the Intermediate and Late periods and later during the Mission period.

Burial Feature 408

This feature is located in the western portion of the main burial area and consisted a 30–40-year-old female who was fully flexed on her left side and oriented south with her head facing northwest. Within Group 1 burial features, burial Feature 408 was the only feature with a single inhumation.

Analysis included a total of 6,061 shell beads consisting of six different varieties (see Table 72). Nearly all of the beads were semiground disks, dating to the late Mission period. Approximately 4,200 beads were directly associated with this individual. These beads were found in five to six bead-strand loops around her neck. Because of degradation, the original number of bead strands could not be determined. The strands were made up of mostly semiground disks, including a few lipped varieties, as well as very low frequencies of ground disks and red abalone epidermis disks.

The remaining beads, totaling approximately 1,860, were recovered from the burial matrix. These beads were identical to types found with the individual, with the exception of one bushing bead recovered from the matrix. In general, bead types with narrow time ranges, including those recovered from feature matrix, consisted of ground disks (early Mission period) and semiground disk (late Mission period). The abundance of semiground disks provides strong evidence for a late Mission period date; however, this portion of the site appears to have been used on different occasions during the Mission period. As noted before, compared to the burial features discussed above, the bead composition for burial Feature 408 is unusual in that nearly all of the beads were identified as semiground disks. It is also possible that the near absence of other bead types may reflect cultural preferences or perhaps limited access to other bead types in the Ballona at the time of interment.

Burial Feature Group 2 (Bead Counts 1,501–4,600)

Group 2 consists of six burial features identified with bead counts ranging between 1,501 and 4,600 (Table 73; see also Table 71). Burial Features 13, 265, and 327 were located in a 4.1-by-2.7-m area in the southwest portion of the main burial area, and burial Features 22, 105, and 516 were located in the west-central portion of the main burial area (see Figure 68). These burials, along with those containing bead frequencies greater than 4,600 are located in a circular cluster within the west-southwest portion of the main burial area. Many of the burials within the central portion are part of Group 5, containing bead frequencies ranging between 101 and 1,500.

Burial Feature 13

This feature is located in the southwest portion of the main burial area and included a 25–35-year-old female, who was interred fully flexed on her left side and oriented to the south and facing west. The primary individual in Feature 6 (Group 5) appears to have impacted the burials of Feature 13. Additionally, the remains of three other individuals were found in the burial pit: two adults of indeterminate sex and a third individual of indeterminate age and sex.

A total of 2,478 shell beads was recovered from the burial feature, including six different varieties (see Table 73). Olivella semiground disk beads composed the bulk (66.9 percent) of the collection. As with the burial features discussed above, a single olivella spire bead was found associated with the primary individual. The primary individual was buried with approximately 650 shell beads. Bead types were similar to those found with primary individuals in burial Features 38, 76, and 408 (of Group 1), who were also female and of similar age. Three or four bead-strand loops, composed of mostly semiground disks, were recovered from the neck area. Beads found fused side by side suggest the following stringing patterns: semiground disks, semiground disks strung with tiny saucers, and tiny saucers.

A second cluster, composed of more than 300 beads, was found adjacent to the cranium. This cluster contained beads similar to those found in the neck area, in addition to one Pismo clam tube and olivella beads of unknown type. A stone plummet charmstone, found immediately adjacent to this cluster of beads, may have once been strung with the shell beads.

The remaining beads, approximately 1,500, were recovered from the burial matrix and consisted of mostly semiground disks and tiny saucers. Dates for beads recovered from this feature range from the early Intermediate period through the terminal Mission period. Bead types with narrow time ranges, including those recovered from feature matrix, consisted of ground disks (early Mission period), semiground disk (late Mission period), and rough disks (terminal Mission period). The abundance of semiground disks provides strong evidence for a late Mission period date. Nevertheless, the range in bead dates and recovery of 60 glass beads from the burial matrix indicates this portion of the site may have been used on various occasions during the Mission period.

Burial Feature 105

This burial feature is located in the southwest portion of the main burial area and appears to have intruded into burial Feature 143. Burial 105 consisted of a single primary inhumation of a 7–9-month-old infant of unknown sex placed in a supine position and oriented to the southwest. The infant was associated with a relatively high frequency of shell beads. In all, 4,382 shell beads, grouped into 11 bead types, were analyzed (see Table 73).

California mussel cylinders and olivella tiny saucers were found fused side by side. Beads of the same type were also found fused together, including California mussel cylinders, red abalone epidermis disks, and olivella semiground disks. The fused segments were likely once part of strands; however, because of degradation, the number of original strands could not be determined. Several strands were likely present, considering that approximately 20.2 percent of the beads were found in fused segments.

Of the 18 burial features containing California mussel beads, Feature 105 had by far the highest frequency of California mussel beads. This high frequency may be a function of the young age of the individual, and the prevalent purple color may be indicative of emotive rather than sacred offerings (Pietak 1998). On an aesthetic level, the purple beads would have also provided a dramatic visual contrast to the white olivella beads.

Dates for bead types found in the burial feature range from the early Millingstone period through the late Mission period, with most of the beads clustering with the latter period. Bead types with narrow time ranges, including those recovered from the feature matrix, consisted of ground disks (early Mission period) and semiground disk (late Mission period). The abundance of semiground disks provides strong evidence for a late Mission period date. Nevertheless,

Table 73. Summary of Shell Beads in Human Burial Feature Group 2, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Burial Feature No.						Total	Percent within Each Shell Type	Percent of All Shell Beads
			13	105	222	265	327	516			
Olivella	spire-lopped	simple spire-lopped	—	—	2	28	—	—	30	0.2	0.18
	end-ground	end-ground	—	1	—	—	—	—	1	<0.1	0.01
		barell	—	—	—	—	—	1	1	<0.1	0.01
		spire	1	2	1	1	—	—	5	<0.1	0.03
Subtotal (end-ground)			1	3	1	1	—	1	7	<0.1	0.04
	lipped	round thin lipped	—	—	—	—	1	—	1	<0.1	0.01
		thick lipped	—	2	1	—	—	—	3	<0.1	0.02
		rough large lipped	—	—	—	—	51	—	51	0.3	0.30
Subtotal (lipped)			—	2	1	—	52	—	55	0.4	0.32
	saucer	tiny saucer	315	134	3	—	281	—	733	4.9	4.33
	disk	disk	—	—	6	—	—	—	6	<0.1	0.04
		ground disk	3	11	57	—	—	—	71	0.5	0.42
		semiground disk	1,671	2,764	2,961	2,144	1,406	6	10,952	72.9	64.64
		rough disk	30	—	9	—	—	—	39	0.3	0.23
Subtotal (disk)			1,704	2,775	3,033	2,144	1,406	6	11,068	73.7	65.32
	wall disk	wall disk class	3	—	—	—	—	—	3	<0.1	0.02
	callus	bushing	—	—	—	—	—	2,661	2,661	17.7	15.70
		cylinder	—	7	—	5	—	—	12	0.1	0.07
Subtotal (callus)			—	7	—	5	—	2,661	2,673	17.8	15.78
	unknown	unknown	449	—	3	4	—	—	456	3.0	2.69
Subtotal (olivella)			2,472	2,921	3,043	2,182	1,739	2,668	15,025	100.0	88.67
Red abalone	disk	epidermis disk	5	203	300	28	23	30	589	1.0	3.48
California mussel	cylinder	cylinder	—	1,258	—	—	—	—	1,258	1.0	7.42
Pismo clam	cylinder	cylinder	—	—	—	—	—	62	62	88.6	0.37
	tube	tube	1	—	3	—	—	4	8	11.4	0.05
Subtotal (Pismo clam)			1	—	3	—	—	66	70	100.0	0.41
Gastropod	columella	columella	—	—	—	2	—	—	2	100.0	0.01
Total			2,478	4,382	3,346	2,212	1,762	2,764	16,944		100.00

the range in bead dates indicates this portion of the site may have been used on various occasions during the Mission period. The 289 glass beads found with the infant provides additional evidence for a Mission period date. Although the glass beads were found with the clusters of shell beads, it is unclear whether they were strung together.

Burial Feature 222

This burial feature was located near the center of the main burial area and consisted of a single primary inhumation and isolated remains associated with at least three additional individuals. The primary inhumation was a 1–2-year-old infant of indeterminate sex interred in a prone position and oriented to the east with its head facing down. The other remains were of a 9-month–1.5-year-old individual of indeterminate sex. The second individual was an adult of indeterminate sex.

A total of 3,346 beads consisting of 12 different varieties was recovered from the burial (see Table 73). Approximately 775 (23.2 percent) beads were found associated with the primary inhumation. Semiground disks were fused together as well as fused with red abalone epidermis disks, indicating that they were likely strung together. The number of original bead strands could not be determined; however, approximately 40 percent of the beads associated with the primary inhumation were found in fused segments. Most likely one or more strands were present. Similar to the burial Feature 105 primary individual, a 7–9-month fetus-infant, the 1–2-year-old infant in burial Feature 222 was buried with a variety of different bead types (11–12 different types), as well as relatively high frequencies of semiground disks and red abalone epidermis disks. Unlike burial Feature 105, however, the infant in burial Feature 222 was not associated with large quantities of California mussel beads. Dates for beads found with the primary inhumation in burial Feature 222 ranged from the Late period through the late Mission period, particularly the latter period. Glass beads found with the primary individual also support a Mission period date. In all, 446 glass beads were recovered from the burial feature.

The remaining shell beads, approximately 2,570, were found in the burial matrix and could not be clearly associated with particular individuals. Bead types were similar to those found with the primary individual in addition to low frequencies of olivella rough disks and one spire bead. Dates for beads found in the primary inhumation correspond to those from the burial matrix. Bead types with narrow time ranges, including those recovered from the feature matrix, consisted of ground disks (early Mission period), semiground disk (late Mission period), and rough disks (terminal Mission period). The abundance of semiground disks provides strong evidence for a late Mission period date. Nevertheless, the range in bead dates indicates this portion of the site may have been used on various occasions during the Mission period.

Burial Feature 265

This feature is located on the southwest edge of the main burial area. The individual was a 25–35-year-old possible female interred fully flexed on the right side and oriented to the southeast and with the head facing northwest. A total of 2,212 beads consisting of six different varieties was recovered from the feature (see Table 73).

Approximately 1,860 beads were found with the primary inhumation. Most (98.5 percent) were recovered from the top of the head and consisted of a high frequency of semiground disks in addition to lower frequencies of red abalone epidermis disks, olivella simple spire-lopped beads, and columella beads. Semiground disks were found fused side by side, along with red abalone epidermis disks. Of the beads recovered from the top of the head, 84.8 percent were found in fused clusters, indicating that one or more strands were likely present. Additionally, approximately 65 beads were recovered from around the legs and torso. Bead types from this area were identical to those found on top of the head in addition to 4 olivella beads of unknown type. These beads were found associated with approximately 63 glass beads, indicating that they had likely been strung together.

Nearly 150 olivella semiground disks and cylinders were recovered from a copper pot found in association with the primary individual. Beads from the pot exhibited greenish-colored copper oxide staining. Additionally, one olivella spire bead was found in proximity to the copper pot and exhibited a greenish tint from oxidation. The remaining 200 beads were found in the burial matrix. Considering proximity and identical bead types, the beads recovered from the matrix were likely associated with the primary individual. Dates for beads recovered from the feature range widely through time, though most date to between the Late period and the late Mission period, particularly the latter period. Semiground disk was the only bead type with a narrow time range, dating to the late Mission period. Considering the presence of the glass beads and other historical-period artifacts, the primary individual was likely buried sometime around the late Mission period.

Burial Feature 327

This burial feature consisted of a 4–6-month-old primary individual of indeterminate sex. Orientation of the individual could not be determined because of poor preservation. The burial pit appeared to have been lined with a layer of asphaltum. Burial Feature 327 contained 1,762 beads interspersed with the human remains and from the burial matrix (see Table 73). Unlike the burials discussed above, glass beads, totaling 2,212, outnumbered shell beads in this burial feature. Six varieties of shell beads were identified, including olivella rough large lipped beads, which were absent from other Group 2 burial features. Rough large lipped beads were commonly produced during the early and late Mission periods.

Olivella tiny saucers were found fused together, along with semiground disks and red abalone epidermis disks. The burial feature also contained an olivella round thin lipped bead, commonly manufactured between A.D. 1500 and 1600. Other bead types with narrow time ranges consisted of rough large lipped (early to late Mission period) and semiground disks (late Mission period). The abundance of semiground disks and recovery of glass beads provides strong evidence for a Mission period date, particularly the late Mission period. The round thin lipped bead associated with earlier dates may have intruded from another burial or underlying midden. In general, the range in bead dates indicates this portion of the site may have been used on various occasions during the Protohistoric and Mission periods.

Burial Feature 516

This feature was located near the center of the main burial area. The burial consisted of a primary inhumation and the remains of at least three additional individuals. The primary individual was a 40-year or older adult of indeterminate sex who was interred fully flexed on their left side and oriented to the southeast. The others, all of indeterminate sex, included a 20–30-year-old and 15–20-year-old individual, as well as an adult of indeterminate age.

The burial feature yielded a total of 2,764 beads, consisting of six different varieties (see Table 73). Of note, semiground disks were nearly absent (0.2 percent) from the collection. Instead, olivella bushings composed the bulk (96.3 percent) of the collection. Bushings reportedly date to A.D. 1150 to the Mission period. Most of the beads (97.7 percent) were found with the primary individual. Approximately 40 beads were found in the neck region; the remaining beads were located around the left and right forearms. Beads found around the neck consisted of mostly olivella bushings and a lower frequency of semiground disks. Approximately 1,770 beads were recovered from the left forearm and 890 from the right forearm. Beads recovered from these two areas were similar and, as with the neck region, included mostly bushings (97.1 percent) in addition to lower frequencies of red abalone epidermis disks, Pismo clam cylinders and tubes, semiground disks, and a barrel bead. Chronologies for beads recovered from the primary individual ranged from all periods; however, most clustered between the Late period and the late Mission period. Additionally, three abalone disk ornament fragments were recovered from the top of and adjacent to the cranium. Two of the ornaments each had two clearly visible perforations (Gifford Type K3), whereas the third had only one identifiable perforation (Gifford Type K1).

The second burial individual was associated with approximately 20 Pismo clam cylinder beads recovered from around the neck and were likely once part of a strand. A sausage-shaped abalone ornament (Gifford Type Z) coated with asphaltum on one side was recovered adjacent to these beads (Gifford 1947). The ornament, however, does not appear to have been strung with the beads, as it was not perforated.

The remaining beads, nearly 50, were recovered from the burial matrix and not clearly associated with particular individuals. Bead types were similar to those found associated with burial individuals. As with the primary and secondary individuals, overall bead dates for the feature ranged from the Late period through the Mission period. Eight glass beads, as well as the small number (n = 6) of semiground disks, indicate a possible Mission period date. However, considering the near absence of these late bead types, these beads may have intruded from an adjacent burial. Compared to Group 1 and other Group 2 burial features, burial Feature 516 was unusual in its bead type distribution, being composed primarily of olivella bushings. Considering the near absence of semiground disks, as well as the possibility that these beads may have been displaced from adjacent burials, burial Feature 516 may predate the burial features discussed above, possibly dating to as early as A.D. 1150.

Burial Feature Group 3 (Bead Counts 701–1,500)

Eight burial features with bead counts ranging from 701 to 1,500 are included in this group (Table 74; see also Table 71). The burial features were clustered in an 8-by-7-m area in the southwest and central portions of the main burial area, forming a relatively tight cluster in the central portion of the burial area (see Figure 68). Burial Feature 165 was situated approximately 3 m to the southwest of this cluster, whereas burial Feature 174 was located 2 m east of the cluster. The burial features are discussed below according to their horizontal spatial groupings: central, southwestern, and eastern.

Central Group

Burial Features 50, 90, 155, 223, 276, and 313 were relatively tightly clustered in the central portion of the main burial area (see Figure 68). Number and ages of individuals in each burial varied. Burial Feature 50 consisted of the remains of at least three individuals, including the primary inhumation of a 20–30-year-old individual of indeterminate sex. An infant aged birth to 2 years old of indeterminate sex was identified in burial Feature 90. Four individuals, including a primary inhumation of a 30–45-year-old female and the remains of a 7-month-in-utero–6-month-old infant constituted burial Feature 155. Burial Feature 223 consisted of the remains of at least eight individuals, including the primary inhumation of an 18–25-year-old possible female. Burial Feature 276 contained the remains of a single individual, a 3–10-year-old child of indeterminate sex. Two primary inhumations were identified in burial Feature 313, consisting of a 25–35-year-old adult of indeterminate sex and a 5–7-month-old in-utero fetus of indeterminate sex.

Collectively, these central burials yielded 8,151 shell beads. Burial Feature 276 contained the highest (n = 1,451) frequency of shell beads, whereas Feature 155 yielded the lowest (n = 1,278). Beads were grouped into 29 different types (see Table 74). Relatively uncommon bead types included olivella appliqué spire-lopped and rough large lipped beads. As with most of the burials discussed above, olivella spire beads were found in low frequencies in each of the central burials, with the exception of burial Features 50 and 313 in which they were absent.

Beads were found directly associated with the primary individuals in each burial. In general, these beads were recovered

Table 74. Summary of Shell Beads in Human Burial Feature Group 3, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Burial Feature No.								Total	Percent within Each Shell Type	Percent of All Shell Beads
			50	90	155	165	174	223	276	313			
Olivella	spire-lopped	spire-lopped	—	—	10	—	—	5	—	—	15	0.17	0.14
		appliqué spire-lopped	—	—	2	—	—	—	—	—	2	0.02	0.02
Subtotal (spire-lopped)			—	—	12	—	—	5	—	—	17	0.19	0.16
	end-ground	spire	—	1	1	—	—	1	1	—	4	0.04	0.04
	lipped	lipped	—	—	—	—	—	4	1	—	5	0.06	0.05
		thin lipped	—	—	1	—	—	—	—	—	1	0.01	0.01
		rough large lipped	—	—	1	—	—	7	55	—	63	0.70	0.60
Subtotal (lipped)			—	—	2	—	—	11	56	—	69	0.77	0.65
	saucer	tiny saucer	—	—	3	14	—	1	—	363	381	4.24	3.61
		normal saucer	—	—	—	—	2	—	—	—	2	0.02	0.02
Subtotal (saucer)			—	—	3	14	2	1	—	363	383	4.26	3.62
	disk	disk	—	—	627	924	—	—	—	—	1,551	17.26	14.68
		ground/ semiground disk	—	—	127	13	—	—	—	—	140	1.56	1.32
		ground disk	—	19	40	6	—	—	8	—	73	0.81	0.69
		semiground disk	1,262	782	134	49	—	1,300	1,362	1,031	5,920	65.87	56.02
		rough disk	—	3	—	—	—	—	—	—	3	0.03	0.03
Subtotal (disk)			1,262	804	928	992	—	1,300	1,370	1,031	7,687	85.53	72.75
	wall disk	wall disk	—	1	2	—	—	—	—	—	3	0.03	0.03
	callus	cupped	—	1	—	—	235	—	—	—	236	2.63	2.23
		bushing	—	—	—	—	15	—	—	2	17	0.19	0.16
		cylinder	—	—	—	—	46	—	—	—	46	0.51	0.44
Subtotal (callus)			—	1	—	—	296	—	—	2	299	3.33	2.83
	unknown	unknown	15	401	33	70	4	2	—	—	525	5.84	4.97
Subtotal (olivella)			1,277	1,208	981	1,076	302	1,320	1,427	1,396	8,987	100.00	85.05

Shell Type	Bead Class	Bead Type Grouping	Burial Feature No.								Total	Percent within Each Shell Type	Percent of All Shell Beads
			50	90	155	165	174	223	276	313			
California mussel	disk	disk	—	—	—	—	2	—	—	—	2	0.43	0.02
	cylinder	cylinder	—	—	199	82	178	—	—	3	462	99.57	4.37
Subtotal (California mussel)			—	—	199	82	180	—	—	3	464	100.00	4.39
Abalone	disk	red abalone disk	—	168	65	—	562	5	24	6	830	99.88	7.85
		black abalone disk	—	—	—	—	1	—	—	—	1	0.12	0.01
Subtotal (abalone)			—	168	65	—	563	5	24	6	831	100.00	7.86
Pismo clam	cylinder	cylinder	—	—	—	—	2	7	—	—	9	10.34	0.09
	tube	tube	2	15	30	—	17	14	—	—	78	89.66	0.74
Subtotal (Pismo clam)			2	15	30	—	19	21	—	—	87	100.00	0.82
Clam	cylinder	cylinder	—	—	1	—	3	—	—	—	4	100.00	0.04
Gastropod	columella	columella	—	—	—	—	6	—	—	—	6	100.00	0.06
Unknown	cylinder	cylinder	—	—	—	—	83	—	—	—	83	44.15	0.79
	unknown	unknown	—	1	2	—	102	—	—	—	105	55.85	0.99
Subtotal (unknown)			—	1	2	—	185	—	—	—	188	100.00	1.78
Total			1,279	1,392	1,278	1,158	1,258	1,346	1,451	1,405	10,567		100.00

as segments of fused beads and bead clusters from one or more of six areas: head, face, neck, chest, right humerus, and left humerus. Bead types found in these areas consisted of mostly semiground disks, as well as lower frequencies of olivella disks, simple spire-lopped, Pismo clam tubes, red abalone epidermis disks, and California mussel cylinders. Stringing patterns, as evidenced by fused beads, included semiground disks, tiny saucers, olivella disks strung with California mussel cylinders, semiground disks strung with olivella lipped beads, and semiground disks strung with rough large lipped beads. Additionally, red abalone epidermis beads and semiground disks, as well as glass beads, were sewn to a textile recovered from burial Feature 313. Of note, approximately 480 shell beads, likely a part of a strand, were recovered from the chest area of the infant in burial Feature 90. Beads consisted of those mentioned above, as well as 13 Pismo clam tube beads, representing a higher-valued bead type. A cluster of approximately 20 Pismo clam tube beads were recovered from the neck region of the adult female in burial Feature 155 and likely represent a necklace.

With the exception of Feature 50 and 313, each of the burials had beads dating to the early and late Mission periods. Shell beads in burial Features 50 and 313 date to the late Mission period, whereas rough disks recovered from burial Feature 90 suggest a terminal Mission period date.

In addition to the semiground disks and Pismo clam tubes found in burial Feature 50, the individual was buried with a black abalone shell container found approximately 25 cm from the cranium. The dorsal side of the shell was ground and the siphon holes had been plugged with asphaltum.

Burial Feature 155 was found with additional worked shell as well, including a red abalone shell container located near the cranium that had been ground on the dorsal surface and a Pismo clam ornament fragment (Gifford Type D) consisting of the shell with a perforation drilled near the hinge. Burial Feature 276 contained a California venus clam shell that had been cut along the edge and ground on the dorsal surface. The function of this worked-shell fragment is unknown.

The second primary inhumation in burial Feature 313 was buried with seven abalone circular ornaments disks with one to two perforations (Gifford Types K, K1, and K3). Although shell beads were absent, the second primary inhumation was also found with glass beads recovered from the cranium, pelvis, and leg regions.

Burial Feature 223 contained two containers, one derived from a black abalone shell and the other from a red abalone shell. The black abalone shell contained a deer bone and was found near the base of the skull of the primary individual. The primary individual was also interred with a red abalone shell that was ground on the dorsal side, and the siphon holes had been plugged with asphaltum and located near fibrous material. Additionally, two abalone rectangular-shaped ornaments, each with a single perforation near the end (Gifford Type S2), were also recovered from the burial feature. The ornaments were found near the left humerus of the primary inhumation.

Southwestern Group

This group consists of burial Feature 165 situated approximately 3 m to the southwest of the central cluster of Group 3 features (see Figure 68). The burial consisted of a single primary inhumation of a 32–36-week-old in-utero fetus of indeterminate sex. The burial contained a second individual, an adult of indeterminate sex.

The burial feature yielded a total of 1,158 beads grouped into nine bead types (see Table 74). Two clusters of beads were found with the primary individual—one cluster among the skeletal elements and the other 26 cm to the northwest. The two clusters, nearly identical in composition, contained all nine bead types. Many of the beads were found in fused segments, including olivella disks, indicating that some of these beads likely had been strung together.

Dates for beads recovered from burial Feature 165 ranged from the early Intermediate period through the late Mission period, with most beads dating to the Mission period. Shell beads with narrow time ranges, however, included ground disks (early Mission period) and semiground disks (late Mission period). The recovery of 200 glass beads also highlights Mission period use in this portion of the site.

Eastern Group

Burial Feature 174 was found approximately 2 m east of the central cluster of Group 3 burial features (see Figure 68). This burial consisted of a single primary inhumation of a 25–35-year-old woman interred fully flexed on the left side and oriented southeast with the head facing down.

The burial contained a total of 1,258 beads representing 12 different varieties (see Table 74). Unlike the burial features discussed above, olivella disks, including semiground disks, were not identified in the collection. Red abalone epidermis disks (44.7 percent) and olivella cupped (18.7 percent) beads dominated the collection.

A total of 875 shell beads were found around the neck of the primary individual. Bead types included olivella bushing, cupped, and cylinder; clam cylinders; Pismo clam tubes; columella beads; California mussel disks and cylinders; and beads of unknown type. The arrangement of the beads indicate they were likely once part of one or more strands. Additionally, beads were found fused together, indicating the following stringing patterns: California mussel cylinders strung with olivella cylinders, red abalone epidermis disks, and Pismo clam cylinders strung with olivella bushings.

The remaining 383 shell beads were recovered from the burial matrix. Similar bead types were found in this context in addition to 2 olivella normal saucers. Dates for bead types ranged from the early Millingstone period to the Mission period. Considering the absence of olivella semiground disks and other Mission period disk beads, as well as glass beads, burial Feature 174 may date prior to or the beginning of the Mission period. An olivella normal saucer—the only bead type with a narrow time range—indicates this portion of the site may have been used sometime during the Intermediate and early Late periods.

Burial Feature Group 4 (Bead Counts 301–700)

A total of 13 burial features contained shell beads ranging in count between 301 and 700 beads (Table 75; see also Table 71). In general, the burials were located in a 7-by-6-m area in the central and southwest portion of the main burial area between and adjacent to the Group 3 burial feature clusters (see Figure 68). The burial features comprising Group 4 were located in three clusters based on horizontal spatial distribution: western, central, and eastern. A fourth cluster, the northern cluster, contains two burial features that may be slightly older than other burial features comprising Group 4. Although these two features overlap spatially with the central and eastern groups, they are included in a separate group owing to chronological considerations.

Western Group

Four burial features constituted the western group. Burial Feature 11 consisted of the remains of at least four individuals, including the primary inhumation of 20–30-year-old female. Burial Feature 85 consisted of the remains of at least three individuals, including the primary inhumation of a 30–40-year-old individual of indeterminate sex. Burial Feature 170 contained the remains of at least two individuals, including the primary inhumation of a 7–8-month-old infant of indeterminate sex. Burial Feature 196 consisted of the remains of at least three individuals, including two primary individuals: the first primary individual was a 25–35-year-old possible female and the second primary individual was 1 month in utero to 3 months of age.

Collectively, the burials in the western cluster yielded 2,143 shell beads representing 13 different varieties (see Table 75). Shell beads were found directly associated with primary individuals in burial Features 11 and 170, along with the second primary individual in burial Feature 196. Beads were recovered in strand fragments and clusters from four areas: pelvis, mandible, and among and immediately adjacent to the skeletal remains. Some beads were found in fused segments and their associations indicate the following possible stringing patterns: olivella disks, semiground disks strung with rough large lipped, tiny saucers, and red abalone epidermis disks. Glass beads were also found in each of the burial features (discussed in Chapter 6, this volume). Frequencies of glass beads ranged from 11 to 425. Nearly twice as many shell beads as glass beads were recovered from the features, with the exception of Feature 11 which yielded more than five times as many shell beads.

Collectively, dates for bead types recovered from in the western cluster of Group 4 range from the early Intermediate period to the terminal Mission period. Shell-bead types with narrow time ranges included ground disk (early Mission period), rough large lipped (early to late Mission period), semiground disk (late Mission period), and rough disk (terminal Mission period). Of these types, early–late Mission period beads were recovered from burial Features 11, 85, and 170, and early–terminal Mission period beads from burial Feature 196. Overall, the western-group burials probably date to between the early and late Mission period.

In addition to shell beads, burial Feature 11 contained a Nuttall's cockle (*Clinocardium nuttalli*) container that had been ground on the dorsal side and slightly burned on the ventral side. The shell was found next to the primary individual's cranium. Considering the charred state of the inside of the shell, it was likely used to hold offerings for burning. A shell container, derived from red abalone, was also found in burial Feature 85. The shell's siphon holes had been plugged with asphaltum, and the dorsal surface was ground.

Burial Feature 170 was found with a Euroamerican-made mother-of-pearl button (two-hole sunken panel), as well as six abalone shell disks. Three of the ornaments had a single perforation clearly identified (Gifford Type K1), whereas the other three were fragmented and highly degraded making perforations difficult to identify. One of the perforated disks was fused to approximately 75 olivella tiny saucers. The abalone disks were found adjacent to clusters of fused beads that were once likely part of strands. The abalone disks and beads were likely originally strung together. The Euroamerican-made mother-of-pearl button was associated with the primary individual.

Central Group

Compared to the western group, the central group is tightly clustered (see Figure 68). Burial Feature 31 consisted of the primary single inhumation of a 28–40-year-old female. Burial Feature 39 contained the remains of at least three individuals, including two possible males 30–40 and 35–45 years old and a 17–25-year-old individual of indeterminate sex. At least two individuals were identified in burial Feature 96, including the primary inhumation of a 1.5–2.5-year-old infant of indeterminate sex. In burial Feature 143, the primary individual, 18–22 years old of indeterminate sex, was found with the remains of at least two other individuals. Burial Feature 243 consisted of the remains of two individuals, including the primary inhumation of a 30–45-year-old adult of indeterminate sex.

The central group yielded a total of 3,164 beads representing 23 different varieties (see Table 75). Relatively uncommon bead types included giant rock scallop disks from burial Features 39 and 143 and olivella scoop and split-end perforated beads from burial Feature 31 matrix. Shell beads were found clearly associated with individuals in three of the burial features (Features 31, 243, and 334). In these burial features, beads were recovered in strand fragments and clusters from the vertebrae, left ribs, neck, and upper chest areas. Beads found fused together indicated the following stringing patterns: semiground disks, ground/semiground disks strung with rough large lipped beads, and Pismo clam cylinders.

Glass beads were recovered from all of the burial features in the central group. Counts for glass beads in these features ranged from 32 to 328. In all features, shell beads outnumbered glass beads. In burial Feature 31, 6 glass beads were recovered from a cluster of shell beads in the vertebrae area of the primary individual. It is possible glass and shell beads

Table 75. Summary of Shell Beads in Human Burial Feature Group 4, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Human Burial Grouping				Total	Percent within Each Shell Type	Percent of All Shell Beads
			West	Central	East	North			
Olivella	spire-lopped	simple spire-lopped	5	2	—	—	7	0.11	0.10
	end-ground	spire	—	—	1	—	1	0.02	0.01
	split	split end-perforated	—	1	—	—	1	0.02	0.01
		scoop	—	1	—	—	1	0.02	0.01
Subtotal (split)			—	2	—	—	2	0.03	0.03
	lipped	lipped	—	19	—	—	19	0.29	0.27
		round thin lipped	—	—	1	—	1	0.02	0.01
		deep lipped	—	—	—	1	1	0.02	0.01
		deep large lipped	—	1	—	—	1	0.02	0.01
		rough large lipped	14	74	1	—	89	1.37	1.27
		rough large lipped, normal variant	1	50	—	—	51	0.78	0.73
Subtotal (lipped)			15	144	2	1	162	2.49	2.31
	saucer	tiny saucer	591	22	—	20	633	9.74	9.01
	disk	disk	30	387	—	—	417	6.42	5.94
		ground/semiground disk	303	205	—	—	508	7.82	7.23
		ground disk	30	103	—	—	133	2.05	1.89
		semiground disk	463	1,437	582	—	2,482	38.20	35.34
		rough disk	1	—	—	—	1	0.02	0.01
Subtotal (disk)			827	2,132	582	—	3,541	54.50	50.42
	wall disk	wall disk	—	2	—	—	2	0.03	0.03
	callus	cupped	—	1	7	—	8	0.12	0.11
		bushing	—	2	1	977	980	15.08	13.95
		cylinder	—	1	—	1	2	0.03	0.03
Subtotal (callus)			—	4	8	978	990	15.24	14.10
	unknown	unknown	432	726	—	1	1,159	17.84	16.50
Subtotal (olivella)			1,870	3,034	593	1,000	6,497	100.00	92.51
Abalone	disk	red abalone epidermis disk	268	80	21	29	398	99.75	5.67
	unknown	unknown	1	—	—	—	1	0.25	0.01
Subtotal (abalone)			269	80	21	29	399	100.00	5.68

Shell Type	Bead Class	Bead Type Grouping	Human Burial Grouping				Total	Percent within Each Shell Type	Percent of All Shell Beads
			West	Central	East	North			
California mussel	cylinder	cylinder	—	8	1	—	9	100.00	0.13
Pismo clam	disk	disk	—	27	1	—	28	25.69	0.40
	cylinder	cylinder	—	10	1	50	61	55.96	0.87
	tube	tube	3	—	—	17	20	18.35	0.28
Subtotal (Pismo clam)			3	37	2	67	109	100.00	1.55
Clam	disk	disk	—	2	—	—	2	66.67	0.03
	unknown	unknown	1	—	—	—	1	33.33	0.01
Subtotal (clam)			1	2	—	—	3	100.00	0.04
Giant rock scallop	cylinder	cylinder	—	2	—	—	2	100.00	0.03
Gastropod	columella	columella	—	—	—	2	2	100.00	0.03
Unknown	unknown	unknown	—	1	1	—	2	100.00	0.03
Total			2,143	3,164	618	1,098	7,023		100.00

were strung together; however, because of degradation, the stringing pattern could not be determined.

Dates for beads recovered from the central group range from the early Millingstone period to the late Mission period. A significant majority of the beads, however, date to the late Mission period. The presence of glass beads in each of the burial features also indicates a Mission period date. Shell-bead types with narrow time ranges included olivella scoop and split end-perforated (Late period), ground disk (early Mission period), rough and deep large lipped (early to late Mission period), and semiground disk (late Mission period). Of these types, Late period and early to late Mission period beads were recovered from burial Feature 31; early Mission period beads from burial Feature 96; early to late Mission period beads from burial Features 39, 243, and 334; and late Mission period beads from burial Feature 143. The beads in burial Feature 31 indicate that that portion of the site was likely used during the Late period and later during the Mission period.

In addition to shell beads, a red abalone disk ornament was identified in burial Feature 96. The ornament was disk shaped with a central perforation (Gifford Type K1). The ornament was found within a shell-bead scatter.

Eastern Group

Only one burial feature constitutes the eastern cluster of Group 4, burial Feature 268 (see Table 75). This burial was located approximately 2.5 m east of the central cluster (see Figure 68). The burial feature contained the remains of at least four individuals, including the primary inhumation of a 17–25-year-old possible female and a child of indeterminate sex aged 1–4 years.

The burial feature contained 618 beads grouped into 11 bead types (see Table 75). A cluster of 221 semiground disks and 8 red abalone epidermis disks beads were recovered from the neck region of the primary individual. Semiground disks were found fused together, along with red abalone epidermis disks. Most likely these beads were part of one or more strands. One glass bead was recovered from the burial matrix.

Dates for beads recovered from the burial feature range from the Late period to the late Mission period. The primary individual was likely interred during the late Mission period considering the presence of directly associated semiground disk beads. An olivella round thin lipped bead, commonly manufactured between A.D. 1500 and 1600, was found in the burial matrix. Considering this earlier time range, it is possible the primary inhumation intruded into earlier burials.

Northern Group

Burial Features 316 and 376 constitute the northern cluster of Group 4 burial features (see Table 75). As noted earlier, the two burial features were grouped together based on chronological similarities (see Figure 68). Spatially, however, Features 376 and 316 are located in the northern portions of the central and eastern clusters, respectively. Burial Feature 316 consisted of the remains of at least three individuals, including the primary inhumation of a 13–31-year-old individual of indeterminate sex. Burial Feature 376 consisted of the remains of at least three individuals, including two primary inhumations, one a 17–25-year-old individual of indeterminate sex and the second a 9-month–1-year-old child of indeterminate sex.

The two burial features contained nearly equal frequencies of shell beads, with slightly more beads recovered from burial Feature 376 (n = 558) compared to burial Feature 316 (n = 540). Collectively, eight different bead types were identified. Olivella bushings composed the bulk (89 percent) of the collections. Olivella semiground disks, as well as other distinctly Mission period shell beads, were absent from the features. Burial Feature 376, however, did contain 5 glass beads recovered from the burial matrix. The burial also yielded a black abalone shell container containing red ocher and tiny saucer beads. The container was located directly west of the second primary inhumation.

Bead clusters and strand fragments were directly associated with the primary individuals in both burial features. These beads were located in five different areas: beneath and adjacent to the face and immediately adjacent to the head, upper chest, pelvis, and legs. These concentrations contained mostly olivella bushings in addition to lower frequencies of Pismo clam cylinders and tubes and red abalone epidermis disks. Beads found fused together indicate bushings were strung together, along with Pismo clam cylinders.

Dates for beads recovered from the northern cluster range from the Late period to the Mission period. No shell beads with narrow time ranges were identified in the features. Burial Features 316 and 376 likely date to post–A.D. 1650 and post–A.D. 1500, respectively. If the glass beads were in fact associated with the individuals in burial Feature 376, then the feature dates to the Mission period. Unlike most of the burials in Group 4, there is no clear evidence that features in the northern cluster date to the late Mission period or even the early Mission period.

Burial Feature Group 5 (Bead Counts 101–300)

In total, 21 burial features yielded shell-bead counts ranging from 101 to 300 (Table 76; see also Table 71). The Group 5 burials were in a 7.9-by-4.9-m area located, for the most part, in the central portion of the main burial area surrounding the Groups 3 and 4 burial features (see Figure 68). The burial features comprising Group 5 were located in two main clusters: central and northern. The northern cluster was located approximately 0.5 m north of the central cluster.

Central Group

The central group included 17 burial features (see Table 76 and Figure 68). Collectively, the remains of at least 80 individuals were identified in these features, including 10 males and possible males, 9 females and possible females, and 61 individuals of indeterminate sex. Ages of individuals ranged from 1.5 months in utero to 45 years of age, along with adults of indeterminate age.

Table 76. Summary of Shell Beads in Human Burial Feature Group 5, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Human Burial Feature Grouping		Total	Percent within Each Shell Type	Percent of All Shell Beads
			Central	North			
Olivella	spire-lopped	simple spire-lopped	4	—	4	0.13	0.11
	end-ground	spire	2	—	2	0.06	0.05
	lipped	lipped class	12	—	12	0.38	0.32
		thin lipped	2	—	2	0.06	0.05
		round thin lipped	1	—	1	0.03	0.03
		thick lipped	5	—	5	0.16	0.13
		deep large lipped	1	—	1	0.03	0.03
		rough large lipped	31	—	31	0.97	0.83
		rough large lipped, normal variant	1	—	1	0.03	0.03
Subtotal (lipped)			53	—	53	1.66	1.42
	saucer	saucer class	—	4	4	0.13	0.11
		tiny saucer	34	64	98	3.06	2.62
		very tiny saucer	18	14	32	1.00	0.86
		normal saucer	128	—	128	4.00	3.42
Subtotal (saucer)			180	82	262	8.19	7.01
	disk	disk class	140	—	140	4.38	3.74
		ground/semiground disk	108	—	108	3.38	2.89
		ground disk	130	2	132	4.13	3.53
		semiground disk	1,500	27	1,527	47.72	40.84
		rough disk	6	—	6	0.19	0.16
		chipped disk	2	—	2	0.06	0.05
Subtotal (disk)			1,886	29	1,915	59.84	51.22
	wall disk	wall disk class	1	—	1	0.03	0.03
	callus	cupped	1	136	137	4.28	3.66
		bushing	158	127	285	8.91	7.62
		cylinder	28	11	39	1.22	1.04
Subtotal (callus)			187	274	461	14.41	12.33
	thin rectangle	thin rectangle	1	—	1	0.03	0.03
	unknown	unknown	497	4	501	15.66	13.40
Subtotal (olivella)			2,811	389	3,200	100.00	85.58
Red abalone	disk	epidermis disk	96	10	106	100.00	2.83
California mussel	cylinder	cylinder	186	—	186	100.00	4.97
Pismo clam	disk	disk class	2	—	2	0.87	0.05
	cylinder	cylinder	65	135	200	87.34	5.35
	tube	tube	21	6	27	11.79	0.72
Subtotal (Pismo clam)			88	141	229	100.00	6.12
Clam	disk	disk class	5	—	5	83.33	0.13
	cylinder	cylinder	1	—	1	16.67	0.03
Subtotal (clam)			6	—	6	100.00	0.16
Giant rock scallop	disk	disk class	1	1	2	16.67	0.05
	tube	tube	9	1	10	83.33	0.27
Subtotal (giant rock scallop)			10	2	12	100.00	0.32
Total			3,197	542	3,739		100.00

The burial features comprising the central group contained 3,197 shell beads grouped into 36 bead types. Shell beads were directly associated with individuals in six of the burial features (Features 60, 134, 204, 244, 319, and 461). Bead-strand fragments and clusters were recovered from a variety of different areas, including the head, adjacent to the head, face, neck, pelvis, leg or knee area, and adjacent to the legs. Bead types found in these areas consisted of mostly semiground disks and lower frequencies of red abalone epidermis disks and Pismo clam tube beads. Beads found fused side by side indicate the following stringing patterns: semiground disks, olivella tiny saucers, bushings, bushings strung with Pismo clam tube beads, red abalone epidermis disks, Pismo clam tube beads, and California mussel cylinders.

Bead types recovered from burial Feature 320 varied slightly compared to other features comprising the central group. Beads from this burial feature, containing the remains of an infant aged between birth and 1 year, consisted of mostly California mussel cylinders (98.4 percent). Olivella semiground disks were nearly absent (n = 1). Burial Feature 244 contained nine giant rock scallop tube beads, a relatively uncommon bead type in the burial features discussed above. These beads, as well as olivella normal saucers, semiground disks, Pismo clam tubes and cylinders, were found in a cluster, along with strands of glass beads, on top of the cranium of the primary individual, a 20–30-year-old female. Semiground disks were absent from burial Feature 461, which consisted of mostly olivella bushings. The primary individual, a 25–35-year-old of indeterminate sex, appeared to have been buried with a necklace of olivella bushings strung with Pismo clam cylinder and tube beads.

All of the burial features comprising the central cluster in Group 5 contained glass beads, ranging in count from 11 to 2,328. Glass beads outnumbered shell-bead frequencies in seven of the burial features: Features 9, 112, 204, 227, 244, 282, and 319.

Bead types with narrow time ranges recovered from the features date to the Intermediate period to the early Late period, the different phases of the Mission period, and the post–Mission period (A.D. 1834–1900). Most beads appear to date to the late Mission period. Time ranges for burial Features 9 and 60 are slightly more general, dating to the Mission period. With the exception of one bead from the burial matrix of burial Feature 320, distinctly Mission period bead types were absent from burial Features 320 and 461. The Intermediate–early Late period beads consisted of normal saucers recovered from burial Features 244 and 285. Both of these features contained early and late Mission period beads, indicating that the saucers likely intruded from underlying midden. Overall, ages for the beads with narrow time ranges indicate that this portion of the site was likely used on different occasions, during the Intermediate and early Late periods and later during the Mission period.

In addition to shell beads, burial Feature 9 contained two other worked-shell artifacts: a perforated red abalone whole shell, ground on one side and ocher residue on the dorsal side and an abalone rectangular pendant with two perforations. The perforated whole shell was likely ceremoniously killed. Burial Feature 112 contained a black abalone container. Asphaltum residue was present in small circular concentrations on the dorsal side, along with a coating on the ventral surface. Considering the circular concentrations, the dorsal side was likely decorated with inlaid beads. Ground disks were recovered from the burial feature that exhibited asphaltum residue and may have been such inlays. Burial Feature 134 also contained a shell container, this one derived from Pismo clam. The ventral side contained burned and mineralized material. The container was recovered from the burial matrix. Finally, three abalone ornament fragments were recovered from burial Feature 461. The ornaments consisted of one disk with two central perforations, a disk with one central perforation, and a rectangular-shaped ornament. The ornaments were recovered from a cluster of shell and glass beads.

Northern Group

The northern group was made up of four burial features (see Tables 71 and 76). Burial Feature 285 consisted of the remains of eight individuals of indeterminate sex, ranging in age from 36 to 38 weeks in utero to 35 years old. Additionally, two adults of indeterminate age were identified. Burial Feature 453 consisted of the remains of at least six individuals ranging in age from 1 to 17 years old or possibly older, as age could not be determined for the adult individuals. Sex was determined for one of the individuals, an adult male. Burial Feature 575 contained the remains of six individuals of indeterminate sex. Ages ranged from 3 to 21 years old, along with adults of indeterminate age. Burial Feature 616 consisted of the remains of at least four individuals of indeterminate sex. Ages ranged from 2 to 25 years of age, along with adults of unknown age.

The northern cluster of burial features yielded a total of 542 shell beads representing nine different varieties (see Table 76). Shell beads were directly associated with an individual in one burial feature, burial Feature 575. A necklace composed of approximately 10 olivella bushings and Pismo clam tube and cylinder beads was found under the mandible and cranium of a 3–5-year-old individual of indeterminate sex. Additionally, three semiground disks were recovered from the top of the skull. This inhumation likely dates to the late Mission period.

Glass beads were recovered from the burial matrix of all four burial features in the northern burial features subgroup. Compared to the central group of Group 5, glass beads were in low frequencies with counts ranging from 1 to 2 and 14 in burial Feature 285. The recovery of glass beads would suggest historical-period temporal ranges; however, the lack of clear association makes temporal determination tenuous.

Only burial Features 285 and 575 contained shell-bead types with narrow time ranges. Burial Feature 285 yielded normal saucers (Intermediate period to early Late period), ground disks (early Mission period), and semiground disks (late Mission period). Semiground disks (late Mission period) were recovered from burial Feature 575. Time ranges for these beads indicate that this portion of the site may have been used on various occasions sometime during the Intermediate and early Late periods and during the Mission period.

In addition to shell beads, burial Feature 616 contained a black abalone shell coated with asphaltum on both sides. The shell was found near a cluster of Pismo clam cylinders, bushings, and tiny saucer beads.

Burial Feature Group 6 (Bead Counts 26–100)

A total of 43 burial features yielded frequencies ranging from 26 to 100 shell beads (Table 77; see Table 71). The Group 6 burial features were in a 14.5-by-10-m area located, for the most part, in the central portion of the main burial area surrounding Groups 1–5 burial features (see Figure 68). The Group 6 burial features were located in three clusters: southern, central, and northern.

Southern Group

The southern group was composed of 20 burial features (see Table 77). With the exception of burial Feature 277, the southern group was tightly clustered. Collectively, the remains of at least 55 individuals were identified in these features, including 6 males and possible males, 13 females and possible females, and 36 individuals of indeterminate sex. Ages of burial individuals ranged from 30 to 32 weeks in utero to 45 years of age, along with adults of indeterminate age.

The burial features comprising the central group contained 1,007 shell beads grouped into 24 bead types (see Table 77). Shell beads were found directly associated with individuals in three burials: burial Features 58, 59, and 225. The primary inhumation in burial Feature 58, a 20–30-year-old possible female, had a strand of Pismo clam cylinder beads recovered from around the neck. The primary individual in burial Feature 59, a 20–30-year-old female, also had a concentration of beads found around the neck, including clam cylinders, Pismo clam tube beads, and semiground disks. Burial Feature 225 contained a primary individual, a 25–35-year-old of indeterminate sex, associated with shell beads. These beads, Pismo clam tube beads, were recovered from the neck and chest region. Fused olivella tiny and very tiny saucers were recovered from burial matrix, indicating that these bead types were likely strung as well.

Glass beads were found in all of the burial features with the exception of burial Features 58, 187, 216, and 368. Frequencies of glass beads in these features ranged from 1 to 207. Glass beads outnumbered shell beads in 5 of 13 burial features containing both types of beads (burial Features 8, 141, 220, 225, and 277).

Dates for bead types recovered from the southern cluster of Group 6 burial features ranged from the early Millingstone period to the late Mission period. Most of the burials yielded shell beads recovered from the burial matrix rather than associated with burial individuals. Shell-bead types with narrow time ranges, including those recovered from the feature matrix, dated to the later Late period to the Protohistoric period and from the early to late Mission periods. Most of the bead types dated to the latter time range. An oval thin lipped bead dating from between the later Late period and the Protohistoric period was recovered from burial Feature 277. Burial Feature 277 also yielded a semiground disk (late Mission period). Beads directly associated with burial individuals indicate that burial Feature 58 dates to sometime between the Protohistoric period and the late Mission period, whereas burial Feature 59 likely dates to the late Mission period.

In addition to shell beads, burial Feature 58 contained a cockle (Cardiidae) shell container. Red ocher was smeared across the edge of the shell and along both the dorsal and ventral surfaces. The shell was recovered from the matrix. However, the ocher staining may have been from a large piece of ocher found above the pelvis of the primary inhumation.

A shell container was also found in burial Feature 175. The container, derived from a black abalone shell, contained a large piece of charcoal on the ventral side. The shell was found among a cluster of human bones. The primary inhumation in burial Feature 372 was associated with a scallop shell container that was recovered from the chest region. Ocher staining was noted on the ventral side of the shell. Additionally, a black abalone shell coated with asphaltum on both sides was found in burial Feature 141 among a cluster of human bones.

Central Group

The central group was composed of a total of 22 burial features located approximately 0.6 m north of the southern group (see Table 77). Collectively, the remains of at least 78 individuals were identified in the central feature group, including 3 males and possible males, 7 females and possible females, and 68 individuals of indeterminate sex. Ages of burial individuals ranged from 30 to 36 weeks in utero to 55 years of age, along with adults of indeterminate age.

The burial features comprising the central group contained a total of 1,267 shell beads grouped into 23 bead types (see Table 77). Beads were found directly associated with individuals in seven burial features: burial Features 67, 370, 512, 529, 565, 584, and 615. In burial Feature 67, Pismo clam disk, cylinder, and tube beads were recovered from the neck area of the primary individual, an 18–21-year-old possible female. The first primary inhumation in burial Feature 370, a 25–35-year-old male, was found with 66 Pismo clam cylinder beads around the neck area. No other bead types were recovered from the burial feature. In burial Feature 512, the primary inhumation, a 17–19-year-old possible female, was found with olivella bushing beads recovered from the distal half of the right femur. Burial Feature 529 contained an adult of indeterminate age and sex buried with two clusters of beads, one of which was found near the neck region and was composed of a strand of olivella rough large lipped and full lipped beads. The second cluster, less than 5 cm south of the first cluster, contained olivella full lipped beads. Burial Feature 565 contained the primary inhumation of an

Table 77. Summary of Shell Beads in Human Burial Feature Group 6, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Human Burial Feature Grouping			Total	Percent within Each Shell Type	Percent of All Shell Beads
			South	Central	North			
Olivella	lipped	lipped class	—	7	1	8	0.5	0.3
		round thin lipped	10	2	—	12	0.8	0.5
		oval thin lipped	1	1	—	2	0.1	0.1
		thick lipped	11	21	—	32	2.0	1.4
		rough large lipped	3	22	—	25	1.6	1.1
Subtotal (lipped)			25	53	1	79	5.0	3.4
	saucer	saucer class	1	—	—	1	0.1	<0.1
		tiny saucer	32	32	—	64	4.0	2.8
		very tiny saucer	11	1	—	12	0.8	0.5
		normal saucer	—	2	—	2	0.1	0.1
Subtotal (saucer)			44	35	—	79	5.0	3.4
	disk	disk class	11	—	—	11	0.7	0.5
		ground/semiground disk	3	—	—	3	0.2	0.1
		semiground disk	612	161	29	802	50.4	34.8
		chipped disk	—	1	—	1	0.1	<0.1
Subtotal (disk)			626	162	29	817	51.4	35.5
	callus	cupped	36	37	—	73	4.6	3.2
		bushing	67	372	—	439	27.6	19.1
		cylinder	25	16	—	41	2.6	1.8
Subtotal (callus)			128	425	—	553	34.8	24.0
	unknown	unknown	56	7	—	63	4.0	2.7
Subtotal (olivella)			879	682	30	1,591	100.0	69.1
Red abalone	disk	epidermis disk	20	32	—	52	80.0	2.3
		small disk	—	13	—	13	20.0	0.6
Subtotal (abalone)			20	45	—	65	100.0	2.8
California mussel	disk	disk	—	18	—	18	42.9	0.8
	cylinder	cylinder	—	24	—	24	57.1	1.0
Subtotal (California mussel)			—	42	—	42	100.0	1.8

Shell Type	Bead Class	Bead Type Grouping	Human Burial Feature Grouping			Total	Percent within Each Shell Type	Percent of All Shell Beads
			South	Central	North			
Pismo clam	disk	disk	—	1	—	1	0.2	<0.1
	cylinder	cylinder	6	458	—	464	90.3	20.1
	tube	tube	27	22	—	49	9.5	2.1
Subtotal (Pismo clam)			33	481	—	514	100.0	22.3
Clam	disk	disk	1	—	—	1	2.0	<0.1
	tube	tube	1	—	—	1	2.0	<0.1
	cylinder	cylinder	48	1	—	49	96.1	2.1
Subtotal (clam)			50	1	—	51	100.0	2.2
Giant rock scallop	disk	disk	2	—	—	2	100.0	0.1
Gastropod	columella	columella	3	—	—	3	100.0	0.1
Unknown	unknown	unknown	20	16	—	36	100.0	1.6
Total			1,007	1,267	30	2,304		100.0

11–15-year-old adolescent of indeterminate sex. A strand of 59 Pismo clam cylinders and 3 Pismo clam tubes was wound around the head, across the maxilla, and under the mandible. Several beads of the same type were found in the feature matrix and were likely once part of this strand. Burial Feature 584 contained a cluster of shell beads located approximately 2 cm east of the legs of the primary individual, an adult of indeterminate age and sex. The cluster of 88 beads was composed of mostly Pismo clam cylinders and lower frequencies of red abalone epidermis disks and one olivella chipped disk. In burial Feature 615, the primary inhumation, a 2–5-year-old child of indeterminate sex was found with a cluster of 45 Pismo clam cylinders and 3 olivella bushings. Some of the Pismo clam cylinders were found fused together indicating that they were likely once strung together.

Glass beads were found in half of the burial features: Features 120, 153, 181, 210, 237, 370, 485, 502, 239, 584, and 598. Frequencies of glass beads ranged from 1 to 93, with the highest frequency recovered from burial Feature 485. This feature was also the only one in which glass bead frequencies outnumbered shell beads. Compared to the southern cluster of Group 6 burial features, the central cluster had fewer burials containing glass beads, as well as lower frequencies of glass beads.

Dates for bead types recovered from the central cluster of the Group 6 burial features ranged from the early Millingstone period to the late Mission period. Shell-bead types with narrow time ranges, including those recovered from the feature matrix, dated to the Intermediate period to the early Late period, from the later Late period to the Protohistoric period, and from the early to late Mission periods. An Intermediate–early Late period bead (a normal saucer) was recovered from burial Feature 210, and a later Late period to Protohistoric period bead (an oval thin lipped) was recovered from burial Feature 295. Most of these beads date to the late Mission period; however, the beads associated with earlier dates indicate that this portion of the site was likely used sometime between the Intermediate period and the Protohistoric period.

In addition to shell beads, burial Feature 403 contained a Pismo clam disk ornament consisting of an unperforated disk with a ground perimeter. Additionally, a red abalone offset ring ornament (Gifford Type J7aI) fragment with a single perforation was recovered from the burial feature. Ornaments of this type were commonly manufactured between A.D. 1500 and 1816.

Northern Group

The northern group consisted of burial Feature 367 located approximately 5.6 m northeast of the central cluster (see Table 77). The burial consisted of a single inhumation of an individual of indeterminate sex aged 36 weeks in utero to 1 year old. A total of 30 shell beads was recovered from the burial matrix, including 29 olivella semiground disks and 1 olivella lipped class bead. The latter bead type indicates that the burial feature may date to between A.D. 1500 and the Mission period, whereas the semiground disks indicate a late Mission period component. No other worked-shell artifacts or glass beads were recovered from the burial feature.

Burial Feature Group 7 (Bead Counts 1–25)

More than half (68.4 percent) of the LAN-62, Locus A, burials yielded shell beads with frequencies ranging between 1 and 25 beads (Table 78; see also Table 71). A total of 206 burial features constituted Group 7, which yielded a total of 1,238 beads. The burial features were much more widely distributed than the Groups 1–6 burial features, as they were located within a 45.7-by-26.2-m area (see Figure 68). However, Group 7 burial features were mostly located in the central and northern portions of the burial area. The cluster of Group 7 burial features was divided into three groups: western, central, and northern. Shell-bead types with narrow time ranges were identified in each of the three groups, providing evidence for use of this portion of the site on various occasions between the Intermediate period and the Mission period. There was, however, a slightly higher frequency of shell beads dating between the Intermediate period and the Late period in the central group.

Western Group

The western cluster of Group 7 burial features partially bisected the distribution of features in Groups 1–6 (see Figure 68). The western group was composed of 47 burial features yielding a total of 322 beads. Collectively, the remains of at least 112 individuals were identified in these features, including 7 males and possible males, 22 females and possible females, and 83 individuals of indeterminate sex. Ages of burial individuals ranged from 3–9 months to 50 years, along with adults of indeterminate age.

Most burial features contained either a single bead (n = 9) or four beads (n = 8). Only two burials contained the highest frequency of shell beads (n = 24). In all, 17 bead types were identified. Most of the beads were recovered from the burial matrix. However, three burial features contained shell beads directly associated with the burial individuals: Features 5, 7, and 52. Burial Feature 5 consisted of a 20–30-year-old female with a Pismo clam tube bead found around the chest area. Additional Pismo clam tubes were found in the burial matrix. A Pismo clam tube bead was recovered from near the cranium and chest area of the individual in burial Feature 7, an 18–25-year-old possible female. Finally, burial Feature 52 contained the remains of a 30–40-year-old female with semiground disks found near the neck region. In addition to shell beads, glass beads were recovered from Features 5 and 7. Glass beads outnumbered shell beads in these features. Only Feature 7 had glass beads directly associated with the individual, found in two clusters with one near the head and the other near the tibia.

Fused shell beads were recovered from 18 burial features, including semiground disks, unknown olivella beads fused

Table 78. Summary of Shell Beads in Human Burial Feature Group 7, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Human Burial Feature Grouping			Total	Percent within Each Shell Type	Percent of All Shell Beads
			West	Central	North			
Olivella	spire-lopped	simple spire-lopped	1	—	—	1	0.1	0.1
	end-ground	end-ground, small	—	1	—	1	0.1	0.1
	lipped	lipped class	1	14	3	18	1.8	1.5
		thin lipped	—	1	—	1	0.1	0.1
		round thin lipped	1	37	26	64	6.5	5.2
		oval thin lipped	1	6	7	14	1.4	1.1
		thick lipped	3	27	13	43	4.4	3.5
		large lipped	—	2	—	2	0.2	0.2
		full large lipped	—	2	—	2	0.2	0.2
		rough large lipped	5	14	14	33	3.4	2.7
Subtotal (lipped)			11	103	63	177	18.0	14.3
	saucer	tiny saucer	5	49	7	61	6.2	4.9
		normal saucer	—	2	3	5	0.5	0.4
		irregular saucer, oval	—	—	1	1	0.1	0.1
Subtotal (saucer)			5	51	11	67	6.8	5.4
	disk	disk class	—	5	—	5	0.5	0.4
		ground/semiground disk	—	5	—	5	0.5	0.4
		ground disk	1	2	—	3	0.3	0.2
		semiground disk	138	151	1	290	29.5	23.4
		rough disk	—	2	—	2	0.2	0.2
Subtotal (disk)			139	165	1	305	31.0	24.6
	wall disk	wall disk	—	2	1	3	0.3	0.2
	callus	cupped	21	104	24	149	15.1	12.0
		bushing	36	167	7	210	21.3	17.0
		cylinder	—	32	5	37	3.8	3.0
Subtotal (olivella)			57	303	36	396	40.2	32.0
	thin rectangle	elongate pendant	—	3	—	3	0.3	0.2
	unknown	unknown	20	11	—	31	3.2	2.5

continued on next page

Shell Type	Bead Class	Bead Type Grouping	Human Burial Feature Grouping			Total	Percent within Each Shell Type	Percent of All Shell Beads
			West	Central	North			
Abalone	disk	red abalone epidermis disk	14	16	2	32	94.1	2.6
	red abalone small disk		—	1	—	1	2.9	0.1
	black abalone epidermis disk		—	1	—	1	2.9	0.1
Subtotal (abalone)			14	18	2	34	100.0	2.7
California mussel	disk	disk	—	1	—	1	9.1	0.1
	cylinder	cylinder	—	10	—	10	90.9	0.8
Subtotal (California mussel)			—	11	—	11	100.0	0.9
Pismo clam	disk	disk	—	1	—	1	0.6	0.1
	cylinder	cylinder	56	66	—	122	76.3	9.9
	tube	tube	18	19	—	37	23.1	3.0
Subtotal (Pismo clam)			74	86	—	160	100.0	12.9
Clam	disk	disk	—	3	—	3	25.0	0.2
	cylinder	cylinder	1	8	—	9	75.0	0.7
Subtotal (clam)			1	11	—	12	100.0	1.0
Giant rock scallop	disk	disk	—	18	—	18	90.0	1.5
	cylinder	cylinder	—	1	—	1	5.0	0.1
	tube	tube	—	1	—	1	5.0	0.1
Subtotal (giant rock scallop)			—	20	—	20	100.0	1.6
Gastropod	columella	columella	—	11	—	11	100.0	0.9
Unknown	unknown	unknown	—	6	—	6	100.0	0.5
Total			322	802	114	1,238		100.0

to red abalone epidermis disks, tiny saucers, cupped beads, and Pismo clam tube beads. However, considering the limited frequencies of fused beads, it is unclear whether they were once strung together. One burned olivella tiny saucer bead was recovered from the burial matrix in burial Feature 49. Burned remains or charcoal, however, were not identified in the burial feature, indicating that the burned bead may have been displaced from another context or perhaps already present at the time interment occurred.

Dates for beads recovered from the western cluster of Group 7 burial features ranged from the early Millingstone period through the late Mission period. Most dates, however, overlapped from the Late period through the late Mission period. Considering the low frequency and lack of direct association of beads with most of the burials, determining time ranges for individual burials based on bead dates was difficult. As noted, three burials had beads directly associated with the individuals. Dates for beads recovered from burial Feature 5 ranged between the Late period and the Mission period. Burial Feature 7 also likely dated to this time range. However, the presence of glass beads directly associated with the burial individual narrows this time range to the Mission period. The remaining feature, burial Feature 52, dates to the late Mission period.

In addition to shell beads, other worked-shell artifacts were recovered from the western cluster of Group 7 burial features. These included 12 other worked-shell artifacts: 1 black abalone and 1 California venus clam shell coated with asphaltum, 1 California venus clam indeterminate worked-shell fragment, 3 abalone ornaments, 4 black abalone shell containers, 1 black abalone perforated whole shell, and 1 Pismo clam possible ornament or tool. The 12 artifacts were recovered from seven different burial Features (Features 5, 7, 10, 286, 304, 358, and 438).

Burial Feature 438 contained 5 of the 12 other worked-shell artifacts. The artifacts included an abalone disk ornament with a single perforation (Gifford Type K1), two abalone rectangular ornaments with single perforations and incised edges (Gifford Type S5bII), two black abalone shell containers, a whole black abalone shell that was perforated near the apex and likely ritually killed, and a Pismo clam plummet-shaped object with a grooved end exhibiting asphaltum staining. The latter may have been a pendant or tool. One of the black abalone shell containers had its siphon holes plugged with asphaltum and exhibited burning on the ventral surface. The whole black abalone perforated shell was found above the chest of the primary individual, a 25–35-year-old female in burial Feature 438. The other shell container was found immediately east of the head of the primary individual. The possible shell ornament or tool was recovered from the burial matrix approximately 50 cm northeast of the primary individual. The ornaments were found in the burial matrix.

Burial Feature 5 contained two rectangular-shaped ornaments (Gifford Type S5bII) with decorative lines incised around the perimeters of the ornaments. The ornaments, recovered from the burial matrix, were a style commonly manufactured between 200 B.C. and A.D. 1050, as well as later in time, between A.D. 1150 and 1816. The latter time range overlaps with chronologies for beads recovered from the primary individual in the burial feature.

Burial Feature 10 contained a black abalone shell container with its siphon holes plugged with asphaltum. The shell was found 20 cm east of the primary individual, a 30–40-year-old possible female. In burial Feature 358, an abalone shell container was found in the northern end of the burial among a cluster of human bones. Burial Feature 286 contained a black abalone shell coated with asphaltum with a Z-twist coiled basketry impression. Burial 7 also contained a shell, a California venus clam, coated with asphaltum on the dorsal surface. Finally, the California venus clam indeterminate worked-shell fragment was recovered from burial Feature 7. The shell was cut on two sides adjacent to the hinge and ground on the dorsal surface.

Central Group

Analysis of the central group included a total of 802 shell beads recovered from 139 burial features (see Table 78). Collectively, the remains of at least 378 individuals were identified in the central group, consisting of 45 males and possible males, 66 females and possible females, and 267 individuals of indeterminate sex. Ages of burial individuals ranged from 5 months in utero to 55 years old, along with adults of indeterminate age.

A total of 40 different bead types was identified (see Table 78). Unlike the other burial groups discussed above, no one bead type dominated the central cluster of Group 7 burial features. Relatively unusual bead types included three olivella elongate pendants. The pendants were recovered from three burial features: Features 305, 525, and 546. In all three features, the elongate pendants were found with several different bead types, including round thin lipped beads. If these two bead types are associated, overlapping dates indicate possible interment ca. A.D. 1500.

Within the central cluster of Group 7 burials, three burial features had shell beads directly associated with burial individuals: burial Features 332, 428, and 435. Burial Feature 332 consisted of the inhumation of a 20–35-year-old individual of indeterminate sex. A single Pismo clam tube bead was recovered from the neck region. Other bead types recovered from the burial matrix included Pismo clam cylinders, rough large lipped beads, semiground disks, and cupped beads. Burial Feature 428 consisted of a 25–35-year-old possible female with a Pismo clam tube bead found near the chest and left humerus, along with a columella found near the rib. Additional bead types recovered from the matrix included semiground disk, lipped beads, and Pismo clam tube beads. Feature 435 consisted of the inhumation of a 20–35-year-old possible male found with 19 Pismo clam tube beads recovered from the leg region. Glass beads were also recovered from the burial matrix.

Dates for beads recovered from the central cluster range from the early Millingstone period to the Mission period.

Most time ranges, however, overlap between the Late period and the Mission period. For the three burial features containing shell beads directly associated with the burial individual, dates ranged from A.D. 1150 to the Mission period.

In addition to shell beads, 21 burial features contained 42 other worked-shell artifacts. Artifact types included 2 pieces of black abalone shell coated with asphaltum and a third abalone shell fragment coated with asphaltum. The latter was circular and may have been an ornament. The shell was recovered near the right fibula of the primary individual, a 45–55-year-old possible male, in burial Feature 349.

Six indeterminate worked-shell fragments, recovered from six different burial features, consisted of a wavy turban rim fragment that had been cut, as well as another cut fragment of a columella that may have been intended for ornament manufacture; a Pismo clam square-shaped fragment ground on all sides; and a black abalone shell with the dorsal side ground and asphaltum on both sides, as well as a second black abalone rim fragment ground on the dorsal side.

Four black abalone shell containers were recovered from four different burial features. Two of the shells had siphon holes plugged with asphaltum. Three of the shell containers had been ground on the dorsal side. The fourth had a scallop shell adhered with asphaltum to the dorsal side. It is unclear whether the scallop shell was placed intentionally. The black abalone shell container recovered from burial Feature 289 had been ground. The interior of the shell had been burned near the apex and residue of burned mineralized material was present, like the remains of a burned offering. The container was found adjacent to the right humerus of the primary individual, a 30–45-year-old female. Burial Feature 245 also contained a shell container, with the siphon holes plugged with asphaltum. The container was found immediately east of the head of the primary individual, a 40–55-year-old male. The shell container found in burial Feature 274 had been ground on the dorsal side and was found approximately 15 cm west of the head of the primary individual in burial Feature 274, a 29–31-year-old female. The inside of the shell had been charred, indicating that an offering was likely burned in it.

A perforated black abalone shell was found immediately west of the pelvis of the primary individual in burial Feature 284, a 40–60-year-old female. The dorsal side of the shell, including the siphon holes had been ground. The shell, perforated near the apex, was likely ritually killed.

Other worked-shell artifacts also included two black abalone shell tools. One tool consisted of a rim that had been chipped on both edges and ground on the dorsal surface. The other tool consisted of a shell margin that had been chipped, cut, and ground along the edge. Asphaltum residue was present on the ventral side.

Additionally, 27 shell ornaments were recovered from nine burial features (Features 172, 256, 269, 392, 428, 505, 537, 547, and 558). Only the ornaments in burial Feature 558 were directly associated with particular individuals. Ornaments found in the other burial features were recovered from the burial matrix. Overall, ornament types included 6 scallop and venus clam perforated shells (Gifford Type D), 1 giant keyhole limpet plain ring (Gifford H2aI), 1 abalone disk (Gifford Type K1), 1 abalone rectangular ornament with a single perforation (Gifford Type S2), and 18 offset rings with single perforations (Gifford Type J7aI). The abalone offset rings were found in burial Feature 558 and were recovered from the neck region of the primary individual, a 7–10-year-old child of indeterminate sex (Figure 69). This type of pendant was commonly manufactured between A.D. 1500 and 1816. Twelve shell beads, consisting of nine different varieties were recovered from the burial matrix.

Two of the venus clam ornaments were recovered from burial Feature 505, along with the wavy turban columella fragment (indeterminate worked shell) noted above. As noted, these shell artifacts were recovered from the burial matrix.

Northern Group

Twenty burial features constituted the northern cluster of Group 7 features (see Table 78). These burials were widely dispersed and located on the north side of the Van Horn trench. The burial features located within the western portion of the northern group were situated adjacent to FB 7. Collectively, the remains of at least 35 individuals were identified in these features: 8 males and possible males, 9 females and possible females, and 18 individuals of indeterminate sex. Ages of burial individuals ranged from a fetus of indeterminate age to a 55-year-old adult, along with adults of indeterminate age. The analysis included 114 beads grouped into 16 different types.

Relatively uncommon bead types included an irregular saucer from burial Feature 56. Normal saucers, as well as round thin and full lipped beads and red abalone epidermis disks, were also recovered from the burial matrix. Only one semiground disk was identified in the northern cluster of Group 7 burial features, recovered from Feature 249. This burial feature also contained olivella full lipped, cylinder, and red abalone epidermis disk beads, all with overlapping time ranges ranging from the Late period to the Mission period. Another burial feature of note was Feature 46 which contained a relatively high frequency of rough large lipped (n = 14) beads, commonly manufactured during the Mission period, particularly during the late Mission period, as well as one olivella thin lipped bead, commonly produced between A.D. 1500 and 1700.

Of the 20 burial features, two (burial Features 4 and 145) had beads directly associated with the burial individuals. Burial Feature 4 contained a 25–35-year-old possible female with an oval thin lipped bead found in the chest area. Three additional oval and round thin lipped beads were recovered from the burial matrix. A 25–35-year-old individual of indeterminate sex was identified in burial Feature 145, found with an olivella thick lipped bead in the upper chest area. Round thin lipped, as well as cupped, bushings, and tiny saucers, were recovered from the burial matrix. Burial Feature 4 may date to between A.D. 1500 and 1700, or perhaps between the end of the Late period and the beginning of the Protohistoric period. Burial Feature 145 most likely dates to

Figure 69. Abalone offset ring pendants from LAN-62. (Note string used for artifact preservation visible on pendant surfaces.)

between A.D. 1650 and the Mission period. Dates for beads recovered from the northern cluster range from the early Intermediate period to the Mission period, with most dates overlapping between the Late period and the Mission period.

In addition to shell beads, a total of six other worked-shell artifacts was recovered from four different burial features (Features 4, 136, 214, and 300) in the northern cluster. All of the other worked-shell artifacts were recovered from the burial matrix and were not directly associated with burial individuals. Artifacts included a venus clam ornament, one venus clam and two black abalone shells coated with asphaltum, and two fragments of indeterminate worked shell (one black abalone and one California venus clam). The venus clam ornament, recovered from burial Feature 214, consisted of a nearly whole shell with a perforation near the hinge (Gifford Type D). Burial Feature 4 contained two of the asphaltum-coated shells, including a fragment of black abalone shell that had siphon holes plugged with asphaltum, as well as other portions of the dorsal and ventral surfaces. Also of note, the California venus clam indeterminate worked shell recovered from burial Feature 214 was cut on three sides, with the lower margin intact, and ground on both sides. The fragment may have been a preform of an ornament or tool.

Summary and Discussion of Worked Shell Recovered from Burial Features

The burial feature collection included several unusual shell-bead types based on their relatively low frequencies. For example, 23 olivella spire beads were recovered from 13 burial features, all in Groups 1–5. Additionally, each of these burial features contained shell-bead strands. King (1996:31) identified spire beads strung with rough disks at LAN-264 (Humaliwo). Although stringing associations are unclear, of the 13 burial features with spire beads at LAN-62, 6 also contained rough disks and semiground disks, and the remaining 7 yielded semiground disks. As was the case at LAN-264, spire beads in LAN-62 burials may have been strung with different varieties of olivella disks. The cultural significance of this stringing pattern, however, is currently unknown.

Another relatively unusual bead type included an olivella wide sequin recovered from burial Feature 76. This bead type, commonly manufactured during the Intermediate–Late period transition (A.D. 1150–1500), was the only one of its kind identified at LAN-62. Feature 76 was a burial with an exceptional number of beads and probably dated to the Late Mission period. The wide sequin bead may have been an heirloom or was intrusive.

Comparisons of shell-bead frequencies and sex and age of primary individuals directly associated with shell beads also revealed considerable variation (Table 79). There was a slight tendency for children and infants to be buried with large quantities of beads, a pattern that was also identified at the Medea Creek and Malibu burial grounds. Males and females of all ages were interred with shell beads. Of the primary individuals directly associated with shell beads and for which sex could be determined, 80.6 percent (n = 25) were identified as female. Additionally, in burial features containing more than 700 shell beads, seven of the eight

Table 79. Summary of Sex and Age of Primary Individuals Associated with Shell Beads in Human Burial Groups 1–7, LAN-62 A/G

Human Burial Group (Bead Frequency per Burial Feature)	Sex	Approximate Age of Primary Burial Individual					Total No. of Burial Individuals	Percent, by Sex within Group
		Fetus/Infant/Child	17–25	20–30	25–35	>30		
Group 1 (>4,600)	male and possible male	—	—	—	—	1	1	20.0
	female and possible female	—	—	2	—	1	3	60.0
	indeterminate	—	—	—	—	1	1	20.0
Subtotal		—	—	2	—	3	5	100.0
Percent, by age range		—	—	40.0	—	60.0	100.0	
Group 2 (1,501–4,600)	male and possible male	—	—	—	—	—	—	
	female and possible female	—	—	—	1	—	1	25.0
	indeterminate	3	—	—	—	—	3	75.0
Subtotal		3	—	—	1	—	4	100.0
Percent, by age range		75.0	—	—	25.0	—	100.0	
Group 3 (701–1,500)	male and possible male	—	—	—	—	—	—	
	female and possible female	—	1	—	2	—	3	42.9
	indeterminate	2	—	1	1[a]	—	4	57.1
Subtotal		2	1	1	3	—	7	100.0
Percent, by age range		28.6	14.3	14.3	42.9	—	100.0	
Subtotal for groups with bead frequencies >700		5	1	3	4	3	16	
Group 4 (301–700)	male and possible male	—	—	—	—	—	—	
	female and possible female	—	1	1	—	1	3	33.3
	indeterminate	2	2	1	—	1	6	66.7
Subtotal		2	3	2	—	2	9	100.0
Percent, by age range		22.2	33.3	22.2	—	22.2	100.0	
Subtotal for groups with bead frequencies >300		7	4	5	4	5	25	
Group 5 (101–300)	male and possible male	—	1	1	1	—	3	33.3
	female and possible female	—	—	2	1	—	3	33.3
	indeterminate	2	1	—	—	—	3	33.3
Subtotal		2	2	3	2	—	9	100.0
Percent, by age range		22.2	22.2	33.3	22.2	—	100.0	

Human Burial Group (Bead Frequency per Burial Feature)	Sex	Approximate Age of Primary Burial Individual					Total No. of Burial Individuals	Percent, by Sex within Group
		Fetus/Infant/ Child	17–25	20–30	25–35	>30		
Group 6 (26–100)	male and possible male	—	—	—	1	—	1	12.5
	female and possible female	—	2	2	—	—	4	50.0
	indeterminate	2	—	—	1	—	3	37.5
Subtotal		2	2	2	2	—	8	100.0
Percent, by age range		25.0	25.0	25.0	25.0	—	100.0	
Group 7 (1–25)	male and possible male	—	—	—	1	—	1	10.0
	female and possible female	—	1	3	3	1	8	80.0
	indeterminate	—	—	—	1	—	1	10.0
Subtotal		—	1	3	5	1	10	100.0
Percent, by age range		—	10.0	30.0	50.0	10.0	100.0	
Total		11	9	13	13	6	52	

[a] A 5–7-month in-utero fetus was identified with the adult.

primary individuals for which sex was determined were identified as females. This propensity for females to be interred with shell beads, including large amounts of shell beads, however, is likely a factor of the higher number of female compared to male burials (see Volume 4 of this series), rather than differential access to shell beads or burial practices according to sex.

According to ethnohistoric accounts, shell beads were often placed with the deceased in at least three different ways: as strands, in loose bead clusters, or broadcast across the individual (Brown 1999:653–655; Simpson 1961). At LAN-62, bead strands were identified either in situ as linear alignments at the time of excavation or as fused bead segments. A total of 137 burial features yielded shell beads either in part or fused together or as strands clearly identified at the time of excavation. Additional burial features likely contained bead strands; however, they lacked fused segments or were not identified at the time of excavation. Beads in strands could have been dispersed as a result of bioturbation or other ground disturbance.

A total of 41 burial features contained shell-bead strands, clusters, fused beads, or a combination recovered from various locations on the burial individual in addition to beads found in the burial matrix. The total number of beads recovered from these features ranged from 4 to 6,623 beads. Other burial features likely contained shell beads directly placed on the burial features; however, this direct association was not discerned in situ at the time of excavation. Beads could have easily been dislodged from the individual as a result of bioturbation, intrusion by other burial features, other ground disturbance, or displacement as a result of decomposition, or other factors.

In general, beads were recovered from seven locations on the burial individual: head, head and neck region, neck, chest and abdomen, forearm, hand and knee region (in the case of flexed individuals), and legs. Most of the individuals in the 41 burial features had shell beads recovered from the neck region (more than half), followed in decreasing frequency by the chest and abdomen area (about a third), head (roughly a quarter), head and neck (about a fifth), legs (around 10 percent), forearm (approximately 5 percent), and hand and knee region (approximately 5 percent). Although most of the beads recovered from these regions were part of strands, some appeared to have been deposited as loose bead clusters. In general, shell beads were recovered from the neck or skull areas in over 80 percent of these 41 individuals. About a third of the 41 individuals had beads on the chest region and roughly 10 percent of the 41 individuals had beads in the leg region. Shell beads were recovered from the forearm area for less than 5 percent of the 41 individuals. A similar distribution was identified at the Malibu burial grounds, where more than 80 percent of the individuals had shells around the neck or in the skull area (Gamble et al. 2001:199).

Of the 41 burial features discussed above, 19 of these also had glass beads recovered directly from or immediately adjacent to the burial individuals. In all, 29 burial features had shell and glass beads associated with burial individuals (these burial features are discussed in greater in the LAN-62 summary section below). When comparing placement of glass beads on the individual, more than half (57.9 percent) of the 19 burial features had glass and shell beads arranged in identical locations. For example, in burial Feature 204, concentrations of shell and glass beads were recovered from the head, chest, and leg areas of the individual. In burial Feature 31, shell and glass beads were recovered from the neck region of the individual, although glass beads were also recovered from the chest region. Most often, shell and glass beads were recovered from the head region (63.6 percent), followed by the chest or abdomen area (45.5 percent), neck (27.3 percent), and legs and arms (each 9.1 percent). This overlap in arrangement indicates that mourners followed similar burial practices when it came to placement of shell and glass beads.

In some cases, partial stringing patterns were identified by beads that were fused side by side. Likely stringing patterns included the following: red abalone epidermis disks, red abalone epidermis disks strung with olivella semiground disks, semiground disks, semiground disks strung with olivella saucers, saucers, saucers strung with California mussel cylinders, California mussel cylinders strung with olivella cylinders, Pismo tubes strung with olivella bushings, Pismo cylinders, Pismo cylinders strung with Pismo tubes, and Pismo cylinders strung with Pismo tubes and olivella bushings. In a few instances, shell beads were found strung with glass beads. For example, in burial Feature 76, glass beads were found strung with olivella disks and red abalone epidermis disks.

Although infrequent, shell and glass beads were also found directly associated with one another, either strung together (burial Feature 76) or sewn together on the same textile (burial Features 313 and 376). In the case of burial Feature 76, shell and glass beads were strung together in a pattern of shell beads (red abalone disks and olivella disks) followed by a series of 5 glass beads with each series alternating between red and blue glass beads. Twenty-nine burial features contained both glass and shell beads directly associated with the burial individual. Figure 70 shows the distribution of shell and glass beads recovered from each of the burial features. Of the 29 burial features, more than half (n = 16) of the features had glass-bead frequencies that were higher than shell-bead frequencies. Nevertheless, more than half (55.7 percent) of the beads recovered from these 29 burial features were shell beads. The higher frequency of shell beads was due, in part, to two features (burial Features 38 and 76) each of which contained more than 6,000 shell beads. Glass-bead frequencies were relatively low in Feature 38 (n = 262) and Feature 76 (n = 91) and, in general, glass beads never exceeded a total of 3,000 in any one burial feature.

Comparisons of shell-bead and glass-bead frequencies in the 29 burial features revealed that most of the burial features had either much higher or lower shell-bead frequencies compared to glass beads. Glass- and shell-bead frequencies in individual burial features typically differed by 15 percent or greater. Three burial features, however, were the exception, with each feature containing both high shell- and glass-bead

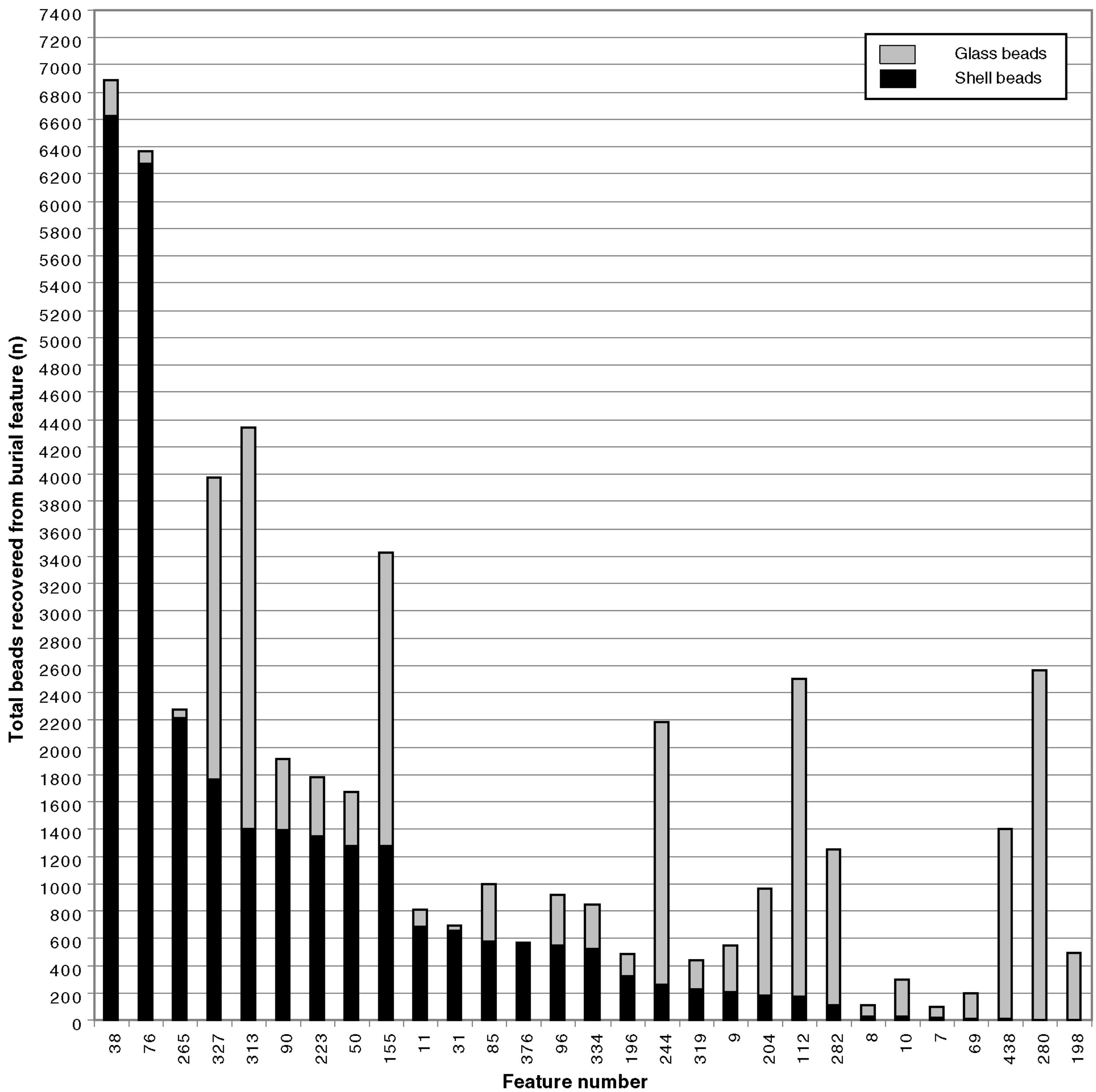

Figure 70. Comparison of frequencies of shell and glass beads directly associated with burial individuals.

frequencies. Each of these three burial features (Features 155, 313, and 327) had shell- and glass-bead frequencies exceeding 1,000 beads. Nevertheless, it appears that one bead material, either glass or shell, was buried in relatively large quantities with the deceased. However, whether this selection was based on availability of beads or aesthetic, cultural, or ideological preferences is unclear.

If grave wealth directly reflects sociopolitical status as Hollimon (2001:51) has suggested, the high frequency of shell beads recovered from the central and southern portions of the main burial area may indicate that these burials were distinct from the rest of the burial population. However, most of these beads were semiground disks, which were likely readily available in the Ballona during the late Mission period. Bead types rather than frequencies may be a better indicator of sociopolitical status. As noted previously, King (1974) has identified a variety of different bead types (e.g., abalone, Pismo clam, California mussel, and giant rock scallop) that were differentially distributed in the Medea Creek burial area. He attributed this distribution to higher-valued bead types accompanying secular and spiritual leaders.

Comparisons of these reportedly higher-valued beads in the different LAN-62 burial groups revealed that they accompanied burials with high, moderate, and low frequencies of shell beads distributed throughout the burial area in burial

Groups 1–7 (Table 80). Of note, however, giant rock scallop beads were absent from the burial features with most of the shell beads, those in Groups 1–3. Considering that burials in Groups 1–3 all contained large amounts of late Mission period beads, it is possible giant rock scallop beads were more commonly used earlier in time.

Dates for bead types with narrow time ranges from burial features indicate that activities occurred in this portion of the site on numerous occasions between the early Intermediate period and approximately A.D. 1900. (Note that despite the broad temporal associations of certain types of shell beads, their inclusion in a burial does not necessarily suggest that they date to the post-Mission period [ca. A.D. 1900s.]) Shell beads dating to the Intermediate and early Late periods were recovered from burial features located in the central and northern portions of the burial area. These beads, however, were recovered from the feature matrix and were not directly associated with burial individuals. It is possible that some (if not all) of the beads intruded from underlying midden. Overall, shell-bead data provide no clear evidence for burial features dating between the Intermediate period and the early Late period. The bead dates do, however, provide evidence for early use of this portion of the site. Shell beads that date to between the later Late period and the Protohistoric period were found directly associated with burial individuals in Features 4 and 525 (Group 7) located in the northern portion of the burial area. Beads within this time range were recovered from the feature matrix of other burials located in the central and northern portions of the burial ground.

Of note, several burials either lacked or contained low frequencies of Mission period shell beads in addition to containing non–Mission period shell beads recovered from the feature matrix. These burials, located in the central portion of the burial area, may date prior to the Mission period. None of the burials contained shell beads dating within narrow time ranges; however, based on the clustering of dates, the burials may postdate A.D. 1150 (burial Feature 461), A.D. 1250 (burial Feature 376), A.D. 1500 (burial Feature 174), and A.D. 1600 (burial Feature 316).

Shell beads dating to the early Mission period were confined to the central and southern portions of the burial area. Shell beads dating to the late Mission period were much more widely distributed throughout the central burial area in addition to a few burials located within 7.5 m north and south of the main burial area. Beads dating to the terminal Mission period and the post–Mission period shared similar distributions, with beads recovered from the central and southern portions of the main burial area. Overall, based on direct association of beads with burial individuals, shell-bead data provide clear evidence that burial activities occurred at LAN-62 A/G during the Mission period and, to a minor extent, during the Late to Protohistoric period transition. Although activities did occur during the Intermediate and early Late periods, it is unclear whether they were burial related.

Table 80. Distribution of Reportedly Higher-Valued Shell-Bead Types in Human Burial Groups 1–7, LAN-62 A/G

Human Burial Group (Bead Frequency per Burial Feature)	Distribution of Bead Types within Burial Feature Group	Bead Type				
		Pismo Tube	Pismo Cylinder	Abalone	Mussel	Giant Rock Scallop
Group 1 (>4,600)	percent of burials with bead type	50.0	25.0	100.0	25.0	—
	beads in group (n)	16	2	913	1	—
Group 2 (1,501–4,600)	percent of burials with bead type	50.0	16.7	100.0	16.7	—
	beads in group (n)	8	62	589	1,258	—
Group 3 (701–1,500)	percent of burials with bead type	62.5	25.0	75.0	50.0	—
	beads in group (n)	78	9	831	464	—
Group 4 (301–700)	percent of burials with bead type	46.2	38.5	76.9	23.1	15.4
	beads in group (n)	20	61	399	9	2
Group 5 (101–300)	percent of burials with bead type	0.6	0.4	0.8	0.1	0.2
	beads in group (n)	27	200	106	186	12
Group 6 (26–100)	percent of burials with bead type	23.3	39.5	37.2	7.0	4.7
	beads in group (n)	49	464	65	42	2
Group 7 (1–25)	percent of burials with bead type	10.2	17.0	9.7	1.9	7.8
	beads in group (n)	37	122	34	11	20

Excavation Units and Nonburial Features in the Burial Area

Of the analytical contexts at LAN-62 A/G, the burial area yielded the second highest frequency of shell beads, totaling more than 17,900 beads. Shell beads were recovered from a total of 209 excavation units and 12 features (Tables 81 and 82).

Excavation Units

More than 16,500 beads representing 58 bead types were recovered from 209 excavation units within the burial area (see Table 81). In addition, two units located in the burial area, are control units (CUs 141 and 186) that have been discussed earlier. In general, the excavation units were distributed throughout the densest part of the main burial area, surrounded by burial features and nonburial features. Most of the beads (98.9 percent) were recovered from cultural strata dating between the Late and Mission periods (see Table 70).

Frequencies of beads recovered from individual excavation units ranged from 1 to 2,035, the latter total recovered from EU 154. A total of 162 (77.5 percent) of the 209 excavation units contained varieties of olivella disks, indicating use of this portion of the site during the Mission period. For the most part, the relative distribution of bead types was similar to that identified for burial features.

Of the 209 excavation units within the burial area containing shell beads, two units are of particular interest. EU 154 contained the highest frequency of shell beads, totaling 2,035 (12.4 percent) beads. Fifteen varieties of beads were identified, as well as olivella beads of unknown type. Semiground disks by far made up the bulk (85.9 percent) of the collection. Beads manufactured from shell other than olivella included red abalone and Pismo clam. EU 154 also contained 385 short segments of fused beads recovered from Levels 52 and 53. The multiple segments consisted of 2–20 fused beads and may have once been part of one or multiple strands. Bead types found fused together included semiground disks, ground disks, and red abalone epidermis disks.

EU 183 also had high frequencies of fused beads, possibly indicative of bead strands. A total of 438 fused bead segments, consisting of 2–18 fused beads per segment, was recovered from Level 49. More than half of the fused beads were tiny saucers (68.5 percent); most of the rest were semiground disks (31.5 percent). Some or all of these may have once been part of one or more strands. EUs 183 and 154 were located in one of the densest portions of the burial area and were surrounded by dozens of burial features, including those within burial Feature Groups 1–5. Considering the high frequencies of shell beads and fused bead segments, as well as the proximity to burial features, the beads recovered from EUs 183 and 154 were likely part of one or more burial features.

Dates for shell beads recovered from the excavation units ranged widely through time. Most of the beads with narrow time ranges dated to the Mission period, particularly the late Mission period (semiground disks). However, the presence of bead types dating to the early Intermediate period (rings), the Intermediate to the early Late periods (normal saucers), and the later Late to the Protohistoric periods (oval and round thin lipped beads) indicates that this portion of the site was used on numerous occasions over time.

Nonburial Features

Shell beads were identified in 12 nonburial features: artifact concentrations (n = 9), rock clusters (n = 1), and pits (n = 2) (see Tables 81 and 82). All of the features, with the exception of Feature 129 (artifact concentration) and Feature 272 (pit), were clustered within the south-central portion of the main burial area. Feature 129 was approximately 12 m to the northeast of the cluster, and Feature 272 was approximately 4 m to the southeast. A total of 1,371 shell beads was analyzed from these 12 features in the burial area. As with burial features and burial-area excavation units, most of the beads (88.8 percent) in nonburial features were recovered from Stratum IV, which dates to the Late to Mission period (see Table 70).

Artifact Concentrations

Most of the beads (98.8 percent) in burial-area features were recovered from artifact concentrations, all of which were surrounded by burial features (see Tables 81 and 82). Overall, the nine features were relatively tightly clustered, with the exception of Features 506 and 129, which were located approximately 3.5 m and 12 m northeast of the cluster, respectively.

Given the spatial proximity to burial features, it is likely these artifact concentrations were associated with burials or perhaps were related to rituals and ceremonies. For the most part, artifact-concentration features consisted of caches of shell beads, and in some cases, beads were found in strand fragments. Glass beads were also present in most of these features, with the exception of Features 129, 224, and 506, mixed with shell beads and, in some cases, appear to have been originally strung with shell beads.

A total of 1,355 shell beads was analyzed with bead frequencies in features ranging from 2 to 425 beads. Feature 129 yielded the lowest (0.1 percent) frequency, whereas Feature 224 yielded the highest (31.5 percent). Collectively, beads were grouped into 15 different bead types. By far, olivella semiground disks composed the bulk (89.3 percent) of the collections.

Fused beads, an indication of possible bead strands, were recovered from six features (Features 35, 68, 70, 75, 127, and 224). The number of beads in fused segments ranged from 13 to 189. Bead types found fused together included olivella semiground disks, abalone epidermis disks, ground disks, ground/semiground disks, and tiny saucers. Types of beads found fused together were similar to those found in burial features. However, whether these fused beads were once part of bead strands remains unclear.

In several of the features, shell beads were associated with other artifacts. Shell beads in Features 35 and 68 were

Table 81. Shell Beads in Excavation Units and Nonburial Features in the Burial Area, LAN-62 A/G

Shell Type	Bead Class	Bead Type Grouping	Count			Percent within Each Shell Type	Percent of All Shell Beads
			EUs	Features	Total		
Olivella	spire-lopped	simple spire-lopped	9	1	10	0.06	0.06
	end-ground	end-ground, small	1	—	1	0.01	0.01
		barrel, small	1	—	1	0.01	0.01
		cap, small	1	—	1	0.01	0.01
		spire	3	—	3	0.02	0.02
Subtotal (end-ground)			6	1	7	0.04	0.04
	lipped	lipped class	113	—	113	0.70	0.63
		thin lipped	2	—	2	0.01	0.01
		round thin lipped	269	3	272	1.68	1.51
		oval thin lipped	290	1	291	1.80	1.62
		thick lipped	405	1	406	2.51	2.26
		large lipped	14	—	14	0.09	0.08
		rough large lipped	48	—	48	0.30	0.27
Subtotal (lipped)			1,141	5	1,146	7.10	6.38
	saucer	saucer class	5	—	5	0.03	0.03
		tiny saucer	876	3	879	5.44	4.89
		very tiny saucer	217	—	217	1.34	1.21
		normal saucer	67	—	67	0.41	0.37
		ring	3	—	3	0.02	0.02
Subtotal (saucer)			1,168	3	1,171	7.25	6.52
	disk	disk class	7	—	7	0.04	0.04
		ground/semiground disk	4	44	48	0.30	0.27
		ground disk	223	32	255	1.58	1.42
		semiground disk	9,899	1,227	11,126	68.91	61.92
		rough disk	8	—	8	0.05	0.04
Subtotal (disk)			10,141	1,303	11,444	70.88	63.69
	wall disk	wall disk class	1	—	1	0.01	0.01
	callus	cupped	734	1	735	4.55	4.09
		bushing	1,536	5	1,541	9.54	8.58
		cylinder	45	—	45	0.28	0.25
Subtotal (callus)			2,315	6	2,321	14.38	12.92
	thin rectangle	thin rectangle class	7	—	7	0.04	0.04
	unknown	unknown olivella bead	39	—	39	0.24	0.22
Subtotal (olivella)			14,827	1,318	16,145	100.00	89.85
Abalone	disk	red abalone epidermis disk	941	36	977	98.89	5.44
		black abalone epidermis disk	2	—	2	0.20	0.01
Subtotal (disk)			943	36	979	99.09	5.45
	cylinder	red abalone epidermis cylinder	9	—	9	0.91	0.05
Subtotal (abalone)			952	36	988	100.00	5.50
California mussel	disk	disk	7	—	7	31.82	0.04
	cylinder	cylinder	15	—	15	68.18	0.08
Subtotal (California mussel)			22	—	22	100.00	0.12
Pismo clam	disk	disk	5	—	5	0.74	0.03
	cylinder	cylinder	451	2	453	66.91	2.52
	tube	tube	202	14	216	31.91	1.20

Shell Type	Bead Class	Bead Type Grouping	Count			Percent within Each Shell Type	Percent of All Shell Beads
			EUs	Features	Total		
	unknown	unknown	3	—	3	0.44	0.02
Subtotal (Pismo clam)			661	16	677	100.00	3.77
Clam	disk	disk	8	—	8	61.54	0.04
	unknown	clam	5	—	5	38.46	0.03
Subtotal (clam)			13	—	13	100.00	0.07
Giant rock scallop	disk	disk	42	—	42	37.84	0.23
	cylinder	cylinder	22	—	22	19.82	0.12
	tube	tube	45	1	46	41.44	0.26
	unknown	unknown	1	—	1	0.90	0.01
Subtotal (giant rock scallop)			110	1	111	100.00	0.62
Gastropod	columella	columella	8	—	8	100.00	0.04
Unknown	unknown	unknown	4	—	4	100.00	0.02
Total			16,597	1,371	17,968		100.00

Table 82. Shell Beads from FB 3 Excavation Units, LAN-62 A/G

Shell Type	Bead Class	Bead Type	Total (n)	Percent within Each Shell Type	Percent of All Shell Beads
Olivella	lipped	lipped	18	4.2	3.8
		round thin lipped	5	1.2	1.1
		oval thin lipped	18	4.2	3.8
		full lipped	20	4.7	4.2
		deep lipped	7	1.6	1.5
		large lipped	2	0.5	0.4
		full large lipped	5	1.2	1.1
		rough large lipped	10	2.3	2.1
Subtotal (lipped)			85	19.9	17.9
	saucer	tiny saucer	4	0.9	0.8
		normal saucer	3	0.7	0.6
Subtotal (saucer)			7	1.6	1.5
	disk	ground/semiground disk	3	0.7	0.6
		semiground disk	219	51.2	46.1
		semiground disk, lipped	2	0.5	0.4
Subtotal (disk)			224	52.3	47.2
	wall	wall disk	1	0.2	0.2
	callus	cupped	111	25.9	23.4
Subtotal (olivella)			428	100.0	90.1
Red abalone	disk	epidermis disk	41	100.0	8.6
Pismo clam	cylinder	cylinder	1	50.0	0.2
	tube	tube	1	50.0	0.2
Subtotal (Pismo clam)			2	100.0	0.4
Giant rock scallop	cylinder	cylinder	1	25.0	0.2
	tube	tube	3	75.0	0.6
Subtotal (giant rock scallop)			4	100.0	0.8
Total			475		100.0

Note: Includes Excavation Units 139, 296, 301, 303, 339, 715, 717, 772–774, 782–784, 809–813, 817–819, 822–827, and 829.

associated with textile and basketry fragments, respectively, indicating that the beads were likely once held in bag or basket containers. Considering the proximity to burial features (Features 35 and 68 are in proximity to burial Features 39 and 14, respectively), containers filled with shell beads were likely presented as burial offerings.

In addition to shell beads, Feature 68 contained a scallop shell fragment coated with asphaltum. In Feature 129, shell beads were found with a worked-bone fragment that was very likely an asphaltum-coated bone whistle or flute. The bone artifact may have been inlaid with shell beads at one time; however, shell beads recovered from the feature did not exhibit asphaltum staining. Shell beads in Feature 252 were associated with a large concentration of artifacts, including a tablet incised with an animal motif, killed stone bowls, and other ground stone fragments. Considering the artifact associations, the artifact-concentration features likely represent mortuary offerings and perhaps the remains of ceremonial activities associated with the burials, including mourning ceremonies.

Most of the shell beads in artifact concentrations were recovered from Late period through Mission period chronostratigraphic contexts. Collectively, dates for shell beads recovered from artifact concentrations ranged from the early Intermediate period through the late Mission period. Numerous features yielded shell-bead types with relatively narrow time ranges. These included round and oval thin lipped beads (later Late and Protohistoric periods) from Features 75, 129, 224, and 272. Features 75 and 224 also yielded semiground disks, as did Features 70 and 127, which indicates activity in this area of the site during the late Mission period. Ground disks in Features 35 and 68 provide evidence for early Mission period activities.

Rock Cluster

One rock cluster, Feature 29, contained shell beads. The feature was located within the main burial area approximately 2 m east of the cluster of artifact-concentration features and adjacent to burial features. Feature 29 consisted of a stone bowl and a scattering of ground stone artifacts and a piece of worked bone with asphaltum. Two olivella bushing beads were found fused together at the bottom of the bowl. Considering the low frequency, it is unclear whether the beads were originally part of a larger strand. Three of the adjacent burial features (Group 1 burial Features 339, 341, and 581) had olivella bushings, and two of these had fused bushings (burial Features 339 and 341). There is a strong possibility that Feature 29 is associated with one or more of these burial features. Based on the bushings recovered from Feature 29, the feature may date to between the Late period and the Mission period, which corresponds with chronostratigraphic analysis for the feature.

Pits

Shell beads were recovered from two pit features: Features 122 and 272. Feature 122 was located within the cluster of artifact-concentration features within the main burial area. Feature 272 was situated adjacent to FB 3 (discussed below). Feature 122 consisted of a concentration of charcoal adjacent to burial features and a feature containing the remnants of fibrous water bottle. Dark soil and concentrations of charcoal and stacked clusters of shell constituted Feature 272. Overall, the two features appear to be refuse pits; however, their proximity to burial features indicates they were likely part of ceremonial activities.

A total of 14 shell beads was recovered from the two pits. Feature 122 contained 10 semiground disks, and Feature 272 yielded 3 red abalone epidermis disks and 1 olivella round thin lipped bead. One of the semiground disks from Feature 122 had asphaltum staining. Considering the proximity to the asphaltum-lined water bottle, the bead may have come in contact with or was associated with the bottle recovered from Feature 119. Additionally 8 of the 10 semiground disks were recovered in fused segments.

A round thin lipped bead, commonly manufactured between A.D. 1500 and 1600, was recovered from Feature 272 and the adjacent burial feature (Feature 287). Considering the similarities in bead type, the two features may be associated. Nevertheless, the small sample size makes it difficult to draw conclusions.

All of the shell beads found in pit features were identified in the chronostratigraphic unit dating between the Late period and the Mission period. As with the burial-area features discussed above, bead dates for pit features ranged from the Late period through the Mission period, particularly the late Mission period in the case of Feature 122.

Feature Block 3

FB 3 was composed of excavation units and features located in the western portion of LAN-62, Locus A, and adjacent to the main burial area. The feature block consists of a well-defined area adjacent to burials that may have been associated with activities in the main burial area in the Protohistoric and Mission periods. FB 3 is characterized by a series of tightly clustered features, including artifact concentrations, rock clusters, thermal features, and pits. One of the features (Feature 384) may represent the remains of mourning-ceremony activities. FB 3 excavation units and features yielded a total of 1,233 shell beads; the highest frequency of shell beads recovered from LAN-62, Locus A, features blocks (Tables 83–85).

Excavation Units

A total of 28 excavation units yielded 475 shell beads consisting of 20 different varieties (see Table 83). Frequencies of beads recovered from the excavation units varied considerably, ranging from 4 to 94 beads per unit. EU 823 contained most of the beads (19.8 percent), whereas EUs 783 and 809 yielded the least (0.8 percent). Types of beads recovered from excavation units varied considerably. However, one bead type, olivella semiground disk, was recovered from all excavation units. Furthermore, olivella lipped varieties were identified in

Table 83. Shell Beads from FB 3 Excavation Units, LAN-62 A/G

Shell Type	Bead Class	Bead Type	Total (n)	Percent within Each Shell Type	Percent of All Shell Beads
Olivella	lipped	lipped	18	4.2	3.8
		round thin lipped	5	1.2	1.1
		oval thin lipped	18	4.2	3.8
		full lipped	20	4.7	4.2
		deep lipped	7	1.6	1.5
		large lipped	2	0.5	0.4
		full large lipped	5	1.2	1.1
		rough large lipped	10	2.3	2.1
Subtotal (lipped)			85	19.9	17.9
	saucer	tiny saucer	4	0.9	0.8
		normal saucer	3	0.7	0.6
Subtotal (saucer)			7	1.6	1.5
	disk	ground/semiground disk	3	0.7	0.6
		semiground disk	219	51.2	46.1
		semiground disk, lipped	2	0.5	0.4
Subtotal (disk)			224	52.3	47.2
	wall	wall disk	1	0.2	0.2
	callus	cupped	111	25.9	23.4
Subtotal (olivella)			428	100.0	90.1
Red abalone	disk	epidermis disk	41	100.0	8.6
Pismo clam	cylinder	cylinder	1	50.0	0.2
	tube	tube	1	50.0	0.2
Subtotal (Pismo clam)			2	100.0	0.4
Giant rock scallop	cylinder	cylinder	1	25.0	0.2
	tube	tube	3	75.0	0.6
Subtotal (giant rock scallop)			4	100.0	0.8
Total			475		100.0

Note: Includes Excavation Units 139, 296, 301, 303, 339, 715, 717, 772–774, 782–784, 809–813, 817–819, 822–827, and 829.

Table 84. Shell Beads and Other Worked-Shell Artifacts from FB 3 Features, LAN-62 A/G

Feature Type	Feature No.	Shell Beads (n)	Other Worked Shell (n)	Total Shell Artifacts (n)	Excavation Volume (m³)	Shell-Bead Density (per m³)	Other-Worked-Shell Density (per m³)	Total Shell-Artifact Density (per m³)
Artifact concentration	384	201	—	201	9.040	22.2		22.2
	433	121	—	121	0.100	1,210.0		1,210.0
	456	4	—	4	0.023	173.9		173.9
	458	13	—	13	0.100	130.0		130.0
	467	273	—	273	0.050	5,460.0		5,460.0
Subtotal		612	—	612	9.313	65.7		65.7
Rock cluster	331	2	4	6	0.100	20.0	40.0	60.0
	471	8	—	8	0.012	666.7		666.7
Subtotal		10	4	14	0.112	89.3		125.0
Pit	454	4	—	4	0.014	285.7		285.7
	475	131	—	131	0.030	4,366.7		4,366.7
	672	1	—	1	0.034	29.4		29.4
Subtotal		136	—	136	0.078	1,743.6		1,743.6
Total		758	4	762	9.503	79.8	0.4	80.2

Table 85. Detail of Shell Beads from FB 3 Features, LAN-62 A/G

Shell Type	Bead Class	Bead Type	Feature Type			Total	Percent within Each Shell Type	Percent of All Shell Beads
			Artifact Concentration	Rock Cluster	Pit			
Olivella	lipped	lipped	1	—	—	1	0.1	0.1
		round thin lipped	—	—	2	2	0.3	0.3
		full lipped	3	—	—	3	0.4	0.4
Subtotal (lipped)			4	—	2	6	0.8	0.8
	saucer	tiny saucer	8	—	—	8	1.1	1.1
	disk	semiground disk	343	2	55	400	55.6	52.8
	callus	cupped	203	3	2	208	28.9	27.4
		bushing	16	5	73	94	13.1	12.4
		cylinder	3	—	—	3	0.4	0.4
Subtotal (callus)			222	8	75	305	42.4	40.2
Subtotal (olivella)			577	10	132	719	100.0	94.9
Red abalone	disk	epidermis disk	9	—	1	10	100.0	1.3
Pismo clam	cylinder	cylinder	1	—	—	1	33.3	0.1
	tube	tube	2	—	—	2	66.7	0.3
Subtotal (Pismo clam)			3	—	—	3	100.0	0.4
Giant rock scallop	cylinder	cylinder	4	—	—	4	66.7	0.5
	tube	tube	1	—	—	1	16.7	0.1
	unknown	unknown	1	—	—	1	16.7	0.1
Subtotal (giant rock scallop)			6	—	—	6	100.0	0.8
Unknown	unknown	unknown	17	—	3	20	100.0	2.6
Total			612	10	136	758		100.0

22 of the 28 units. Fused beads were found in 4 excavation units (EUs 817, 818, 823, and 825), with counts of fused beads in each unit ranging from 8 to 30. Bead types found fused together included olivella cupped and semiground beads in the main burial area. Considering the low frequencies, however, it is unclear whether these fused beads represent fragments of bead strands.

All of the beads were recovered from strata dating between the Late period and the Mission period (see Table 70). Considering the variability in bead types, dates for beads recovered from the 28 excavation units ranged from the early Intermediate period to the Mission period, particularly from the Late period to the late Mission period. Thirteen of the excavation units contained bead types ranging between A.D. 1500 and 1600 (round thin lipped) and A.D. 1500–1700 (oval thin lipped), as well as bead types commonly manufactured within the Mission period (full large lipped, ground/semiground disk, rough large lipped, and semiground disk). Considering the range in bead dates, this portion of the site may have been used on various occasions over a period of at least 300 years, if not longer.

Features

Features in FB 3 containing shell beads included an artifact concentration, rock clusters, and pits. A total of 758 beads was recovered from 10 features (see Tables 83–85). In FB 3, shell beads were recovered in higher frequencies from features than from the excavation units; however, fewer bead types were identified over all of the features. Most of the beads appeared to have been scattered rather than deposited in strands or caches. The following is a discussion of the results of shell-bead analyses by feature type.

Artifact-Concentration Features

Compared to other feature types, the five artifact concentrations in FB 3 contained, by far, most of the shell beads, with a total of 612 shell beads (see Tables 84 and 85). As discussed above, this was also the case for burial-area features. In terms of shell-bead density, however, artifact concentrations collectively had only the second highest density (see Table 84).

The features, located in a cluster in the southern portion of FB 3, consisted of pitlike concentrations of artifacts, including concentrations of charcoal; basketry fragments, many of which were burned; FAR; and fragments of unworked shell and bone. They yielded 14 different types of beads (see Table 85), although semiground disks were recovered from all five artifact concentrations and were the most common bead type in all but Feature 467. Cupped beads composed the bulk (74 percent) of the Feature 467 collection and were found in only one other feature, Feature 384, which was located adjacent to Feature 467.

Feature 467 yielded the highest frequency of shell beads (44.6 percent) recovered from the five features, whereas Feature 456 yielded the lowest frequency (0.7 percent). The greatest variety of bead types was found in Feature 384, with 12 different types identified, including giant rock scallop beads. Feature 384 also contained 12 fused beads that were mostly semiground disks with a few bushings found fused side by side. These fused beads may have once been part of a strand.

Although the five features contained charcoal, there was little evidence of in situ thermal activity. Nevertheless, slightly less than half of the shell beads (48.2 percent) were burned. Burned beads were recovered from all of the features but Feature 465. The frequency of burned beads was low for these features, except for Feature 467, in which 70 percent of the beads exhibited evidence of being fire affected. Of these burned beads, 42 consisted of olivella cupped beads with incised decorative lines. Decorative patterns included crosshatching, diagonal parallel lines, parallel lines, and parallel lines with crosshatching. The high frequency of burned beads in Feature 467 is not surprising considering the concentrations of charcoal and FAR recovered from the feature. These beads may have been ritually burned during a mourning ceremony or other ceremonies.

Overall, dates for beads range widely through time from the early Intermediate period through the Mission period, most overlapping between the Late period and the late Mission period, particularly the latter period. The only bead type, however, with a narrow time range was semiground disk (late Mission period), which was recovered from all five features.

Rock-Cluster Features

Two rock-cluster features containing shell beads were identified in FB 3, Features 331 and 471 (see Tables 84 and 85). Feature 331 was located in the northeastern portion of FB 3, whereas Feature 471 was situated in the southwestern portion immediately northwest of the cluster of five artifact-concentration features. Concentrations of FAR, unworked-shell and bone fragments and charcoal were recovered from Feature 331, and Feature 471 yielded a small cluster of FAR and a few fragments of unworked shell.

Shell-bead density was highest for rock-cluster features; however, they yielded the lowest frequency of shell beads (1.3 percent) (see Table 84). Ten shell beads were recovered from the two rock-cluster features, with Feature 471 yielding a slightly higher frequency. Feature 331 contained 2 olivella semiground disks, and Feature 471 yielded 5 olivella bushings and 3 olivella cylinders. Unlike the artifact-concentration features, none of the beads from the rock-cluster features exhibited evidence of having been burned, indicating that they were likely deposited after any thermal activities. Dates for beads recovered from the two features ranged from the Late period to the late Mission period. The presence of semiground disks in Feature 331 indicates late Mission period activities. The olivella bushings and cylinders in Feature 471 indicate activities likely sometime post–A.D. 1500.

In addition to shell beads, four other worked-shell artifacts were recovered from Feature 331. Artifacts included two black abalone and venus clam shell containers, as well as two venus clam scoops (Figure 71). All exhibited evidence of having been ground from use. The shell containers were distinguished from the scoops based on evidence of additional modifications. For example, the black abalone container had siphon holes plugged with asphaltum, whereas ocher was recovered from the ventral surface of the venus clam container. Considering the evidence of ritual activities in FB 3 and the surrounding area, the shell containers and scoops were likely used in these activities, perhaps as part of ritual feasting, as well as offerings, particularly in the case of the ocher-filled venus clam container.

Pit Features

Three pit features located in the western portion of FB 3 contained shell beads: Features 454, 475, and 672 (see Tables 84 and 85). Feature 475 was situated between two clusters of artifact concentrations, and Feature 454 was located adjacent to the cluster of artifact-concentration features. Feature 672 was identified in the southwesternmost portion of FB 3, adjacent to a rock cluster (Feature 673) which did not contain shell beads. The three pit features were composed, in part, of fragments of unworked-bone, shell, and botanical remains. Additionally, burned basketry fragments were found in Features 454 and 475. Evidence of in situ burning, however, was absent from all three features.

Of the three types of features containing shell beads, pit features yielded the second highest frequency of shell beads (17.9 percent). However, based on excavation volumes, pit features yielded the highest shell-bead density of the features types (see Table 84). The analysis included a total of 136 shell beads representing five different bead types. Bushings were the most common bead type and were recovered from two of the three features (Features 454 and 475). The remaining beads in Feature 454, as well as those in Feature 672, were of unknown type. By far, Feature 475 had the greatest variability in bead types. The feature also yielded 8 fused beads consisting of 6 bushings fused side by side, as well as 2 semiground disks. Feature 475, very likely the remains of a storage or hearth cleanout area, also contained a single burned bushing bead. Burned beads were absent from the remaining features. Considering the low frequency of fire-affected beads, beads recovered from the pits were not likely part of thermal activities and were instead deposited following such activities.

Dates for bead types recovered from the three pit features ranged from the Late period to the late Mission period. Feature 475 contained two olivella round thin lipped beads, commonly manufactured between A.D. 1500 and 1600. The presence of semiground disks indicate that later activities also occurred in this portion of the site, during the late Mission period.

Feature Block 4

FB 4 was composed of excavation units and features located in the central portion of the main excavation area of LAN-62

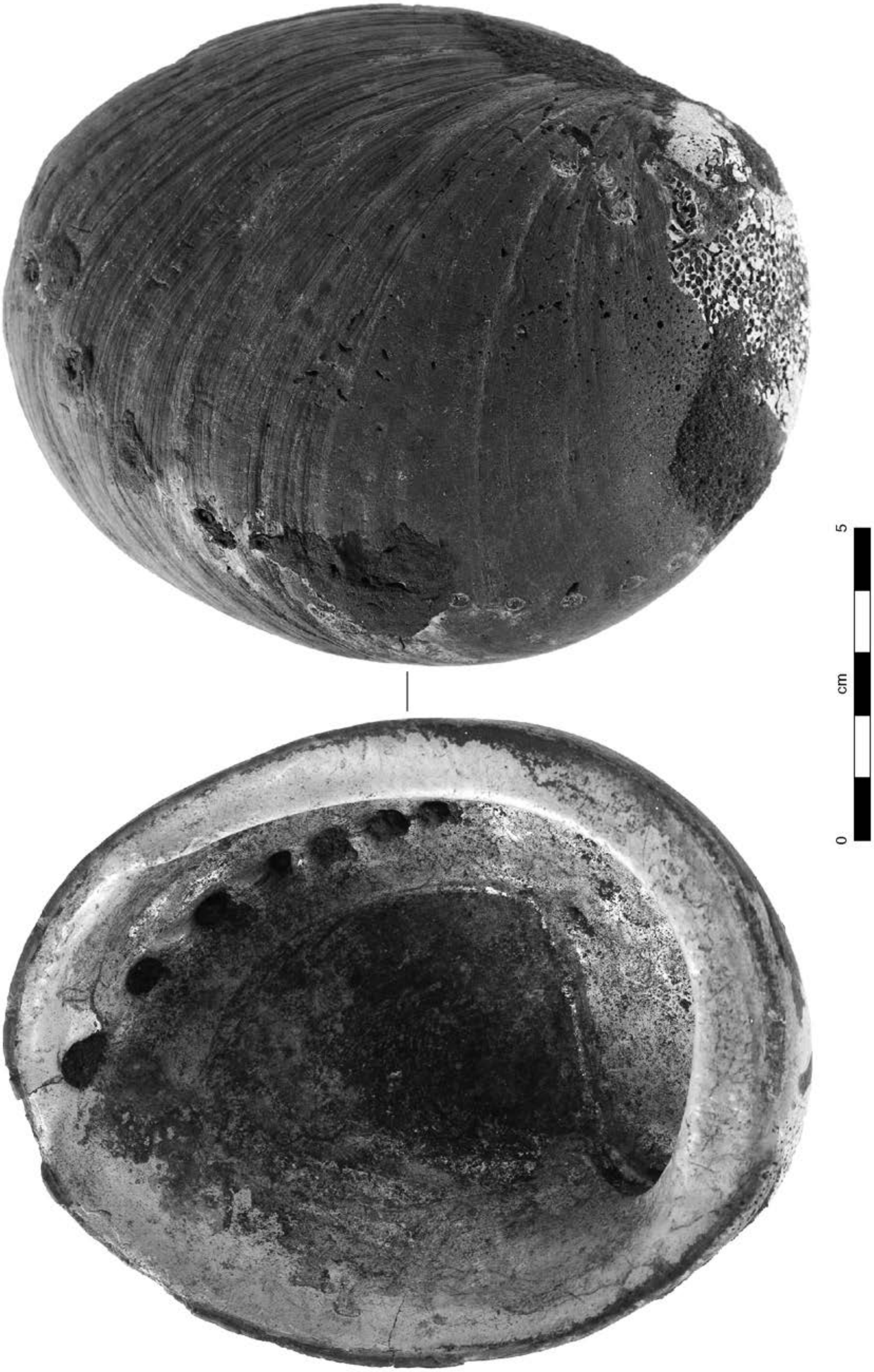

Figure 71. Abalone shell container coated with asphaltum, from LAN-62, nonburial Feature 331.

Locus A and the eastern portion of the main burial area, approximately 9 m east of FB 3. All of the shell beads from FB 4 were recovered from strata associated with human occupation dating to the Intermediate period (see Table 70). Compared to FB 3, FB 4 contained low frequencies of shell beads. A total of 48 beads was recovered from 25 excavation units and 2 features (Table 86).

Excavation Units

The analysis included 45 shell beads recovered from 25 excavation units. Beads were recovered in low frequencies in each of the excavation units, with counts ranging from 1 to 4, and only 1 excavation unit (EU 4) contained 4 beads.

Considering the relatively limited number of shell beads, there was surprising variability of bead types, consisting of 13 different types (see Table 86). Unlike FB 3 excavation units, a single bead type did not dominate the FB 4 collection; however, there was a slightly higher frequency of olivella cupped beads (24.4 percent) compared to other types.

Bead types with narrow time ranges suggest the FB 4 area was likely used on multiple occasions over time. Based on shell-bead dates, use of this area appears to have occurred during the early Intermediate period (oblique spire-lopped bead), during the Intermediate and early Late periods (normal saucer), and between A.D. 1500 and 1700 (round and oval thin lipped beads). The extremely low frequency of beads dating squarely within the Mission period suggests activities in the FB 4 area likely predate the Mission period.

Features

Of the 12 features identified in FB 4, two rock clusters contained shell beads. Feature 419 was located in the south-central portion of the feature block, and Feature 572 was situated approximately 13 cm to the north.

Burial features were located adjacent to Feature 419, which was composed of a cluster of lithics adjacent to a cluster of unworked shell, as well as a concentration of unworked fish, mammal, and bird bone. The lithics consisted of mostly FAR. Feature 572 consisted of a cluster of shell and was considered to be a subfeature of Feature 419. A few fragments of unworked bone were identified as well. Overall, the two features appear to have been the result of food-consumption activities, which would account for the extremely low frequencies of shell beads. Feature 419 contained a single olivella cupped bead commonly manufactured from the Late period through the Mission period. A fragment of abalone shell coated with asphaltum on the dorsal surface of the shell was recovered from Feature 419 as well. Feature 572 yielded two olivella beads, a round thin lipped bead, and a tiny saucer. Round thin lipped beads were commonly manufactured over a short duration, between A.D. 1500 and 1600, whereas tiny saucers were manufactured as early as the early Intermediate period through the Mission period.

For the most part, dates for beads from FB 4 features and excavation units were similar, both indicating activities sometime during the early Intermediate period and the Mission period, although activities during the latter were likely limited. FB 4 activities appear to date to an earlier period than those at FB 3.

Feature Block 7

Millingstone period FB 7 was located in the main excavation area of Locus A, approximately 2 m north of the main burial area. Of the three feature blocks discussed here, FB 7 yielded the lowest frequency of shell beads, with a total of two shell beads recovered from EUs 114 and 343. Shell beads were absent from features in FB 7. Both beads were identified as olivella cupped beads, commonly manufactured from the Late period through the Mission period. No modifications were noted on the beads.

Sitewide Excavation Units and Features

The final analytical context at LAN-62 A/G includes the excavation units and features from across the site located outside of the burial area and feature blocks. Analysis included a total of 5,460 shell beads recovered from 380 excavation units and 40 nonburial features (Table 87).

Excavation Units

A total of 5,287 shell beads from 380 excavation units was analyzed and included 52 bead types (see Table 87). By contrast to the burial area, semiground disks did not constitute the bulk of the shell-bead collection recovered from sitewide excavation units. Instead, most of the beads were identified as olivella cupped (20.8 percent), followed in decreasing frequency by olivella thick lipped beads (14.6 percent), semiground disks (12.4 percent), round thin lipped beads (10 percent), and oval thin lipped beads (8.3 percent). Shell-bead counts in excavation units ranged from 1 to 180, with EU 347 yielding the highest frequency. By far, most of the beads (95.5 percent) were recovered from strata dating between the Late period and the Mission period, followed in decreasing frequency by strata dating to indeterminate periods (3.8 percent), the Intermediate period (0.6 percent), and the Millingstone period (0.1 percent) (see Table 70).

In general, the frequencies of fused beads were low, with only four excavation units containing more than two fused beads (i.e., 5–7 fused beads). Considering the low frequencies, it is unclear whether the fused beads were originally part of strands.

As previously noted, EU 347 contained the highest frequency of shell beads. Bead types recovered from EU 347 consisted of a variety of olivella lipped beads, including thin lipped, full lipped, and full large lipped varieties. Interestingly, these beads provide a consecutive sequence of time with thin lipped beads occurring during the Late and Protohistoric periods, followed by full lipped dating to the Protohistoric and Mission

Table 86. Shell Beads from FB 4 Excavation Units and Features, LAN-62 A/G

Shell Type	Bead Class	Bead Type	EUs (n)	Features (n)	Total (n)	Percent within Each Shell Type	Percent of All Shell Beads
Olivella	spire-lopped	simple spire-lopped, small	4	—	4	8.9	8.3
		simple spire-lopped, medium	1	—	1	2.2	2.1
		oblique spire-lopped, small	1	—	1	2.2	2.1
Subtotal (spire-lopped)			6	—	6	13.3	12.5
	lipped	round thin lipped	1	1	2	4.4	4.2
		oval thin lipped	1	—	1	2.2	2.1
		full lipped	3	—	3	6.7	6.3
Subtotal (lipped)			5	1	6	13.3	12.5
	saucer	tiny saucer	3	1	4	8.9	8.3
		normal saucer	1	—	1	2.2	2.1
		normal saucer, small	3	—	3	6.7	6.3
		normal saucer, large	3	—	3	6.7	6.3
Subtotal (saucer)			10	1	11	24.4	22.9
	disk	semiground disk	1	—	1	2.2	2.1
	callus	cupped	11	1	12	26.7	25.0
		bushing	7	—	7	15.6	14.6
Subtotal (callus)			18	1	19	42.2	39.6
	unknown	unknown	2	—	2	4.4	4.2
Subtotal (olivella)			42	3	45	100.0	93.8
Red abalone	disk	epidermis disk	3	—	3	100.0	6.3
Total			45	3	48		100.0

Key: EU = excavation unit.

Table 87. Shell Beads from Sitewide Excavation Units and Features, LAN-62 A/G

Shell Type	Bead Class	Bead-Type Grouping	EUs (n)	Feature: Artifact Concentration (n)	Feature: Rock Cluster (n)	Feature: Pits (n)	Feature: Thermal Features (n)	Total	Percent within Each Shell Type	Percent of All Shell Beads
Olivella	spire-lopped	simple spire-lopped	73	—	3	—	—	76	1.5	1.4
		oblique spire-lopped	6	—	—	—	—	6	0.1	0.1
Subtotal (spire-lopped)			79	—	3	—	—	82	1.6	1.5
	end-ground	barrel	2	—	—	—	—	2	<0.1	<0.1
	lipped	lipped	325	—	4	—	1	330	6.6	6.0
		thin lipped	8	—	—	1	—	9	0.2	0.2
		round thin lipped	530	—	13	2	—	545	10.9	10.0
		oval thin lipped	438	—	6	—	—	444	8.9	8.1
		thick lipped	773	—	7	2	30	812	16.2	14.9
		large lipped	44	—	3	—	—	47	0.9	0.9
Subtotal (lipped)			2,118	—	33	5	31	2,187	43.6	40.1
	saucer	tiny saucer	224	—	1	—	—	225	4.5	4.1
		normal saucer	169	—	2	—	—	171	3.4	3.1
		ring	3	—	—	—	—	3	0.1	0.1
		oval saucer	2	—	—	—	—	2	<0.1	<0.1
		irregular saucer	2	—	—	—	—	2	<0.1	<0.1
Subtotal (saucer)			400	—	3	—	—	403	8.0	7.4
	disk	disk	4	—	—	—	—	4	0.1	0.1
		ground/semiground disk	4	1	—	—	—	5	0.1	0.1
		ground disk	39	4	—	—	—	43	0.9	0.8
		semiground disk	656	—	—	1	—	657	13.1	12.0
		rough disk	18	—	—	—	—	18	0.4	0.3
Subtotal (disk)			721	5	—	1	—	727	14.5	13.3
	wall disk	wall disk	2	—	—	—	—	2	<0.1	<0.1
	callus	callus	5	—	—	—	—	5	0.1	0.1
		cupped	1,100	—	23	16	—	1,139	22.7	20.9
		bushing	395	—	—	9	—	404	8.1	7.4
		cylinder	21	—	1	2	29	53	1.1	1.0
Subtotal (callus)			1,521	—	24	27	29	1,601	31.9	29.3

continued on next page

Shell Type	Bead Class	Bead-Type Grouping	EUs (n)	Feature: Artifact Concentration (n)	Feature: Rock Cluster (n)	Feature: Pits (n)	Feature: Thermal Features (n)	Total	Percent within Each Shell Type	Percent of All Shell Beads
	thin rectangle	thin rectangle	3	—	—	—	—	3	0.1	0.1
	unknown	unknown	5	—	1	—	—	6	0.1	0.1
Subtotal (olivella)			4,851	5	64	33	60	5,013	100.0	91.8
Abalone	disk	red abalone epidermis disk	308	1	3	5	—	317	98.4	5.8
		black abalone epidermis disk	5	—	—	—	—	5	1.6	0.1
Subtotal (abalone)			313	1	3	5	—	322	100.0	5.9
California mussel	disk	disk	5	—	—	—	—	5	33.3	0.1
	cylinder	cylinder	10	—	—	—	—	10	66.7	0.2
Subtotal (California mussel)			15	—	—	—	—	15	100.0	0.3
Pismo clam	disk	disk	2	—	—	—	—	2	5.4	<0.1
	cylinder	cylinder	23	—	—	—	—	23	62.2	0.4
	tube	tube	12	—	—	—	—	12	32.4	0.2
Subtotal (Pismo clam)			37	—	—	—	—	37	100.0	0.7
Clam	unknown	unknown	5	—	—	—	—	5	100.0	0.1
Giant rock scallop	disk	disk	43	—	1	—	—	44	67.7	0.8
	cylinder	cylinder	16	—	—	—	—	16	24.6	0.3
	tube	tube	5	—	—	—	—	5	7.7	0.1
Subtotal (giant rock scallop)			64	—	1	—	—	65	100.0	1.2
Unknown	unknown	unknown	2	—	1	—	—	3	100.0	0.1
Total			5,287	6	69	38	60	5,460		100.0

Key: EU = excavation unit.

periods, and full large beads used during the Mission period. However, these beads were mixed throughout the excavation-unit levels, and the beads associated with the earliest period (thin lipped beads) were recovered from both lower and upper excavation levels. This intermixing may have been a result of bioturbation or other ground-disturbing activities.

Although no single bead type dominated the sitewide excavation-unit collection, cupped beads constituted about 21 percent of the collection. Larger-sized cupped beads were reportedly manufactured between A.D. 1150 and 1500, whereas smaller varieties were more popular between ca. A.D. 1500 and 1782 (Gibson 1976, 1992). If this temporal variation holds true for the Ballona, it would appear that approximately 92 percent of the cupped beads from LAN-62 A/G date prior to A.D. 1500.

Shell-bead types with narrow time ranges indicate that activities across the site were carried out on various occasions over a period of nearly 3,000 years. Bead types included those dating to the early Intermediate period (oblique spire-lopped and ring), Intermediate period to early Late period (irregular, normal, and oval saucers), Late period to Protohistoric period transition (round and oval thin lipped), early Mission period (ground disk), early to late Mission period (ground/semiground disk and rough and deep large lipped), late Mission period (semiground disk), and terminal Mission period (rough disk). Shell beads dating between the early Intermediate period and the early Late period were widely dispersed across the site, as were later Late to Protohistoric period beads, although in much higher frequencies. Frequencies of late Mission period beads dropped off for sitewide excavation units, and their distribution was somewhat limited to the northern portion of the site. Late Mission period beads, however, were found across the site in much higher frequencies. Although relatively sparse, beads dating to the terminal Mission period were located in excavation units dispersed across the site.

Features

In addition to excavation units, a total of 43 features located across LAN-62 A/G contained shell beads. The analysis included a total of 173 shell beads recovered from four types of features: artifact concentrations (n = 1), rock clusters (n = 31), pits (n = 8), and thermal features (n = 3) (see Table 87). Comparisons of bead dates for features containing more than one shell bead indicate that sitewide features ranged from the Late period through the Mission period, most occurring post–A.D. 1500 (Table 88). This is a narrower time range compared to overall bead dates for sitewide excavation units. The following is a discussion of the results of analysis by feature type.

Artifact-Concentration Features

One artifact-concentration feature (Feature 3) contained six shell beads (see Table 87). Feature 3 consisted of a concentration of faunal bones, as well as low frequencies of FAR and debitage. Bead types consisted of four olivella ground disks, including one lipped variety, one olivella disk, and one red abalone epidermis disk. The olivella disk had been burned, indicating that it was likely associated with the FAR recovered from the feature. The other beads that were not burned, however, were likely deposited at a different time. Dates for the beads ranged from the Late period through the Mission period. The bead type with the narrowest time range—ground disk—indicates early Mission period activities (see Table 88).

Table 88. Summary of Sitewide Features (with Shell-Bead Frequencies >1) and Corresponding Chronologies, LAN-62 A/G

Feature Type	Feature No.	Estimated Time Range (Based on Shell-Bead Dates)	Bead Count (>1)
Artifact concentration	3	A.D. 1770–1816	6
Rock cluster	360	A.D. 1150–historical period	2
	44	A.D. 1500–1600	2
	630	A.D. 1500–1650	8
	92, 146, 169, 632	A.D. 1500–1700	27
	628, 657	A.D. 1650– historical period	5
	182	A.D. 1770–1816	2
Subtotal			46
Pit	21	A.D. 1500– historical period	3
	503	A.D. 1800–1816	25
	636	A.D. 1150– historical period	5
Subtotal			33
Thermal feature	22	A.D. 1500– historical period	30
	62	A.D. 1650– historical period	30
Subtotal			60

Note: Excluded features with a single bead to minimize possibility that the bead was part of background midden rather than the feature context.

Rock-Cluster Features

Of the sitewide features, most (39.9 percent) of the shell beads were recovered from rock-cluster features. The analysis included a total of 69 beads recovered from 31 rock-cluster features (see Table 87). As was the case for those identified in FBs 3 and 4, sitewide rock-cluster features yielded relatively low frequencies of shell beads, with bead counts ranging from 1 to 15. In general, rock-cluster features were largely composed of FAR, lithics, and unworked-shell and bone fragments. As with FBs 3 and 4, sitewide rock-cluster features were identified in a stratum dating between the Late period and the Mission period, with the exception of Feature 44, which was situated within an underlying stratum dating to the Intermediate period.

Collectively, sitewide rock clusters contained 14 bead types (see Table 87), with slightly more than half of the olivella beads (52.4 percent) as lipped varieties, followed in decreasing frequency by callus beads (38.1 percent).

Feature 632, consisting of a FAR and unworked shell and bone, yielded the highest frequency of shell beads, with nine lipped beads and six cupped beads. Two of the beads had been burned. Burned beads were also recovered from Feature 657. The near absence of burned beads, however, indicates that most of the beads were unrelated to thermal activities. In the case of most rock-cluster features, beads were likely deposited subsequent to thermal activities. In addition to burning, other modifications to beads were noted, such as two cupped beads recovered from Features 602 and 628 that were decorated with incised crosshatched lines.

By contrast to patterns noted in the main burial area, semiground disks, as well as other clearly distinct Mission period beads, were absent or nearly absent from the rock-cluster features (see Table 88). In total, three beads commonly manufactured during the Mission period (olivella large lipped) were identified in three features (Features 182, 195, and 251). Other beads of types with narrow time ranges included oval and round thin lipped beads (Features 44, 92, 146, 169, 630, and 632) dating to the Late to Protohistoric period transition (Figure 72) and normal saucers (Features 360 and 381) dating between the Intermediate period and the early Late period.

In addition to shell beads, two features contained other worked-shell artifacts, Feature 44 and 169. Feature 44 contained a California venus clam indeterminate worked-shell fragment that had been chipped and ground on the dorsal surface. Feature 169 contained a California venus clam indeterminate worked-shell fragment that had been cut along the margin and ground on the dorsal surface. The function of the two modified shells are unknown; however, they may represent manufacturing debris or expedient use in the processing of other materials.

Pit Features

A total of 38 shell beads, representing seven varieties and recovered from seven pit features, constituted 22 percent of the shell-bead collection from sitewide features (see Table 87). Bead frequencies in pit features were slightly higher than those found in rock clusters, ranging from 1 to 26. In general, the features consisted of pits with concentrations of charcoal, as well as FAR, flaked and ground stone, and unworked-shell and bone fragments. One feature (Feature 450) also contained 16 glass beads.

As with sitewide rock-cluster features, semiground disks were nearly absent from sitewide pit features. Of the pit features, Feature 503 contained the highest frequency of shell beads (n = 26). Bead types recovered from the feature included mostly cupped (42.3 percent), as well as bushings (26.9 percent) and red abalone epidermis disks (19.2 percent). In addition to shell beads, the pit contained small amounts of unworked shell and bone, ground stone, FAR, and charcoal.

Dates for shell beads in pit features ranged from the Late period to the Mission period. The feature yielding glass beads, Feature 450, also contained an olivella bushing bead, commonly manufactured between the Late period and the Mission period. Three additional features, each containing more than one shell bead, had relatively narrow temporal ranges based on shell-bead dates (see Table 88). Feature 503 likely dates to the late Mission period, and Features 21 and 636 date to some time between the Late period and the Mission period.

Thermal Features

Two thermal features in sitewide contexts contained 60 shell beads (see Table 87). Shell beads were concentrated in these features, and the two thermal features constituted approximately 34.7 percent of the beads recovered from sitewide feature contexts.

The two features, Features 22 and 62, each yielded 30 beads, the highest frequency of shell beads found in any of the sitewide features. Feature 22 consisted of a charcoal stain in addition to flaked stone artifacts and a few fragments of unworked shell and bone. Feature 62 consisted of low frequencies of flaked and ground/battered stone artifacts and fragments of unworked shell and bone. The feature was heavily disturbed by rodent activity.

Collectively, the two thermal features contained four varieties of shell beads (see Table 87). Of the 30 beads recovered from Feature 22, 28 cylinder beads exhibited asphaltum staining and were also burned. Feature 62 also contained 7 burned olivella lipped beads, including 1 asphaltum-stained full lipped bead. Although Feature 22 contained asphaltum-stained shell beads, no additional asphaltum or asphaltum-coated artifacts were identified in the feature. It would appear that the beads were coated with asphaltum prior to their deposition. These beads, however, appear to have been burned during in situ thermal activity. Dates for beads recovered from the two thermal features indicate the features have relatively similar time ranges (see Table 88). Bead dates for Feature 22 range from A.D. 1500 (Late period) to the Mission period, and Feature 62 dates to between A.D. 1650 (Protohistoric period) and the Mission period.

In addition to shell beads, Feature 22 contained two other worked-shell artifacts. These artifacts included a black abalone possible fishhook blank and an abalone fishhook. The

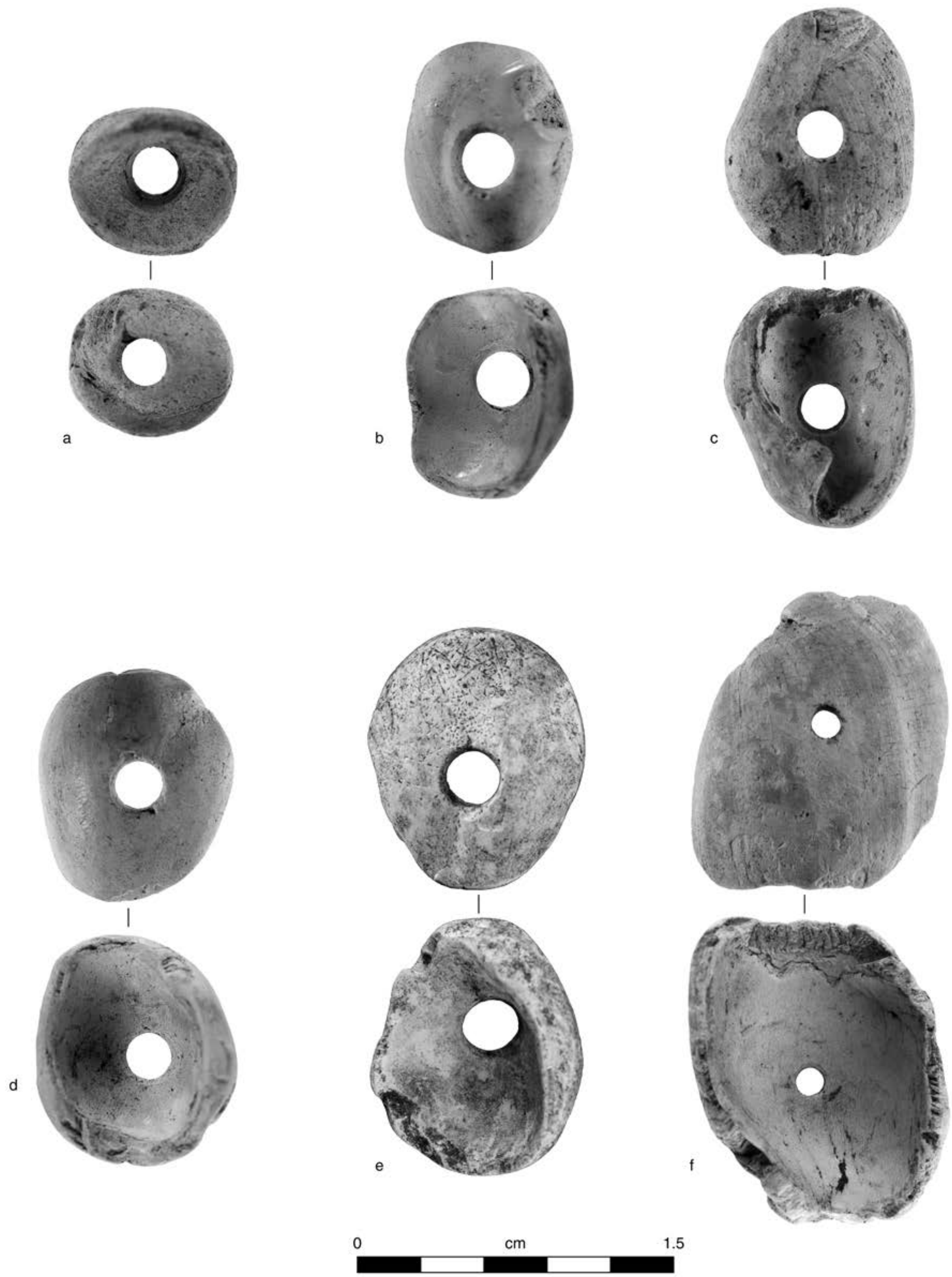

Figure 72. Examples of olivella lipped beads from PVAHP sites: (*a*) round thin lipped; (*b*) oval thin lipped; (*c*) full lipped; (d) deep lipped; (*e*) full large lipped; and (*f*) rough large lipped.

possible fishhook blank consisted of a robust, offset ring, likely representing an intermediate stage of fishhook production, or Stage 2. The second artifact was a complete circular shell fishhook with the tip oriented to the left, or left-handed. Neither artifact appeared to have been burned, indicating that they were likely deposited following thermal activities. Considering the near absence of fishhooks and fishhook blanks recovered from LAN-62, the recovery of a complete fishhook and possible fishhook blank in a single feature was highly unusual. The feature may represent a food-processing area or, considering the high frequency of shell beads and other worked-shell artifacts, may represent ritual activities.

Other Worked Shell

Analysis of worked-shell artifacts at LAN-62 A/G included a total of 255 other worked (nonbead) shell artifacts recovered from across the site, including control units; the burial area; FBs 3, 4, and 7; and sitewide contexts (Table 89).

Worked-shell artifacts associated with shell beads recovered from the burial area and feature blocks have been discussed earlier in this chapter. The following is a general review of the other worked-shell artifact collection and includes descriptions of some of the notable artifacts.

Frequencies of other worked-shell artifacts recovered from features and excavation units ranged from one to eight, with EU 772, located in FB 3, yielding the highest frequency. Compared to shell beads, other worked-shell artifacts were recovered in relatively low frequencies within any single context. In general, more than half (54.9 percent) of the other worked-shell artifacts were recovered from feature contexts. As with shell beads, most of the other worked-shell artifacts (44.7 percent) were from burial features.

A variety of different types of shell were used in the manufacture of shell artifacts (see Appendix C.18). Approximately half of the other worked-shell artifacts consisted of modified abalone shells. Different varieties of clam (29.4 percent) were relatively common as well. Overall, the vast majority of shells were edible varieties, and likely the shells were reserved for use following consumption.

Nine artifact categories were identified, including ornaments, artifact blanks, tools, containers, and scoops, among other categories (Table 90). Additionally, a miscellaneous or "other" category included artifacts of unknown function, such as a black abalone shell with a serrated edged that was recovered from a burial-area excavation unit (EU 417) (Figure 73). The shell may have functioned as an ornament or container, among other possibilities. Additionally a California venus clam shell from EU 215 was identified with asphaltum adhering to the edge of the shell (Figure 74). Although uncertain, these shells may be fragments of treasure boxes or rattles (Hudson and Blackburn 1986:333–334; Walker 1936). In both cases, objects (e.g., pebbles, stone, and shell ornaments) would be placed inside of a bivalve shell and then the two valves would be glued together with asphaltum.

By far, nonbead ornaments (52.6 percent) were the most common type of worked-shell artifact; these were recovered mainly from burial features (see Table 90). Artifact types recovered from excavation units were much more varied, consisting of nearly equal quantities of nonshell-bead ornaments, asphaltum-coated shell, and indeterminate worked-shell artifacts. Of the shell ornaments from excavation units, 12 were recovered from the burial area, indicating that they were likely associated with burial activities. The remaining 10 nonbead shell ornaments were recovered from nonburial contexts.

Although limited, there was evidence for shell ornament manufacture, which included 11 bead and nonbead ornament blanks recovered from within (n = 8) and outside of (n = 3) the burial area. Types of shells included black abalone, olivella, and Pismo clam. Based on shell types and overall shapes of the blanks, it appears some of them were intended for the manufacture of Pismo clam tube and disk beads, abalone pendants, and possibly olivella beads, as evidenced by the presence of 4 whole olivella shells. The low frequency of shell ornament blanks and manufacturing debris, some of which

Table 89. Distribution of Other Worked-Shell Artifacts in Analytical Contexts, by Control Units and Excavation Units, LAN-62 A/G

Provenience	Excavation Context			Total	Percent
	CU	EU	Feature		
Control unit	11	—	—	11	4.3
Burial feature	—	—	114	114	44.7
Burial Area	—	37	2	39	15.3
FB 3	—	10	4	14	5.5
FB 4	—	5	7	12	4.7
FB 7	—	4	—	4	1.6
Sitewide	—	48	13	61	23.9
Total	11	104	140	255	100.0

Key: CU = control unit; EU = excavation unit; FB = feature block.

Table 90. Other Worked-Shell Artifact Types in Control Units, Excavation Units, Burial Features, and Nonburial Features, LAN-62 A/G

Artifact Category	Artifact Type	Excavation Context				Total	Percent of Artifact Type
		CU	EU	Burial Features	Nonburial Features		
Ornament		1	22	60	—	83	32.5
Historical-period button		—	—	1	—	1	0.4
Blank	bead	1	5	—	—	6	2.4
	ornament	—	4	1	—	5	2.0
	fishhook	—	—	—	1	1	0.4
Subtotal		1	9	1	1	12	4.7
Container		1	10	21	8	40	15.7
Scoop		—	—	1	4	5	2.0
Tool	fishhook	—	5	—	1	6	2.4
	rim tool	1	1	1	—	3	1.2
	sieve	—	—	—	1	1	0.4
	other	1	11	2	2	16	6.3
Subtotal		2	17	3	4	26	10.2
Perforated whole shell		—	—	4	—	4	1.6
Asphaltum-coated shell		3	22	11	3	39	15.3
Indeterminate worked shell		3	21	11	6	41	16.1
Other		—	3	1	—	4	1.6
Total		11	104	114	26	255	100.0

Key: CU = control unit; EU = excavation unit.

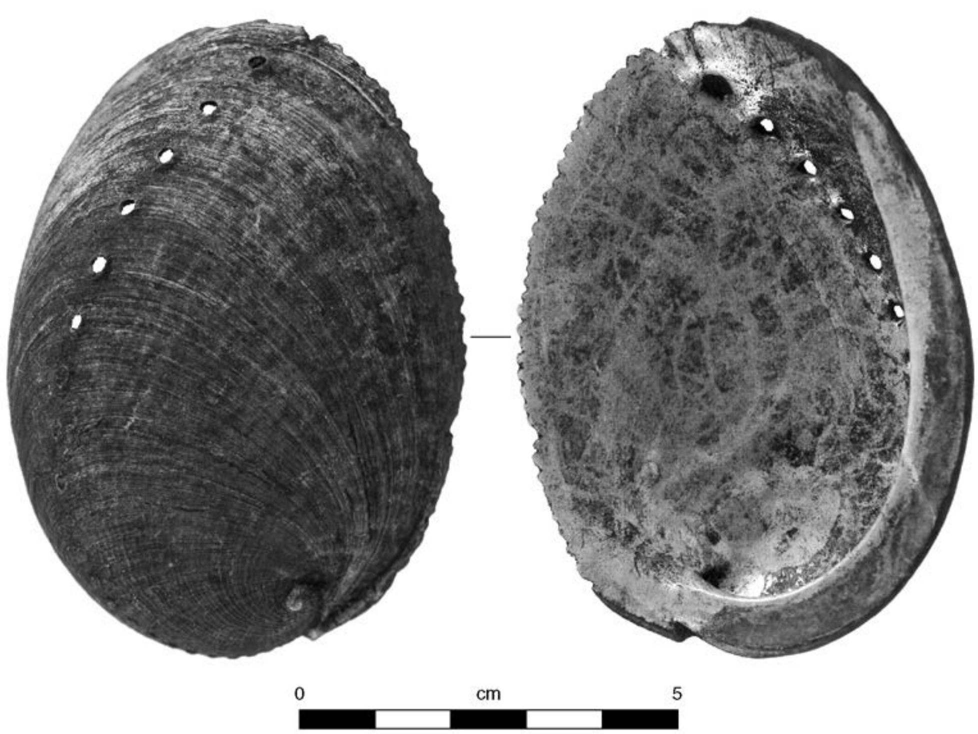

Figure 73. Black abalone shell with serrated edge, from LAN-62, EU 417, Level 50.

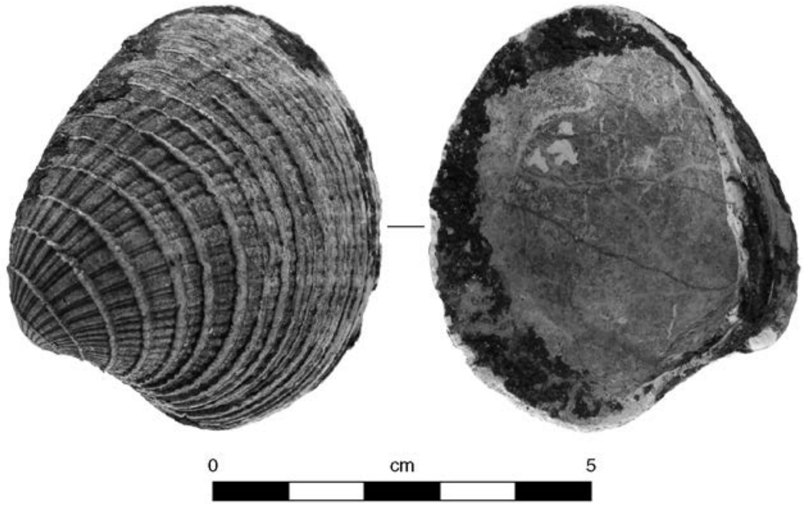

Figure 74. California venus shell coated with asphaltum (possible treasure box or rattle), from LAN-62, EU 215, Level 52 (within burial area).

may be the result of ornament production, suggests that very little ornament manufacture took place in the Ballona, and the vast majority was likely imported to the area.

The tool category consisted of shell fishhooks, an applicator or scraper tool manufactured from the rim of a shell (rim tool), what appears to be a sieve, and tools classified as "other." The latter category consists of worked shells that have a combination of two or more modifications: ground, chipped, or cut. The combination of grinding, chipping, and/or cutting suggests the shells were used for processing or manufacturing other materials, such as food and plant remains, as well as other artifacts. Some of these may have been used expediently, whereas others were used intensively. A tool of note included a black abalone rim tool recovered from burial Feature 183. The tool consisted of a rim fragment that has been chipped along the length of the rim, on both sides, and ground on the dorsal surface. Additionally, a Pismo clam shell tool was recovered from EU 319 that exhibited extensively chipped margins and a ground dorsal surface (Figure 75).

Shell fishhooks were rare in the LAN-62 A/G and the PVAHP collections in general. An abalone fishhook and possible fishhook blank from thermal Feature 22 was previously discussed. The remaining five fishhook fragments were recovered from the burial area (n = 3) and an excavation unit in a sitewide context (n = 2). The fishhooks from the burial area included one California mussel circular fishhook (EU 895) and two fishhook fragments of indeterminate style manufactured from red and black abalone (EUs 341 and 313). A red abalone J-shaped left-oriented fishhook fragment with a knobbed shank was recovered from outside of the burial area (EU 653) (Figure 76a, b). The fishhooks were recovered from excavation units that also contained unworked-shell and bone remains and lithics and appear to be associated with domestic contexts.

Of note, perforated whole shells, all black or red abalone, were found only in burial feature contexts. These shells consisted of whole shells with single perforations near the apex. Based on their association with burials, it is very likely that these shells were ritual offerings and may have been ritually killed.

Also of note, a large red abalone shell with eight holes punched from the shell's dorsal surface was recovered from nonburial Feature 399, a rock cluster located north of the main burial area and 8.5 m northeast of FB 4 (Figure 77). Considering the small perforation diameters and uniformity, the holes may have been punched with a historical-period metal tool, such as an ice pick, nail, or large needle. Although the function of this artifact is unknown, it may have been used as a sieve, considering its overall appearance. No other worked shell was recovered from this feature.

About one-third (31.4 percent) of the worked-shell artifacts recovered from LAN-62 A/G represented different stages of artifact manufacture and processing. Artifact types included bead (2.4 percent), ornament (2.0 percent), and fishhook (0.4 percent) blanks, as well as asphaltum-coated shell (15.3 percent), and indeterminate worked-shell fragments (16.1 percent). The relative proportion of shell types identified for asphaltum-coated shell and indeterminate worked-shell fragments was similar. More than half of these artifacts (56.5 percent) were recovered from excavation units, representing general midden contexts.

Types of shell coated with asphaltum included mostly venus clam (n = 16, 41.0 percent), followed in decreasing frequency by abalone (n = 15, 38.5 percent), and scallop (n = 7, 17.9 percent), as well as 1 nacre fragment (2.6 percent). Following a similar distribution, most of the indeterminate worked-shell fragments were identified as venus clam (n = 15, 36.6 percent) and abalone (n = 10, 24.4 percent). Although identified in low frequencies, Pismo clam and wavy turban, among other types, were also included in the indeterminate worked-shell collection. The indeterminate worked-shell fragments, consisting of evidence of chipping, cutting, and grinding, likely

Figure 75. Pismo clam tool with chipped margins and ground dorsal surface, from LAN-62, EU 319, Level 51.

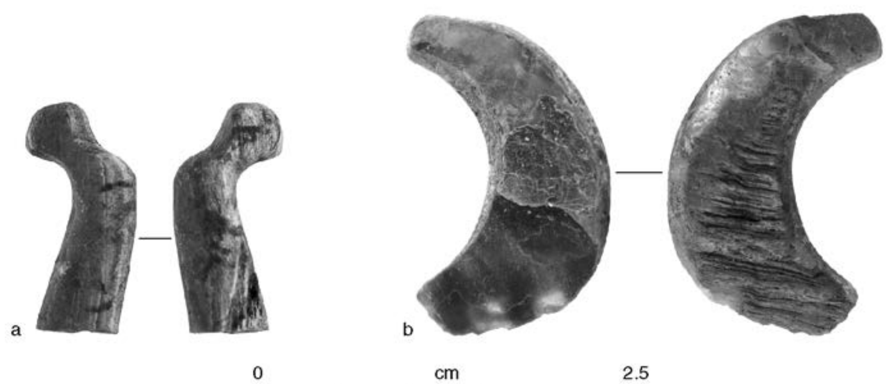

Figure 76. Abalone fishhooks, from LAN-62: (*a*) knobbed shank, nonburial Feature 22; (*b*) indeterminate fragment, EU 653, Level 56.

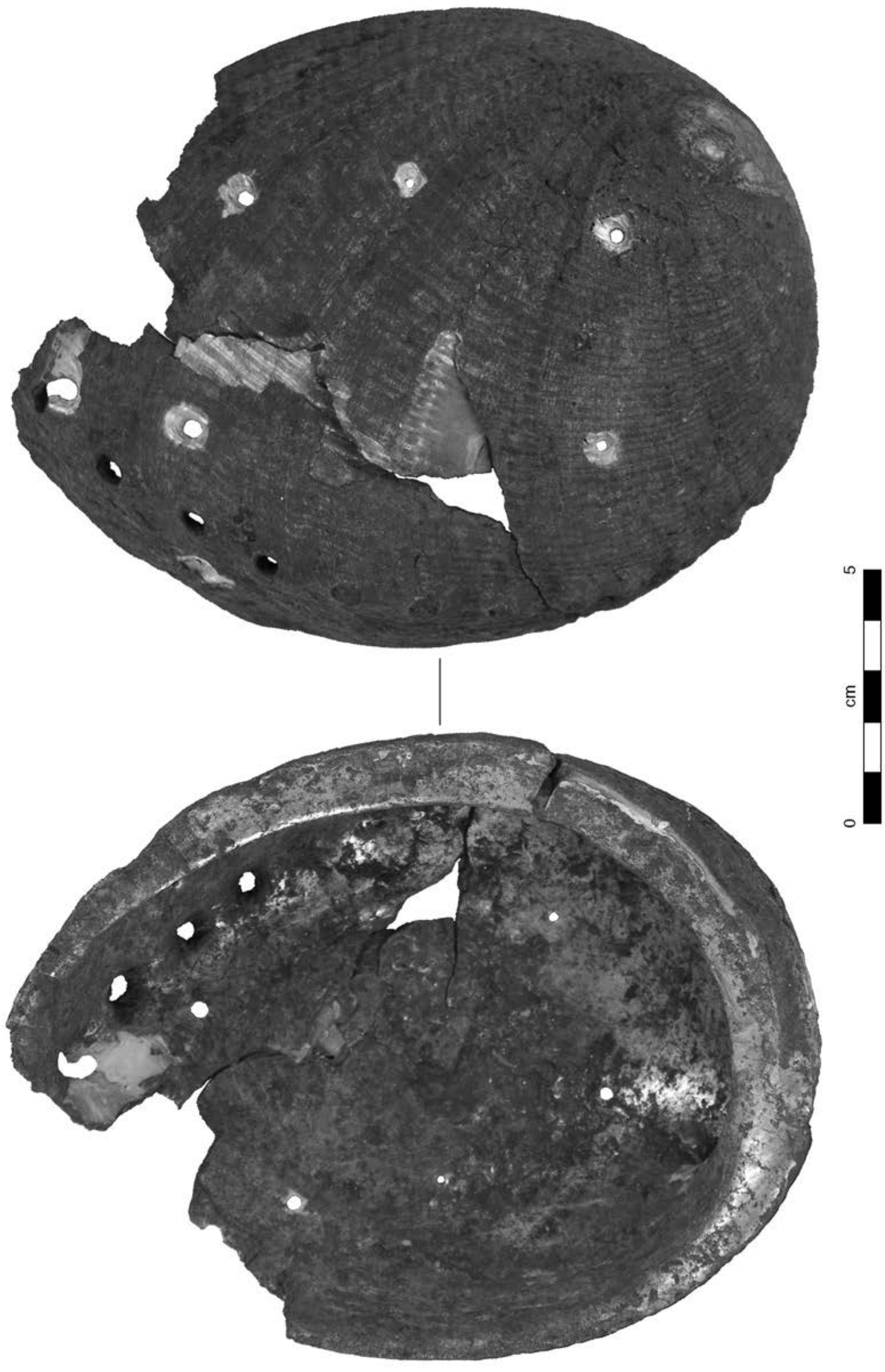

Figure 77. Red abalone shell with punched holes, from LAN-62, nonburial Feature 399.

represented manufacturing and processing debris and perhaps expedient tools used in processing and manufacturing of a variety of different plant, animal, and other materials.

Nearly 69 percent of the other worked shells were recovered from the burial area. Although ornamental and ritual worked-shell artifacts were the most common, the burial area also contained what appeared to have been domestic or utilitarian shell artifacts. It is unclear, however, whether these types of artifacts (e.g., shell tools, ornament blanks, asphaltum-coated shell, and indeterminate worked-shell fragments) were deposited as burial offerings or were present in the underlying midden prior to interment. If the latter, this would indicate a transition from domestic to ritual use of this portion of the site over time. If the former, it would appear items reflecting daily or domestic activities were selected for interment with the deceased.

Summary of LAN-62 A/G

The collection of more than 90,800 shell beads and other worked-shell artifacts provide evidence for a range of ritual and domestic activities that occurred over a period of at least 3,000 years. The diverse collection reflects increased use of worked-shell artifacts over time, peaking during the Mission period, as evidenced by the enormous quantities and diversity of artifacts recovered from historical-period burials. Shell beads constituted the bulk of the collection, consisting of 83 different varieties. The varieties represent a wide range of utilized marine shell, including mostly olivella in addition to abalone, Pismo clam, other types of clam, California mussel, giant rock scallop, and gastropod columella. Collectively, the shell beads represent a variety of types commonly used as items of personal adornment, in socioeconomic and ritual exchange, perhaps as indicators of social status and wealth.

A few bead types dominated the LAN-62 A/G collection. Semiground disks composed more than half of the collection (53.9 percent), followed in decreasing frequency by olivella disks of unknown type (9.2 percent), bushings (7.3 percent), and red abalone epidermis disks (4.7 percent). Of note, the two most common bead classes (disks and callus) are believed by some researchers to have been used as mediums of socioeconomic exchange and, in the case of disks, in ritual exchange as well.

Considering that most of the shell beads (72 percent) were recovered from burial features, they played an important role in mortuary activities in the Ballona. Quantities of shell beads in burial features ranged widely from 1 to 6,623 beads per burial feature. There was a slight tendency for burial features with large quantities of shell beads to be located in the southern and western portion of the main burial area, whereas burial features containing low frequencies tended to be situated in the northern portion and along the periphery.

Shell-bead types and relative frequencies recovered from nonburial features and excavation units within the main burial area were similar to those from burial features. The nonburial features consisted of mostly caches or concentrations of shell beads, whereas shell beads recovered from excavation units were relatively isolated finds, likely displaced from burial features or perhaps scattered as broadcast offerings. Many of the beads were identified as fused segments, indicating that they were likely part of bead strands. Based on beads found fused side by side, stringing patterns were similar to those identified for burial features.

The burial area also contained most of the nonbead shell ornaments. Considering the distribution within mostly burial features, these shell ornaments likely functioned as important burial offerings, reflecting aesthetic preferences or perhaps representing wealth, social status, or cultural affiliation of the deceased. In addition to nonbead shell ornaments, whole abalone shells often accompanied burial individuals. Many of these shells were likely containers of burial offerings, as evidenced by their ground surfaces, siphon holes plugged with asphaltum, burned interiors, and/or the contents noted within the interiors of the shells. It should be noted that many of the unworked abalone shells identified in burial features (discussed in Chapter 13, this volume) may have functioned as containers. However, because of extensive degradation and/or the absence of notable modifications, they could not be clearly identified as containers. Also of note, whole perforated abalone shells were recovered only from burial feature contexts. Considering the absence or near absence of other modifications, these perforated shells appeared to have been ritually killed, a practice that was carried out on other types of artifacts, including ground stone implements (see Chapter 2, this volume).

Other types of worked-shell artifacts recovered from the burial area included fishhook fragments, other shell tool fragments, shell fragments coated with asphaltum, and indeterminate worked-shell fragments. These artifacts may have been interred with buried individuals or were present in the underlying matrix at the time of burial. If they were intentionally buried with the deceased, they may reflect the skillset or activities once carried out by the individual.

With the exception of FB 3, the collection recovered from outside of the main burial area reveals a markedly different distribution of shell artifacts. Shell beads outside of the burial area were recovered in much lower frequencies and rarely as fused segments, indicating that they were not likely part of bead strands. Features tended to be associated with domestic activities, including food consumption, hearth cleanouts, and manufacturing and processing activities. Shell beads were typically not burned, indicating they had been deposited following thermal activities and were not likely part of burning associated with ceremonies. Other worked-shell artifacts consisted of mostly utilitarian items, including shell scoops and tools, as well as manufacturing and processing debris, such as fragments of cut, ground, and/or chipped shell, as well as fragments coated with asphaltum.

FB 3, on the other hand, yielded a shell artifact collection reflecting activities that may have been part of ceremonies associated with the burial area. Moderate frequencies of shell beads, similar in type and relative proportions to the main burial area, were recovered from FB 3 features and excavation units. Nearly half of the shell beads (48.2 percent) had been burned; however, in situ thermal activity was not clearly evident. Four artifact concentrations and pit features yielded caches of shell beads with frequencies greater than 100. Beads recovered from excavation units within FB 3 were much more concentrated compared to other feature blocks or sitewide contexts. These beads may be the remnants of offerings that were broadcast during mortuary ceremonies. Additionally, the recovery of shell containers and scoops from FB 3, as well as burned items and FAR, provide evidence for food-consumption activities and offerings at FB 3.

Shell-bead distributions for FBs 4 and 7, as well as sitewide or general midden contexts, indicate that shell beads were not the focus of activities in these areas. Features consisting of mostly hearths, hearth cleanouts, and rock clusters attest to mostly domestic activities within these areas. These contexts rarely contained burned beads and fused bead segments were relatively uncommon, suggesting bead strands were rarely deposited in these areas. Although shell ornaments were recovered from general midden contexts, most of the worked shell in these areas consisted of domestic-related items, such as shell scoops, containers, tools, and manufacturing and processing debris, including indeterminate worked-shell fragments and shell coated with asphaltum.

LAN-62 shell fishhook and fishhook blanks were recovered from the burial area, a thermal feature, and sitewide excavation units. Most of the fishhooks were identified in excavation-unit contexts, whereas one fishhook fragment and a fishhook blank were found in a thermal feature. Because these contexts were located in general midden areas, faunal bone from these contexts were not analyzed, and it is unclear whether the fishhooks were associated with fish bone. Considering the presence of considerable quantities of fish bone in other contexts, as well as the use of shell fishhooks in southern California beginning around 3,000 years ago, the near absence of shell fishhooks at LAN-62 and absence from other PVAHP sites is puzzling. If LAN-62 occupants frequently used shell fishhooks, they rarely deposited them at the site. Alternatively, use of shell fishhooks may have been limited. Shell fishhooks were commonly used in open waters, whereas bone fishhooks or nets may have been better suited for the shallow waters of the Ballona (Rick, Vellanoweth, et al. 2002). The near absence of shell fishhooks may also be a factor of the availability of metal fishhooks during the Protohistoric and Mission periods. Discerning this use, however, is difficult, as preservation of metal fishhooks tends to be poor in archaeological contexts.

In general, other worked-shell artifacts were widely distributed across the site, although nearly 69 percent of the artifacts were recovered from the burial area. Shell tools and manufacturing debris were not commonly found together, indicating that use of shell tools and deposition of manufacturing debris did not necessarily occur in the same location. Shell tools were likely used to process nonshell materials.

As noted previously, King (1974:88–89) identified abalone, Pismo clam, California mussel, and giant rock scallop as higher-valued beads based on their showy display, time-intensive manufacture, and discrete locations within the Medea Creek burial area, reportedly in burials of spiritual and secular leaders. Figure 78 shows the overall distribution of these reportedly higher-valued beads in burial features, nonburial features, and excavation-unit contexts located across the site. California mussel beads were limited to a few burials and excavation units located in the central portion of the main burial area, as well as a few excavation units north of the main burial area (see Figure 78a). Pismo clam beads were concentrated in the main burial area and, in general, the distribution was similar to that for beads dating to the Mission period (see Figure 78b). Abalone and giant rock scallop beads were much more widely distributed throughout the main burial area and excavation units to the north, in addition to abalone beads recovered from burial features located north of the main burial area (see Figure 78c and d). The widespread distribution of abalone and giant rock scallop beads may be the result of general use of the beads in both burial and nonburial activities. Bead distributions may also be the result of temporal factors, with abalone and giant rock scallop beads used more widely through time. Considering the similar distribution with Mission period beads, California mussel and Pismo clam beads may have been largely part of Mission period activities. Overall, based on spatial distributions of the four bead types, there is no clear evidence for social stratification within the main burial area or across the site (see also Table 80). Furthermore, there is no clear evidence that these bead types were more highly valued than other types. However, comparisons of other artifact types may clarify this issue of differential social status and use of higher-valued items within the burial area (see PVAHP Volume 5, Chapter 6).

Shell-bead data indicate activities occurred at LAN-62 over a period of at least 3,000 years, with the most-intensive use of the site during the Mission period. Figures 79 and 80 show the spatial distribution of shell beads with narrow time ranges in burial features, nonburial features, and excavation units. Shell beads with narrow time ranges dating to the early Intermediate period were recovered from excavation units located in FB 4, the burial area, and areas outside of the main burial area (see Figure 79a). Whether beads recovered from burial features were once associated with burials or displaced from the underlying midden at the time of interment is unclear. Compared to the early Intermediate period, there were considerably more shell beads dating to sometime between the Intermediate period and the early Late period (see Figure 79b). Although not highly concentrated in the main burial area, these beads were identified throughout the site, including in the burial area, FBs 3 and 4, and nonburial features and excavation units located outside of the burial area. Burial features containing beads associated with early time periods were generally located in the central, eastern, and northern portions of the burial area and contained few shell beads. Again, as the beads were recovered from the feature

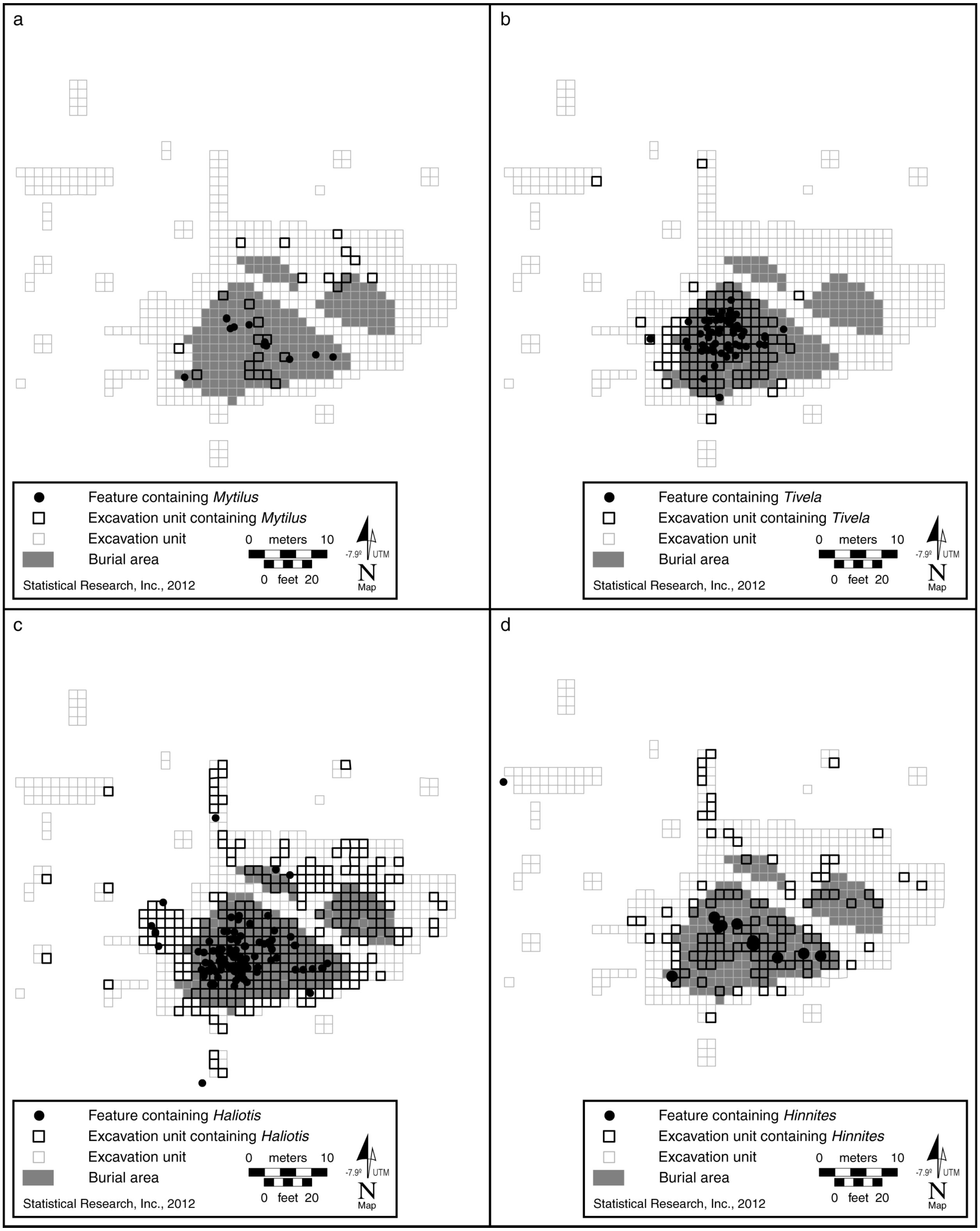

Figure 78. Spatial distributions of reportedly higher valued beads in features and excavation units, LAN-62 (King 1974): (*a*) California mussel beads; (*b*) Pismo clam beads; (*c*) abalone beads; and (*d*) giant rock scallop beads.

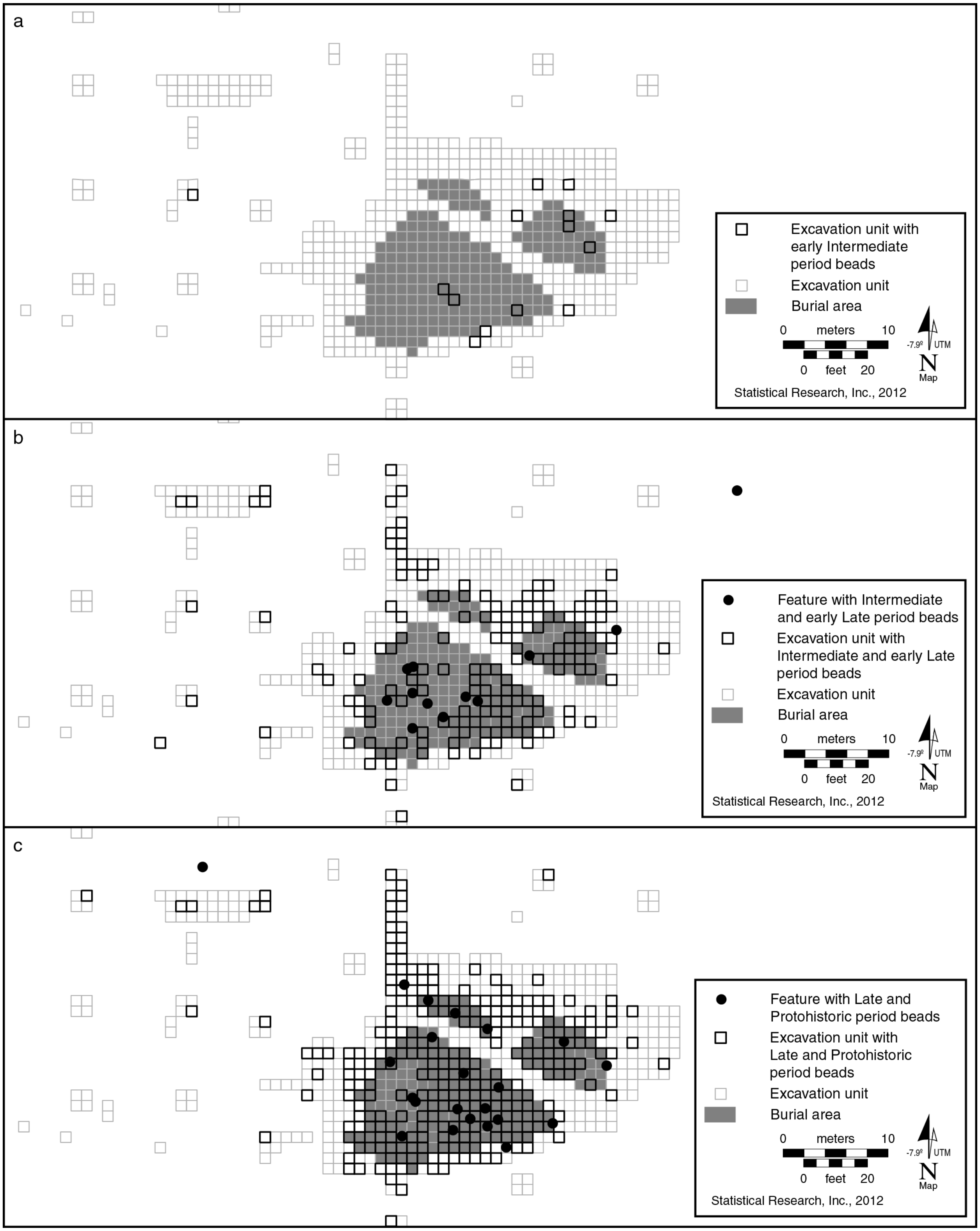

Figure 79. Spatial distributions of early Intermediate through Protohistoric period shell beads in features and excavation units, LAN-62: beads dating to the (*a*) early Intermediate period; (*b*) Intermediate–early Late period; and (*c*) Late to Protohistoric period.

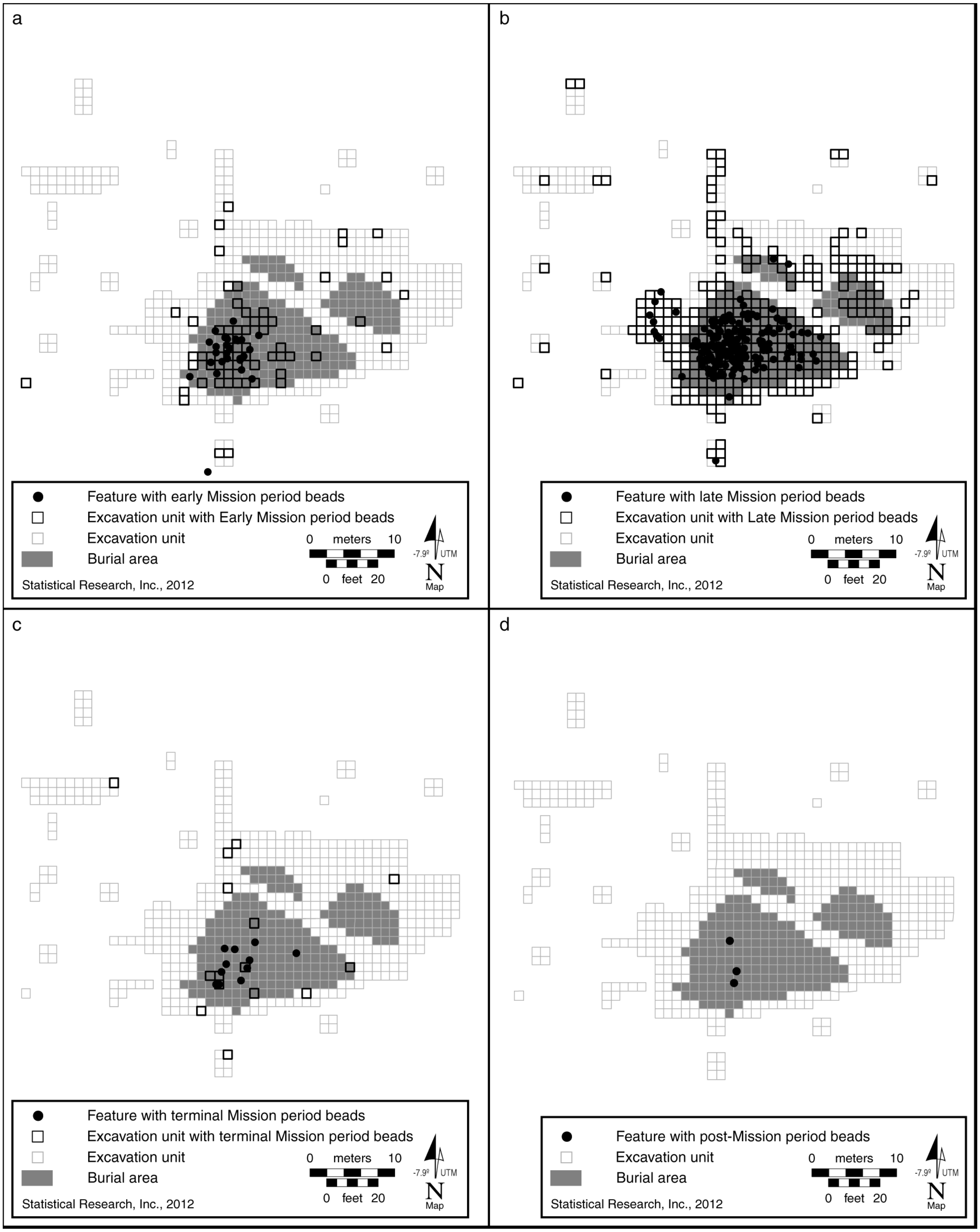

Figure 80. Spatial distributions of Mission and post-Mission period shell beads in features and excavation units, LAN-62: beads dating to the (*a*) early Mission period; (*b*) late Mission period; (*c*) terminal Mission period; and (*d*) post-Mission period.

matrix, it is unclear whether any burials date to between the Intermediate period and the early Late period.

Use of the burial area at LAN-62 appears to have dramatically increased between the latter portion of the Late period through the Protohistoric period, as evidenced by the increase in shell-bead frequencies dating to this period and their widespread distribution across the site, including in FBs 3 and 4 (see Figure 79c). Shell beads dating to this period (A.D. 1500–1700) were found directly associated with burial individuals in Features 4 and 525 (Group 7) located in the northern portion of the burial area. Beads within this time range were also recovered from the feature matrix of other burials located in the central and northern portions of the burial ground.

Compared to beads associated with earlier time periods, early Mission period shell beads were largely confined to the central burial area in addition to low frequencies recovered from nonburial features and excavation units located outside of burial area and feature blocks (see Figure 80a). Early Mission period beads were found directly associated with burial individuals located in the central burial area. Activities at LAN-62 appear to have dramatically increased during the late Mission period, as evidenced by the enormous quantities of late Mission period shell beads recovered from features and excavation units located across the site, including FBs 3 and 4 (see Figure 80b). Most of the beads were recovered from burial features within the main burial area, as well as a few located within 7.5 m north and south of the main burial area.

Based on shell-bead frequencies, activities during the terminal Mission period and the post–Mission period appear to have declined. Shell beads dating to the terminal Mission period were largely confined to the central portion of the main burial area in addition to a few excavation units located outside of the burial area (see Figure 80c). Although terminal Mission period beads were recovered from burial features, none was clearly directly associated with individuals. Shell beads dating to the post–Mission period were also recovered from burial features, although all were recovered from the feature matrix rather than directly associated with particular burial individuals (see Figure 80d). Overall, based on direct association of beads with burial individuals, shell-bead data provide clear evidence that burial activities occurred at LAN-62 during the Mission period and, to a minor extent, during the transition from the Late period to the Protohistoric period. Although there is evidence of Intermediate period and post–Mission period activities, there is no clear evidence of burials dating to these periods.

LAN-62 C/D Shell Beads

Sampling Strategy

Loci C and D at LAN-62 are situated in the northeast portion of the site, away from the main burial area. Located within a relatively narrow strip, Locus C constitutes the western region, whereas Locus D is situated in the eastern portion. The analysis included a total of 12 beads recovered from three control units (n = 7) and four excavation units (n = 5).

Control Units

CU 534 was located within a larger excavation block within the southern half of Locus C along the western margin of the site. The control unit yielded a single late Mission period olivella semiground disk recovered from one of the lowermost levels. CUs 937 and 560, combined for analytical purposes as CU 937/560, were located approximately 9 m apart in the western portion of Locus C. CU 937/560 yielded a total of five shell beads recovered from different excavation levels: three olivella semiground disks, one olivella cupped bead, and one California mussel cylinder. Each bead was recovered from a different excavation level. CU 998, located in eastern portion of Locus D, contained a single olivella semiground disk.

Excavation Units

The remaining five beads were recovered from excavation units: EUs 525, 539, 530, and 912. EU 912 was located in the northern half of an excavation block situated approximately 90 m southwest of EUs 525, 530, and 539, which were located in a second excavation block. A single olivella semiground disk bead was recovered from EU 912, Level 72. The remaining excavation units, situated in a cluster, yielded four different bead types: one olivella cap bead, one olivella cupped bead, one olivella semiground disk, and one red abalone epidermis disk. EUs 525 and 539 each contained a single bead, whereas EU 530 contained two beads: a semiground disk (Level 97) and a cupped bead (Level 86).

Summary of Shell Beads from LAN-62 C/D

Compared to LAN-62 A/G, shell-bead frequencies were extremely low at LAN-62 C/D, indicating that activities carried out at Loci C and D were very different from those at Loci A and G. As with LAN-62 A/G, olivella beads dominated the LAN-62 C/D collection, and semiground disks (58.3 percent) were the most common bead type. Considering their widespread spatial distribution and absence of fused beads, the shell beads do not appear to have been part of caches or part of strands. Shell beads in this portion of the site may have been inadvertently deposited, such as lost during daily domestic activities.

Dates for shell beads recovered from Locus C/D ranged from the Late period to the Mission period, the latter likely dating to the late Mission period. The slightly higher frequencies of semiground disks emphasize activity during the late Mission period, although much less intense in comparison to Loci A and G.

LAN-211

LAN-211, originally designated as SRI-13, was identified during the initial testing stages for the PVAHP. Shell beads and other worked-shell artifacts identified during the testing phase are summarized in Tables 91 and 92 (for a detailed discussion of these artifacts, see Appendix C.19; Gibson et al. 2003). Data recovery excavations at LAN-211 yielded an additional 2,717 shell artifacts, including 2,641 shell beads and 76 other worked shell recovered from LAN-211. LAN-211 yielded the second highest quantity of shell artifacts (2.9 percent) compared to the other six sites in the PVAHP. The following is a discussion of the analyzed worked-shell collection recovered during data recovery excavations.

Sampling Strategy

Shell artifacts selected for analysis were recovered from three main analytical contexts: control units, FB 1, and the area outside of FB 1 (for discussion of FB 1 at LAN-211, see Volume 2 of this series) (Table 93). The analysis included a total of 2,717 worked-shell artifacts.

Control Units

Of the five control units at LAN-211, only three (CUs 119, 120, and 353) yielded shell artifacts. Data from these three control units offer insight into two different spatial areas of the site. CUs 119 and 120 are located within FB 1, and CU 353 is located outside the feature block and well to the west of the main concentration of all features at the site. A total of 64 shell artifacts was recovered from these three control units (Tables 94–96; see also Table 93).

CU 119, located near the eastern edge of FB 1 and away from the main feature and artifact concentrations, yielded low frequencies of worked-shell artifacts recovered from the Late to Mission period contexts (see Table 94). Four different shell-bead types were identified, including normal saucers, suggesting that this portion of the site dates to the Intermediate and early Late periods.

CU 120, excavated in the main portion of the FB 1 area, yielded 54 shell beads and 1 possible bead blank, with most recovered from Mission period cultural strata (see Table 94). The 10 bead types recovered from CU 120 included varieties manufactured from olivella, red abalone, and Pismo clam. Temporal associations of these bead types ranged from the early Intermediate period to the Mission period; however, most of the beads are reported to have been manufactured during and following the end of the Late period. Bead types with narrow time ranges included oval thin lipped (late Late period and Protohistoric period transition), ground disk (early Mission period), and semiground disk (late Mission period). In addition to shell beads, 1 unmodified dwarf olive shell was found in Late period to Mission period strata (Level 64). Considering that this shell has little to no subsistence value, it may have been intended for later shell-bead manufacture.

CU 353 was located in the western portion of the site approximately 64 m west of FB 1. The control unit contained a single olivella cupped bead recovered from an Intermediate period excavation context (see Table 94). The bead type, however, was commonly manufactured between the Late period and the early Mission period, indicating that it may have been displaced from an overlying excavation level associated with a later time period.

Area outside of Feature Block 1

A majority of the analyzed shell artifacts (60 percent) was recovered from the units and features outside FB 1, which included 65 excavation units and 5 nonburial features (see Table 93). Additionally, four worked-shell artifacts were identified during mechanical stripping, including two tools, a scoop, and an indeterminate worked fragment. Three of these isolated finds were point-provenienced.

Excavation Units

Most of the analyzed shell artifacts from LAN-211 were recovered from excavation-unit levels located outside of FB 1 (see Table 93). Although most of these units were located within the same excavation area as FB 1, the units' levels are above and below those defining the three-dimensional feature block. EU 533, however, was located outside of this excavation area, approximately 20 m south of the excavation block. The analysis was conducted on a total of 1,581 shell artifacts from 65 excavation units. Shell artifacts recovered from these contexts included 1,574 beads and 7 worked-shell artifacts. The shell beads are classified into 44 bead types and were manufactured from a variety of different types of shell, including olivella, abalone, California mussel, giant rock scallop, and the columella of a gastropod. Dates for these bead types ranged from the early Millingstone period to the Mission period, with most of the bead types associated with dates ranging from between the Late and the late Mission periods. Bead types with narrow time ranges included oval and normal saucers (Intermediate–early Late period), round and oval thin lipped (transition from the late Late period–Protohistoric period), ground disk (early Mission period), semiground disk and rough large lipped (late Mission period), and rough disk (terminal Mission period).

The vast majority of the excavation units (92 percent, n = 60) contained more than a single shell bead. By contrast, worked-shell artifacts other than beads were relatively rare in excavation units located outside of FB 1. Only a single excavation unit (EU 416) yielded more than one (n = 2) worked-shell artifact. Types of worked shell included nearly equal quantities of decorative (n = 4) and utilitarian items (n = 3), including four ornaments, a container, a scoop, and an asphaltum-coated shell fragment.

Table 91. Shell Beads Identified during Testing at LAN-211

Shell Type	Bead Class	Shell-Bead-Type Grouping	Shell Beads (n)		Total	Percent within Shell Type	Percent of Shell Beads
			Previously Reported (Gibson et al. 2003:207)	Newly Reported			
Olivella	spire-lopped	large spire-lopped	1	—	1	2.9	2.2
	lipped	round thin lipped	1	—	1	2.9	2.2
		oval thin lipped	1	—	1	2.9	2.2
		full lipped	1	—	1	2.9	2.2
Subtotal (lipped)			3	—	3	8.8	6.5
	saddle	round saddle	—	1	1	2.9	2.2
		square saddle	—	1	1	2.9	2.2
Subtotal (saddle)			—	2	2	5.9	4.3
	saucer	tiny saucer	6	—	6	17.6	13.0
		normal saucer	2	—	2	5.9	4.3
Subtotal (saucer)			8	—	8	23.5	17.4
	disk	ground disk	2	—	2	5.9	4.3
		semiground disk	3	—	3	8.8	6.5
		rough disk	6	—	6	17.6	13.0
Subtotal (disk)			11	—	11	32.4	23.9
	wall disk	wall disk	2	—	2	5.9	4.3
	callus	cupped	9	—	9	26.5	19.6
Subtotal (olivella)			34	—	34	100.0	73.9
Abalone	disk	disk	3	—	3	60.0	6.5
	cylinder	cylinder	—	2	2	40.0	4.3
Subtotal (abalone)			3	2	5	100.0	10.9
Norris's top shell	disk	disk	—	2	2	66.7	4.3
	cylinder	cylinder	—	1	1	33.3	2.2
Subtotal (Norris's top shell)			—	3	3	100.0	6.5
Total			37	9	46		100.0

Table 92. Other Worked-Shell Artifacts Identified during Testing at LAN-211

Shell Type	Artifact Type	Previously Reported (Gibson et al. 2003:207)	Newly Reported	Total
Abalone	circular shell fishhook	1	—	1
	asphaltum-coated shell	1	—	1
	indeterminate worked shell	—	1	1
Pismo clam	indeterminate worked shell	—	2	2
Venus clam	scoop	—	1	1
Unknown	circular disk	1	—	1
	bead blank	—	1	1
Total		3	6	9

Table 93. Shell Beads and Other Worked-Shell Artifacts in Analytical Contexts at LAN-211

Provenience	Excavation Context	Analyzed Shell Beads (n)	Analyzed Worked Shell (n)	Total Analyzed Shell Artifacts (n)
	Area on Site: Outside and Inside FB 1			
Control units	CUs 119, 120, 353	63	1	64
	Area on Site: Outside FB 1			
Excavation units	EUs 101–109, 121–128, 164, 179–187, 198–204, 385–386, 390, 396, 398–401, 403–404, 410–416, 420–428, 438–440, 462, 533	1,574	7	1,581
	point provenienced	—	3	3
	mechanical stripping	—	1	1
Subtotal (excavation units)		1,574	11	1,585
Nonburial features	Feature 2	1	—	1
	Feature 3	1	—	1
	Feature 7	2	—	2
	Feature 35	23	2	25
	Feature 52	4	—	4
Subtotal (nonburial features)		31	2	33
Subtotal (outside FB 1)		1,605	13	1,618
	Area on Site: Inside FB 1			
FB 1	excavation units where features cut into the excavation units at different levels	918	56	974
	Feature 4	9	3	12
	Feature 5	1	—	1
	Feature 6	5	—	5
	Feature 13	1	—	1
	Feature 14	4	—	4
	Feature 16	5	—	5
	Feature 17	1	—	1
	Feature 22	1	—	1
	Feature 26	18	3	21
	Feature 28	3	—	3
	Feature 42	7	—	7
Subtotal (FB 1 features)		55	6	61
Subtotal (inside FB 1)		973	62	1,035
Total		2,641	76	2,717

Key: CU = control unit; EU = excavation unit; FB = feature block.

Table 94. Summary of Analytical Contexts, Worked-Shell-Artifact General Counts, and Densities, by Provenience, at LAN-211

Excavation Context	Shell Beads (n)	Other Worked Shell (n)	Volume (m^3)	Shell-Bead Density (per m^3)	Other-Worked-Shell Density (per m^3)	Total Shell-Artifact Density (per m^3)
				Provenience: Outside of FB 1		
Feature 2 (artifact concentration)	1	—	0.220	5	—	5
Feature 3 (artifact concentration)	1	—	0.040	25	—	25
Feature 7 (trash pit)	2	—	0.004	500	—	500
Feature 35 (hearth concentration)	23	2	0.410	56	5	61
Feature 52 (rock cluster)	4	—	0.100	40	—	40
Subtotal	31	2	0.774	40	3	43
				Provenience: Inside of FB 1		
Feature 4 (hearth)	9	3	0.220	41	14	55
Feature 5 (rock cluster)	1	—	0.020	50	—	50
Feature 6 (hearth)	5	—	0.020	250	—	250
Feature 13 (rock cluster)	1	—	0.020	50	—	50
Feature 14 (hearth)	4	—	0.040	100	—	100
Feature 16 (hearth)	5	—	0.200	25	—	25
Feature 17 (hearth)	1	—	0.010	100	—	100
Feature 22 (hearth)	1	—	0.020	50	—	50
Feature 26 (hearth)	18	3	0.220	82	14	95
Feature 28 (hearth)	3	—	0.100	30	—	30
Feature 42 (hearth)	7	—	0.200	35	—	35
Subtotal	55	6	1.070	51	6	57
				Provenience: CU 119		
Late period–Mission period	8	—	0.020	400	—	400
				Provenience: CU 120		
Fill	12	—	0.140	86	—	86
Mission period	32	—	0.200	160	—	160
Late period–Mission period	8	1	0.100	80	10	90
Late Intermediate period–Late period	1	—	0.100	10	—	10
Late Intermediate period	1	—	0.300	3	—	3
Subtotal	54	1	0.840	64	1	65
				Provenience: CU 353		
Late Intermediate period	1	—	0.10	10	—	10

Key: CU = control unit; FB = feature block.

Table 95. General Shell-Bead Types, by Analytical Context, at LAN-211

Shell Type	Bead Type	Control Units	FB 1 (n)	Outside of FB 1 (n)	Total (n)	Percent of All Shell Beads
Six-sided tusk	tube	—	1	—	1	<0.1
Red abalone	epidermis disk	5	54	94	153	5.8
	epidermis cylinder	—	1	1	2	0.1
	small disk	—	1	—	1	<0.1
	rectangle	—	—	1	1	<0.1
Subtotal		5	56	96	157	5.9
Abalone	nacre disk	—	—	1	1	<0.1
Giant rock scallop	disk	—	5	4	9	0.3
	tube	—	1	—	1	<0.1
Subtotal		—	6	4	10	0.4
California mussel	disk	—	1	—	1	<0.1
	cylinder	—	—	1	1	<0.1
	indeterminate	—	—	1	1	<0.1
Subtotal		—	—	2	3	0.1
Olivella	simple spire-lopped	—	6	7	13	0.5
	end-ground	—	—	2	2	0.1
	lipped	13	222	105	340	12.9
	saucer	2	54	104	160	6.1
	disk	21	341	957	1,319	49.9
	wall disk	—	1	3	4	0.2
	callus	20	278	316	614	23.2
	thin rectangle	—	2	1	3	0.1
	unknown	—	2	4	6	0.2
Subtotal		56	906	1,499	2,461	93.2
Pismo clam	cylinder	2	1	—	3	0.1
	tube	—	—	1	1	<0.1
Subtotal		2	1	1	4	0.2
Undifferentiated clam	cylinder	—	1	—	1	<0.1
	tube	—	—	1	1	<0.1
Subtotal		—	1	1	2	0.1
Unidentifiable shell	columella	—	—	1	1	<0.1
	indeterminate	—	1	—	1	<0.1
Total		63	973	1,605	2,641	100.0

Key: FB= feature block.

Table 96. Other Worked-Shell Artifacts, by Analytical Context, LAN-211

Worked-Shell-Artifact Type	Collection Units		FB 1		Outside of FB 1		Total (n)
	n	%	n	%	n	%	
Bead blank	1	100	—		—		1
Ornament	—		10	16.1	4	30.8	14
Ornament blank	—		1	1.6	—		1
Historical-period button	—		1	1.6	—		1
Container	—		4	6.5	1	7.7	5
Scoop	—		8	12.9	2	15.4	10
Tool	—		4	6.5	2	15.4	6
Perforated whole shell	—		4	6.5	—		4
Other	—		1	1.6	—		1
Indeterminate worked shell	—		13	21.0	2	15.4	15
Asphaltum-coated shell	—		16	25.8	2	15.4	18
Total	1	100	62	100.0	13	100.0	76

Key: FB= feature block.

Features

In total, 33 shell artifacts were analyzed from five features (see Tables 93–96). Feature types included two artifact concentrations, a trash pit, a hearth, and a rock cluster. With the exception of Feature 35, a dense hearth concentration, significantly fewer shell artifacts were recovered from the features than from outside of FB 1.

Feature 2

Feature 2, characterized as a subsistence-related artifact concentration, was located within the excavation block situated approximately 23 m northeast of FB 1. The feature is associated with late Intermediate and Late period deposits. Diagnostic artifacts, including shell artifacts, were found in very low frequencies in this feature. One olivella shell bead was recovered from the feature fill; however, the bead type could not be determined, because it was distorted through burning.

Feature 3

Feature 3, an artifact concentration likely representing a hearth cleanout or discard area, yielded a single olivella full lipped bead. The bead type was commonly manufactured between the Protohistoric and Mission period.

Feature 7

This feature was a trash pit containing mostly historical-period artifacts with a few possible Native American artifacts, some of which may date to the Mission period or earlier. Shell-artifact analysis included two olivella semiground disk beads that date to the late Mission period.

Feature 35

Feature 35 was discovered during mechanical stripping of the area north of the FB 1 excavation area. The feature was characterized as a dense hearth concentration. A total of 23 shell beads was recovered from the feature, consisting of 21 olivella shell beads, 1 giant rock scallop bead, and 1 red abalone bead. The beads were classified into 10 types, with dates spanning from the early Intermediate period to the Mission period. Bead types with narrow time ranges included normal saucer (Intermediate–early Late period), oval thin lipped (transition from later Late period–Protohistoric period), ground disk (early Mission period), and semiground disk (late Mission period). In addition to beads, 2 other worked-shell artifacts were recovered, including a chestnut cowrie shell indeterminate worked fragment and 1 asphaltum-coated speckled scallop shell.

The recovery of a higher frequency of shell beads from Feature 35, a hearth concentration, was intriguing considering that shell beads were typically not associated with food-preparation and -consumption contexts. However, the recovery of shell beads, asphaltum-coated tarring pebbles, and nearly 600 pieces of flaked stone indicates that the hearth may be associated with artifact production and processing activities as well. Such activities may have included the application of asphaltum, as evidenced by the presence of three shell beads exhibiting decorative lines infilled with asphaltum, a speckled scallop shell coated on both sides with asphaltum, and asphaltum-coated tarring pebbles.

Feature 52

This isolated feature was discovered approximately 15 m north of FB 1 during mechanical stripping of the eastern portion of the excavation area. The feature, a rock cluster, is stratigraphically associated with the late prehistoric–Mission period. The analysis included four shell beads: an olivella cupped bead, a thin lipped bead, an oval lipped bead, and one giant rock scallop disk. Bead dates range from the Late period to the Mission period; however, three of the four beads were commonly produced during the Protohistoric and Mission periods.

Feature Block 1

FB 1 yielded 1,035 shell artifacts recovered from 96 distinct contexts (see Tables 93–96). These contexts included 85 excavation units with overlapping levels in features and 11 nonburial features, including 2 rock clusters and 9 hearths. Compared to shell beads, other worked shell had a much wider spatial distribution in FB 1, although there was a significant clustering of contexts in the west-central portion of the feature block. In this area, worked shell was commonly found in the same contexts yielding shell beads. As with shell beads, other worked-shell artifacts were recovered in relatively low frequencies within the same contexts; typically 1–2 worked-shell artifacts and only 1 context yielded 5 worked-shell artifacts, which was the highest frequency for a single context.

Excavation Units

The analysis included a total of 974 shell artifacts recovered from 85 excavation units (see Table 93). Notably, only some levels of these excavation units were located within FB 1. The 918 beads were grouped into 40 different types, with most manufactured from olivella followed in decreasing frequencies by red abalone, Pismo clam, giant rock scallop, California mussel, and six-sided tusk. Bead types with narrow time ranges were similar to those recovered from excavation units outside of FB 1, including oval and normal saucers (Intermediate–early Late period), round and oval thin lipped (transition from late Late period–Protohistoric period), ground disk (early Mission period), semiground disk (late Mission period), and rough disk (terminal Mission period). In addition to shell beads, the excavation units also yielded 56 worked-shell artifacts: asphaltum-coated shell (n = 14), indeterminate worked shell (n = 12), ornaments (n = 9), scoops (n = 8), containers (n = 3), tools (n = 3), perforated whole shells (n = 4), an ornament blank (n = 1), a historical-period button (n = 1), and other (n = 1).

Overall, worked-shell artifact distribution was relatively dispersed. EU 420, located adjacent to a cluster of hearth features (Features 4, 28, and 26), had the highest frequency of other worked-shell artifacts (n = 5). This unit, as well as the adjacent features, yielded indeterminate worked-shell fragments and asphaltum-coated shell. Given the spatial proximity and similarity in artifact types, the worked-shell artifacts from EU 420 are likely associated with the adjacent features. In general, excavation units situated in the west-central portion of FB 1 contained slightly greater worked-shell artifact frequencies compared to the outlying feature block area, where counts averaged one per control unit.

Nonburial Features

Shell artifacts from 11 nonburial features were analyzed, including 55 shell beads and 6 other worked shell (see Tables 93–96). Collectively, the 11 nonburial features represent a large domestic-activity area within FB 1. Individually, the features consisted of mostly hearths and a few rock clusters. All of the features were identified in strata dating between the Late and Mission periods.

Feature 4

Feature 4, a hearth, was located in the west-central portion of the feature block. The feature yielded 12 shell artifacts, including three olivella bead types commonly manufactured between the Late and Mission periods. Two of the beads were of the oval thin lipped variety, which has narrower production ranges that span A.D. 1500–1700. The remaining shell artifacts from Feature 4 included a tool, asphaltum-coated shell, and an indeterminate worked-shell fragment.

Feature 5

Feature 5, a rock cluster, was located in the central-southern edge of FB 1. The feature yielded an olivella round lipped bead, which was commonly manufactured between A.D. 1500 and 1600.

Feature 6

Feature 6, a hearth, was located in the west-central area of FB 1. The feature contained five shell beads, grouped into three bead classes, with dates ranging from the Late to the Mission period.

Feature 13

Feature 13 was a rock cluster situated in the east-central portion of FB 1. The rock cluster contained only one shell artifact, an olivella semiground disk bead that was commonly manufactured during the late Mission period.

Feature 14

This feature, a hearth, was located in the southwestern area of FB 1. Analysis included four olivella shell beads. Dates for these beads range from the early Intermediate period to the Mission period; however, all four beads have overlapping production sequences dating to the Late and Mission periods.

Feature 16

Feature 16 was a hearth located in the northeastern portion of FB 1 and yielded five shell beads, including four olivella beads and one red abalone bead. All five beads were identified as different bead types. Dates for these beads range from the early Intermediate to the Mission period, with considerable overlap between the Late and Mission periods.

Feature 17

This hearth feature was located in the central area of FB 1. It contained a single olivella round thin lipped bead commonly manufactured during A.D. 1500–1600, or the Late and Protohistoric periods.

Feature 22

Feature 22, a hearth, was located in the west-central area of FB 1 and contained a single olivella oval thin lipped bead. This bead type was commonly manufactured from A.D. 1500 to 1700, during the Late and Protohistoric periods.

Feature 26

This hearth was located in the west-central area of FB 1. Compared to the other features within FB 1, Feature 26 was composed of a relatively moderate concentration of shell artifacts. The feature yielded 21 worked-shell artifacts, including 18 shell beads and 3 other worked-shell artifacts. In total, eight olivella bead types were identified in addition to 1 clam bead and 1 California mussel bead. Bead dates range from all periods, with temporal overlaps between the early Intermediate and Mission periods. Most of the beads appear to have been manufactured sometime during or following the Late period. Other worked shell included a container, tool, and ornament.

Feature 28

This hearth was located in the west-central portion of FB 1. Three olivella beads were analyzed from the feature, and each was a different bead type. Bead dates range from the late Intermediate to the Mission period, including one semiground disk commonly manufactured during the late Mission period.

Feature 42

The Feature 42 hearth was located in the southwestern area of FB 1. The analysis was conducted on seven shell beads: six olivella beads grouped into three bead types and one red abalone bead. Collectively, the Feature 42 shell beads indicate production ranges from the early Intermediate to the Mission period. The only bead type with a narrow time range, semiground disk, indicates activity at the site during the late Mission period.

Shell Beads

Shell beads made up the bulk (97.2 percent) of the analyzed shell collection from LAN-211. A total of 2,641 shell beads was analyzed, manufactured from nine types of shell: olivella, dwarf olive, red abalone, undifferentiated abalone, giant rock scallop, Pismo clam, undifferentiated clam, California mussel, and six-sided tusk, as well as unidentified shell. In addition to an unidentifiable bead fragment, a total of 51 different bead types was identified in the LAN-211 shell-bead collection (Table 97; see also Table 95). Most of the analyzed shell beads (93.2 percent) were manufactured from olivella, comprising 34 bead types grouped into 8 bead classes, as well as 6 unidentifiable bead fragments (see Table 97). By far, red abalone beads constitute the bulk (87.8 percent) of the non-olivella bead collection.

A concentration of 38 olivella bushings was recovered from EU 123 (Level 61), located outside of FB 1. The beads were inlaid in an asphaltum-encased canid (Canidae) distal mandible fragment. These beads were arranged in two rows of 7 beads each and were bordered on both sides by 24 beads and bead fragments. The proximal end had an indentation in the asphaltum where something may have once been attached, perhaps for stringing as a pendant. The mandible fragment was found in the same level containing other shell beads dating from the Late through Mission periods.

In general, there was little evidence of bead strands at LAN-211. Only two excavation units, both located outside of FB 1, yielded what may be fragments of bead strands. EU 121 (Level 61) contained 6 fused semiground disks, whereas EU 106 (Level 59) yielded 5 fused semiground disks. Eight additional excavation units, including one located in FB 1, yielded fused beads. These fused beads, composed of 2–3 beads each, may represent fragments of bead strands. Types of fused beads other than semiground disks included olivella ground disk, saucers, tiny saucers, and bushings. Of the 30 fused beads, most were semiground disks (60 percent, n = 18).

In general, dates for LAN-211 shell beads span all periods. However, the clustering of bead time ranges emphasizes activities between the early Intermediate period and the Mission period, particularly during the Late and Mission periods. These dates correlate well with the chronostratigraphy at the site, as well as comparisons of shell-bead densities through time. When comparing the control units, shell-bead densities are the lowest for contexts dating to the Intermediate period and the highest for late prehistoric–Mission period contexts (see Table 94).

When comparing the types of shell used to produce beads found in FB 1 and the outlying area, relative proportions of olivella bead types vary slightly. Disks account for the bulk (63.8 percent) of the olivella bead collection from outside of FB 1. However, within FB 1, disks (37.6 percent) and callus (30.7 percent) beads collectively constitute the bulk of the collection. The reason for the strong preference for disks outside of FB 1 is not entirely clear, although it is possible they reflect more-intensive use of this area during the Mission period. However, considering that nearly 61 percent of the shell beads at LAN-211 were recovered from outside of FB 1, variations in the bead collections may reflect differences in the types of activities carried out at FB 1 and the outlying area. If FB 1 was a food-processing and -consumption area, large quantities of shell beads would not be expected, as they would have served little to no utilitarian function for such activities. The beads found in FB 1 may have been discarded in trash pits or hearths, inadvertently lost, and/or presented as offerings, if ritual feasting did in fact occur in this area. Beads may have been deposited in a similar fashion outside of FB 1, as well as the result of a variety of other activities, including domestic and/or socioeconomic or ritual exchange of beads and artifact processing and production.

Shell-bead density in features was slightly greater outside of FB 1 compared to within the feature block (see Table 97). Nevertheless, the difference in bead density in these two areas

Table 97. Detail of Olivella Beads, by Analytical, Context, at LAN-211

Bead Class	Bead Type	Control Units	FB 1 (n)	Outside of FB 1 (n)	Total (n)	Percent of All Olivella Shell Beads
Spire-lopped	simple spire-lopped	—	1	4	5	0.2
	simple spire-lopped, small	—	2	3	5	0.2
	simple spire-lopped, medium	—	3	—	3	0.1
Subtotal		—	6	7	13	0.5
End-ground	end-ground, small	—	—	1	1	<0.1
	spire	—	—	1	1	<0.1
Subtotal		—	—	2	2	0.1
Lipped	lipped class	—	25	12	37	1.5
	thin lipped	—	3	—	3	0.1
	round thin lipped	2	43	15	60	2.4
	oval thin lipped	4	52	25	81	3.3
	thick lipped	—	1	1	2	0.1
	full lipped	7	88	47	142	5.8
	deep lipped	—	1	1	2	0.1
	full large lipped	—	7	3	10	0.4
	rough large lipped	—	2	1	3	0.1
Subtotal		13	222	105	340	13.8
Saucer	saucer class	—	—	3	3	0.1
	tiny saucer	1	43	90	134	5.4
	normal saucer	1	2	3	6	0.2
	normal saucer, small	—	6	7	13	0.5
	normal saucer, large	—	2	1	3	0.1
	oval saucer	—	1	—	1	<0.1
Subtotal		2	54	104	160	6.5
Disk	disk class	—	2	2	4	0.2
	ground disk	3	39	44	86	3.5
	ground disk, lipped	—	3	1	4	0.2
	semiground disk	16	269	867	1,152	46.8
	semiground disk, lipped	1	19	26	46	1.9
	semiground disk, shelved	1	2	6	9	0.4
	rough disk	—	7	11	18	0.7
Subtotal		21	341	957	1,319	53.6
Wall disk	wall disk	—	1	3	4	0.2
Callus	cupped	10	64	127	201	8.2
	bushing	10	185	182	377	15.3
	cylinder	—	29	7	36	1.5
Subtotal		20	278	316	614	24.9
Thin rectangle	thin rectangle class	—	1	—	1	<0.1
	normal sequin	—	—	1	1	<0.1
	normal pendant	—	1	—	1	<0.1
Subtotal		—	2	1	3	0.1
Unidentifiable	unidentifiable bead	—	2	4	6	0.2
Total		56	906	1,499	2,461	100.0

is not significant (t = 0.59, p <.05) (see Table 97). That is, the two samples appear to be from the same shell-bead population. In general, bead densities varied considerably by feature type across the site. Keeping in mind that the sample size was small, there was no significant difference when comparing bead densities in rock clusters with hearths (t = 0.19, p <.05) and artifact concentrations (t = 0.17, $p \leq .05$). However, bead densities in hearths were significantly greater than those in artifact concentrations (t = 0.03, p <.05), indicating they were from different populations. It would appear that shell beads were rarely deposited in artifact concentrations and that they were not the focus of activities resulting in the creation of these concentrations. Despite the significant variability, it cannot be ignored that hearths, the most frequent feature type at the site, yielded 77.6 percent of the beads recovered from all feature contexts. Beads may have been purposely discarded in hearths as offal. Considering the extensive activity and time spent around hearths, it is also possible some of these beads may have been inadvertently deposited or lost.

Although many of the features at LAN-211 yielded shell beads, most of the beads (96.3 percent) were recovered from excavation units and control units. Comparisons of bead types in features and nonfeature contexts revealed considerable variability. Olivella semiground disk were found most frequently (45.0 percent) in nonfeature contexts, whereas bushings dominated (38.8 percent) feature collections. The variability between feature and nonfeature contexts may, in part, be due to temporal differences. Considering the presence of mostly semiground disks in nonfeature contexts, bead-related activities in these areas may have occurred most intensively during the late Mission period, and considering the similarity in bead types, perhaps associated with the LAN-62 burial area. By contrast, activities associated with features may have occurred mostly before the late Mission period, considering the presence of olivella bushings first used during the Late period.

Alternatively, this distribution may be a function of different types of activities associated with the features and the adjacent area. Interestingly, the two most common bead types recovered from features, olivella bushings and tiny saucers, were often used to decorate objects and also worn as necklaces (King 1981). Beads recovered from features may represent mostly personal adornment or decorations lost or discarded during activities associated with the features. Bead types that were frequently found in nonfeature contexts, however, were used in socioeconomic and ritual exchange (Gibson 1976, 1992; King 1981). Perhaps the areas adjacent to features reflect locales where beads were, in part, more frequently exchanged during nondomestic activities.

Other Worked Shell

In addition to shell beads, 2.7 percent of the analyzed LAN-211 shell-artifact collection included other worked shell. These 76 worked-shell artifacts were grouped into 11 categories: bead blanks, ornaments, ornament blanks, historical-period buttons, containers, scoops, tools, perforated whole shell, other, indeterminate shell, and asphaltum-coated shell (see Table 96). Worked-shell artifacts consisted mostly of black abalone (26.3 percent) in addition to red abalone (2.6 percent), undifferentiated abalone (3.9 percent), Pacific white venus clam (1.3 percent), California venus clam (22.4 percent), venus clam (3.9 percent), Pismo clam (5.3 percent), undifferentiated clam (5.3 percent), California frog shell (6.6 percent), chestnut cowrie (5.3 percent), speckled scallop (3.9 percent), scallop (5.3 percent), Lewis's moon snail (2.6 percent), wavy turban (1.3 percent), dwarf olive (1.3 percent), and unidentifiable shell (2.6 percent). These artifacts were recovered from excavation units and features in FB 1 and the outlying area. However, only one of the control units (CU 120) yielded nonbead worked shell (see Table 95). CU 120 also yielded a dwarf olive whole shell-bead blank. The following discussion will briefly describe each worked-shell artifact category.

Ornaments and Ornament Blanks

The analysis included a total of 14 shell ornaments and 1 ornament blank, most of which (71.4 percent) were recovered from FB 1. With the exception of 2 ornaments, they were all classified according to Gifford's ornament typology: 1 Lewis's moon snail perforated wall ornament (Type C), 3 chestnut cowrie perforated wall ornaments (Type C); 4 perforated pelecypod ornaments manufactured from Pismo clam (n = 2), scallop (n = 1), and Lewis's moon snail (n = 1) (Type D); and 5 California frog shell natural shell opening ornaments (Type H). Additionally, an abalone disk ornament was recovered from outside of FB 1. This ornament has a star design incised on one side consisting of four bisecting lines. In addition to completed ornaments, one Pismo clam circular ornament blank was recovered from FB 1.

Historical-Period Button

One historical-period-button fragment was recovered from FB 1 (EU 170, Level 62). The button was mother-of-pearl manufactured from the nacreous portion of an abalone shell. It consisted of a two-hole sunken panel and was most likely sewn on a shirt.

Shell Container

Five shell containers, four from FB 1 and one from the outlying area, were analyzed. Shells used as containers included two black abalone, two California venus clam, and one speckled scallop shell. The black abalone shell recovered from outside

FB 1 had asphaltum residue on the ventral side and may have been used as a container to hold asphaltum. The other black abalone container, recovered from inside FB 1, contained charcoal, ocher, and fish bone. The dorsal side near the apex was extensively ground, likely from where the shell was held in the hand and abrasion against other surfaces. The shell was recovered from an excavation unit also containing fragments of fish and mammal bone, charcoal, and a FAR ground or battered stone. Considering that the shell was recovered from midden deposit within FB 1, the container, in part, may have been used to clean out a hearth.

The two California venus clam containers were likely used to hold asphaltum, as evidenced by asphaltum residue noted on the ventral sides. One of the clam containers, recovered from Feature 26, had asphaltum on the dorsal side as well. The speckled scallop container, recovered from EU 200 in FB 1, had asphaltum along the perimeter of the shell on both the dorsal and ventral surfaces. Considering this ringed application of asphaltum, it is highly likely the shell was attached or sealed to something, such as another shell. Shells sealed with asphaltum were often used as rattles or treasure boxes (Walker 1936).

Scoop

The analyzed worked-shell collection included 10 shell scoops: 8 from within FB 1 and 2 from the outlying area. Most of the scoops (n = 7) consisted of California venus clam; however, undifferentiated clam (n = 2) and black abalone (n = 1) were also identified. All of the scoops were extensively ground on the dorsal surface along the lower margin. Some of the scoops exhibited evidence of additional modifications, indicating that they were likely used for other purposes. Three California venus clam scoops were chipped along the lower margins of the shells. One California venus clam scoop recovered from outside of FB 1 contained charcoal and asphaltum. The black abalone scoop from FB 1 was ground along the lower margin, as well as near the apex and along the siphon holes. Considering the charcoal and faunal bone found in the soil matrix recovered from the ventral cavity of the shell, this scoop may have been used to clean out hearths.

Tool

The LAN-211 collection included six shell tools, four of which were recovered from FB 1. These tools were manufactured from black abalone (n = 3), red abalone (n = 2), and Pacific white venus clam (n = 1) shells. All of the tools exhibited use wear, as evidenced by chipping along the margins and grinding on either the margin or dorsal surface. The two red abalone shell tools were ground on the dorsal side and also retained asphaltum residue. Two of the black abalone shell tools were ground on the dorsal surfaces, and one had asphaltum on the ventral side as well. The third abalone shell tool was ground only on the margin. Similar to the other tools, the dorsal surface of the Pacific white venus clam specimen had been ground and retained asphaltum. The chipping and grinding on these tools indicates they were likely used to cut and/or abrade other materials. These tools may have been used to process plant and animal materials and, perhaps, inorganic items as well. The ground surface on the dorsal side of some of the shell tools likely resulted from hand-wear use while holding the tool.

Perforated Whole Shell

Four whole black abalone shells with perforations were recovered from FB 1. The shells were punched near the center of the shell or along the siphon holes. Three of these shells were also ground on the dorsal surface near the apex, indicating that they may have been used as containers or scoops. Considering that each of the four shells has been punched in a single location, the perforations appear intentional and were likely the result of ritual killing.

Other

A black abalone fragment, recovered from FB 1, had a melted glass bead adhered to the ventral surface. Two glass beads were recovered from the same excavation unit: one each in underlying and overlying levels. Considering that intense heat would be required to melt glass to shell and that there was no evidence of thermal alterations in the excavation unit, it is likely the shell and glass were melted together prior to deposition. Whether this was intentional, however, is unclear.

Indeterminate Worked Shell

Fifteen shells were classified as indeterminate worked shell. Most (86.7 percent, n = 13) of the fragments were recovered from FB 1. The fragments included black abalone (n = 7), Pismo clam (n = 1), California venus clam (n = 3), venus clam (n = 2), scallop (n = 1), and chestnut cowrie (n = 1). Each of the fragments exhibited modifications, including chipping, grinding, and/or asphaltum residue. These indeterminate worked fragments are likely manufacturing debris resulting from the production or processing of artifacts.

Asphaltum-Coated Shell

Eighteen shell fragments were coated with asphaltum, 16 of which were recovered from FB 1. The shell types included California venus clam (n = 5), venus clam (n = 3), undifferentiated clam (n = 1), black abalone (n = 2), undifferentiated abalone (n = 1), speckled scallop (n = 2), scallop (n = 2), wavy turban (n = 1), and unidentifiable shell (n = 1). Three of these fragments were recovered from hearths (Features 4, 26, and 35). It is unclear whether asphaltum was intentionally applied to these shell fragments as part of a manufacturing sequence, or if it inadvertently became adhered, perhaps when the shell was discarded.

Summary of Worked-Shell Artifacts

The vast majority of other worked-shell artifacts (81.6 percent) was recovered from inside FB 1. Excavation units, rather than features, yielded the bulk of the collection. Worked-shell artifact densities in FB 1 and the outlying area do not differ significantly (t = 0.38, p <.05). Therefore, it is unlikely that these artifacts came from different populations. However, worked-shell artifacts were recovered from only a few types of features: an activity area, hearth concentration, and hearths. Worked shell from these features consisted of mostly utilitarian items, in addition to two ornaments, one of which was from the activity area and the other from a hearth. The scoops and containers recovered from these features were likely associated with food-consumption activities and possibly cleaning out of hearths. The presence of asphaltum-coated shell and fragments of chipped and ground shell in features also indicates that artifact processing and manufacturing may have also occurred and/or that production debris was discarded in these areas. Considering that concentrated human activity occurs around features such as hearths, it is not surprising that most of the worked shell was recovered from excavation units located immediately adjacent to and surrounding features rather than within the features. Comparisons of the distributions of shell tools and indeterminate worked shell representing possible manufacturing or processing debris reveal that they were not commonly found within the same excavation context (Figure 81). However, they were often found in adjacent contexts, indicating that tools and debris may have been part of the same manufacturing or processing activities.

Summary of LAN-211

The relative abundance and diversity of shell-artifact types suggest these artifacts were an integral part of domestic life at LAN-211. The analyzed shell-artifact collection is made up of mostly shell beads in addition to utilitarian items, such as shell scoops, containers, tools, and manufacturing debris. Shell beads were widely distributed across the site, perhaps indicative of a variety of uses, including personal adornment and in socioeconomic and possibly ritual exchange. Despite the high frequency of shell beads, there was little to no evidence of shell-bead production at LAN-211. Considering the absence of bead detritus and the recovery of only a single possible bead blank, the occupants of LAN-211 likely obtained shell beads from other locales, such as the Channel Islands.

Most of the shell beads were recovered from outside of FB 1, whereas other worked-shell artifacts were concentrated within FB 1. Considering that shell beads are typically not associated with food processing and consumption, beads recovered from FB 1 may have been intentionally or inadvertently discarded in this area. In general, other worked-shell artifacts appeared to be primarily utilitarian and domestic in nature, rather than decorative. Of note is the absence of shell fishhooks. It would appear that fish consumed at LAN-211 were caught by some other means, possibly by bone barbs, spears, fish nets, and/or metal hooks during the Mission period.

Temporal ranges for shell beads recovered from FB 1 indicate use of this area between the Intermediate and Mission periods, particularly during the Mission period and, to a lesser extent, between the latter portion of the Late period and the Protohistoric period (ca. A.D. 1500–1700). Comparisons of bead types with narrow time ranges indicate that activities were largely focused within the western half of the main excavation area and increased over time (Figures 82 and 83).

Compared to beads dating between the early Intermediate and early Late periods, beads falling within the latter portion of the transition from the Late to Protohistoric period were more widely distributed, including within features (see Figure 82). By the late Mission period, nearly the entire western half of the excavation block contained shell beads dating to this period, with the vast majority recovered from FB 1 (see Figure 83a, b). Although also concentrated within the western half of the main excavation area, shell-bead activities appear to drop off during the terminal Mission period, whereas post–Mission period shell beads are absent (see Figure 83c). Overall, the increase in shell bead use over time, peaking during the late Mission period, mirrors that of LAN-62. Considering the overlap in date ranges and overall similarities in bead types, domestic activities carried out at LAN-211 may have been associated with LAN-62; perhaps the same people used both sites. Collectively, the LAN-211 shell artifact collection is the product of a range of activities through time, including domestic, possibly ritual, and perhaps an intersection of the two.

Shell Beads and Other Worked-Shell Artifacts from LAN-2676

LAN-2676, situated along the edge of a former lagoon, is located in the northwestern portion of the PVAHP site cluster. The site is composed of redeposited cultural materials, likely displaced from one of the neighboring PVAHP sites or the adjacent bluff top during extension of the Hughes Aircraft Company runway during the 1950s (Altschul et al. 2003:167). Excavations within the heavily disturbed deposit

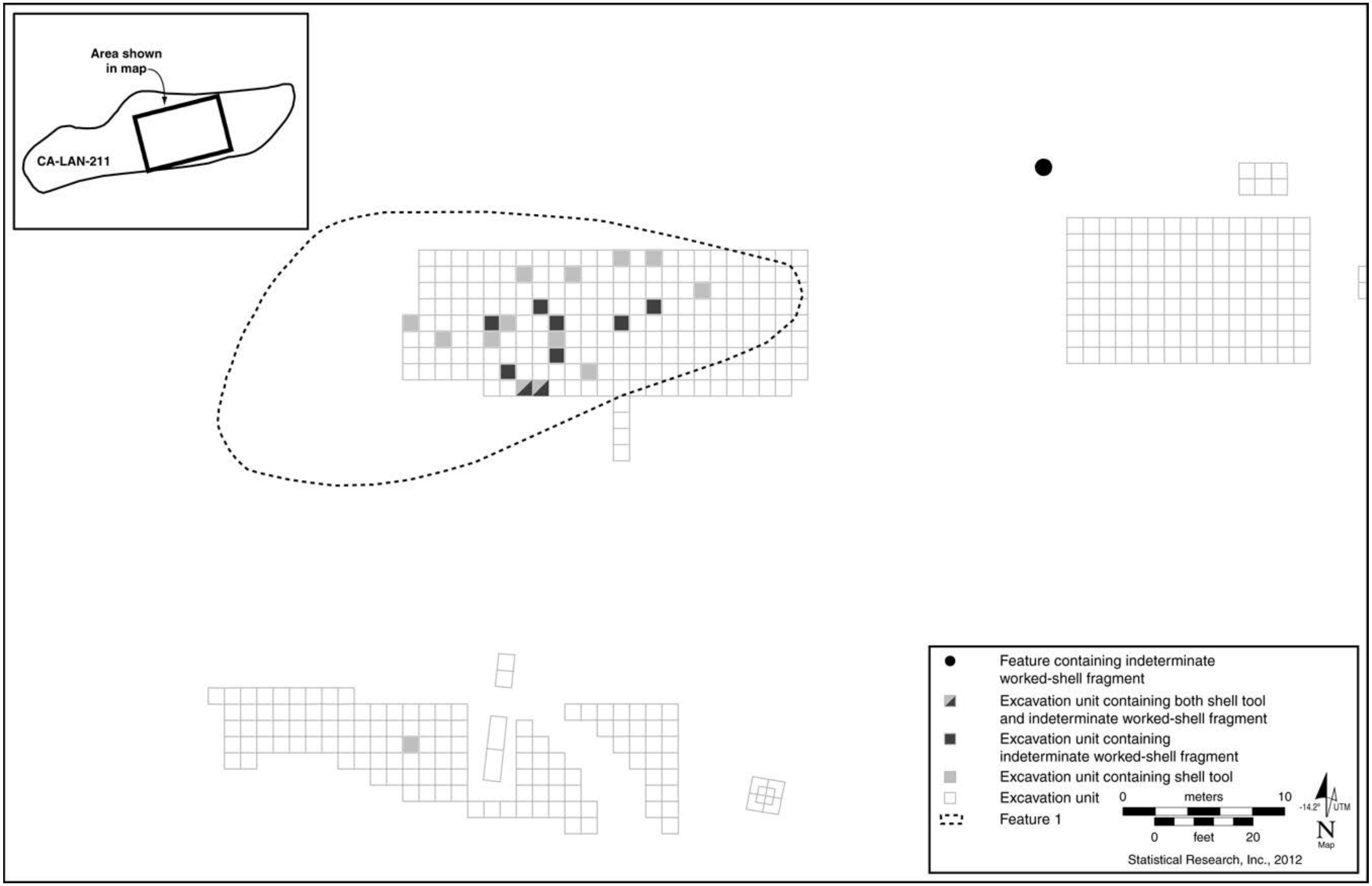

Figure 81. Spatial distribution of shell tools and indeterminate worked shell in feature and nonfeature contexts located within and outside of FB 1, LAN-211.

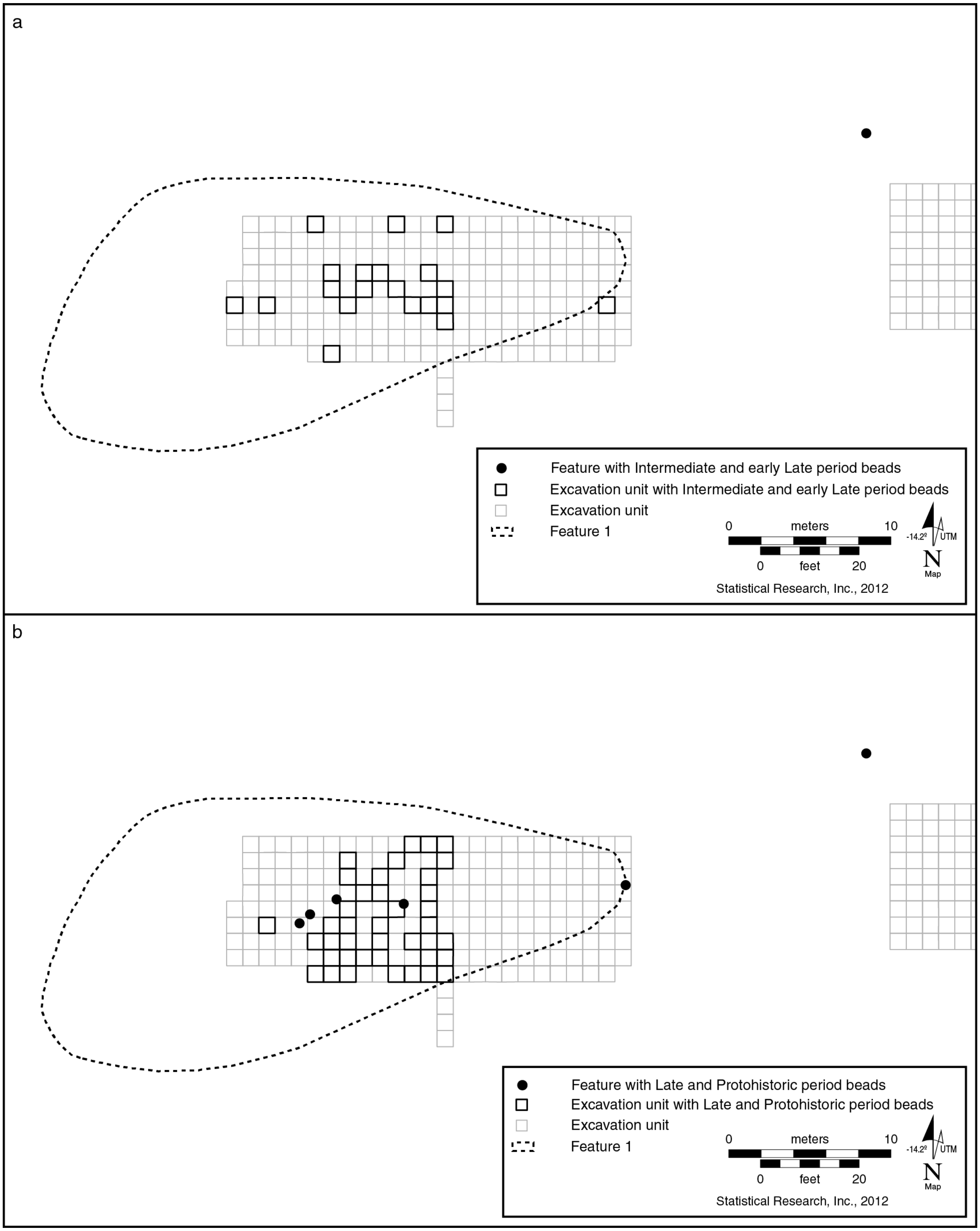

Figure 82. Spatial distributions of early Intermediate–Protohistoric period shell beads in features and excavation units, LAN-211: beads dating to the (*a*) Intermediate–early Late period and (*b*) Late to Protohistoric period.

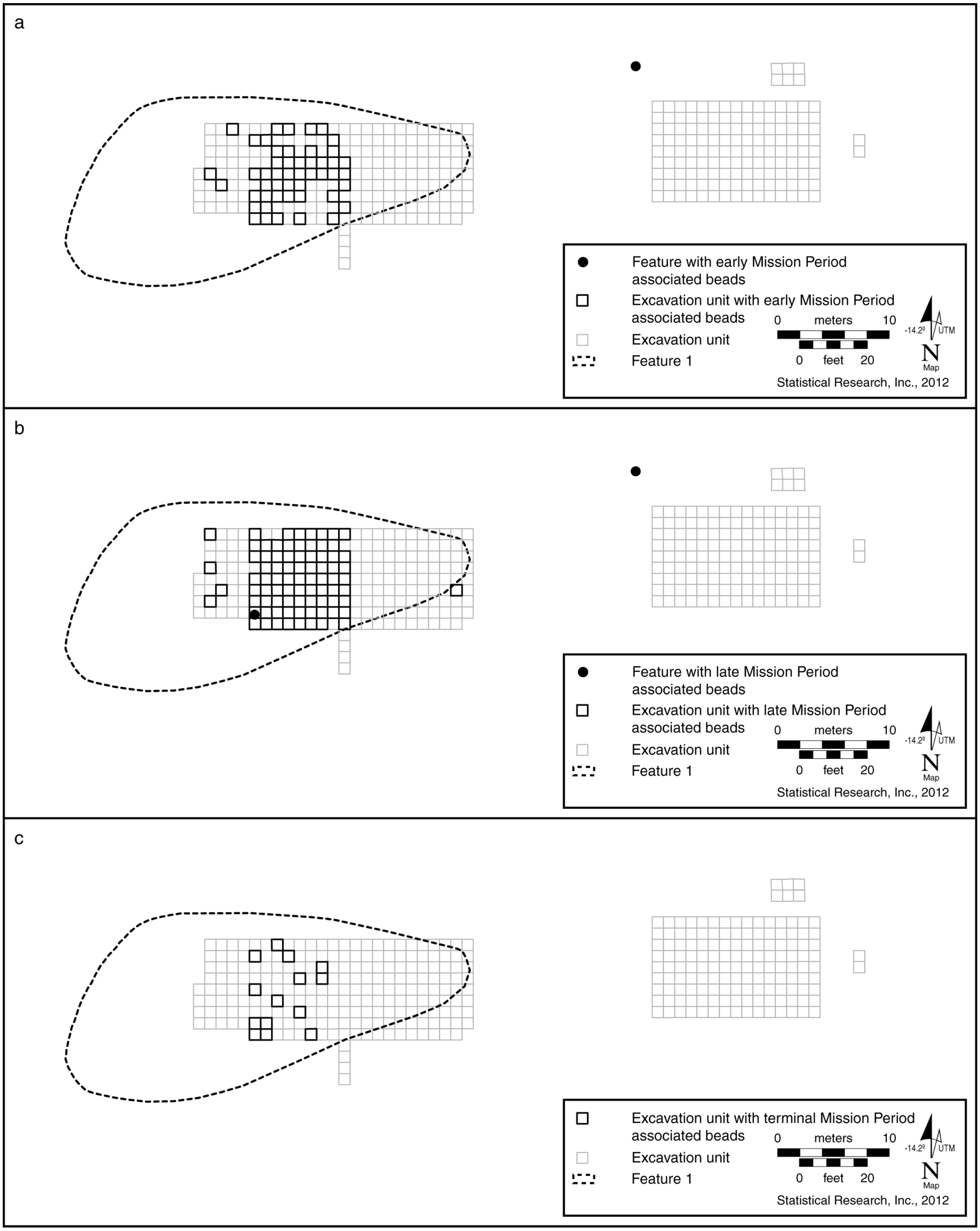

Figure 83. Spatial distributions of Mission period shell beads in features and excavation units, LAN-211: beads dating to the (*a*) early Mission period; (*b*) late Mission period; and (*c*) terminal Mission period.

Table 98. Summary of Shell Artifacts from Excavation Units, LAN-2676

Excavation Unit No.	Shell Beads (n)	Other Worked-Shell Artifacts (n)	Total	
			n	%
1	12	1	13	8.8
2	8	—	8	5.4
206	2	—	2	1.4
216	7	—	7	4.7
226	16	—	16	10.8
236	5	—	5	3.4
606	11	—	11	7.4
616	14	—	14	9.5
626	13	—	13	8.8
636	7	—	7	4.7
1006	4	—	4	2.7
1016	14	—	14	9.5
1036	5	—	5	3.4
1416	5	—	5	3.4
1426	4	3	7	4.7
1436	17	—	17	11.5
Total	144	4	148	100.0

produced a relatively moderate worked-shell collection, totaling 148 shell beads and other worked-shell artifacts (Table 98). The collection was recovered from 16 excavation units across the site.

The collection included a total of 21 different bead types, representing mostly olivella varieties (91.7 percent) (Table 99). No single bead class or type constituted the bulk of the collection. In addition to beads, the collection included four other worked-shell artifacts. EU 1 contained a single black abalone shell rim fragment that was coated with asphaltum on the ventral side. The remaining specimens, all recovered from EU 1426 (Level 4), included two abalone ornament fragments, both with a single perforation; ornament type, including shape, was not noted for either specimen. The third artifact consisted of a cut shell bead or ornament fragment manufactured from shell of unknown type. EU 1426 also contained four shell beads, including an olivella small drilled whole shell bead recovered from the same excavation level, as well as tiny saucer, cupped, and cylinder beads.

Dates for shell beads recovered from LAN-2676 ranged widely through time from the Intermediate to the post–Mission period. Shell beads with narrow time ranges provide evidence for activity at the site during the Intermediate–early Late period (normal saucer), the Late period (split oval), the latter portion of the Late period–Protohistoric period (round and oval thin lipped), the late Mission period (semiground disk), and the post-Mission period (chipped disk). Within excavation units, comparisons of bead time ranges by excavation levels indicated there was extensive stratigraphic mixing with beads associated with earlier time periods often recovered from upper levels overlying beads associated with later time periods. This was likely the result of redeposited site materials.

In terms of similarity to the other PVAHP sites, the relative proportions of bead types at LAN-2676 somewhat mirrors the distribution identified for the area outside of the LAN-62 main burial area and feature blocks—areas that were not likely the focus of burial activities. The LAN-2676 distribution is markedly different from the LAN-62 burial area, where bead-strand fragments were recovered in relatively high frequencies and beads dating to the Mission period constituted the bulk of the collection. Although uncertain, there is a strong possibility LAN-2676 represents redeposited LAN-62 site material, primarily from Locus B.

Worked Shell from LAN-1932

LAN-1932, discovered during removal of overburden from the former Hughes Aircraft Company runway, was located within the central portion of the PVAHP, approximately 330 m northwest of LAN-211 and 280 m north of LAN-62. Cultural deposits comprising LAN-1932 were highly disturbed and appear to have been redeposited from another site, possibly LAN-211 (see Chapter 10, Volume 2 of this series) or LAN-62. LAN-1932 is composed of two deposits: the lower prehistoric portion was originally designated as

Table 99. Shell Beads Identified at LAN-2676

Shell Type	Bead Class	Bead Type Grouping	Shell Beads (n)	Percent within Shell Type	Percent of Shell Beads
Olivella	spire-lopped	spire-lopped	2	1.5	1.4
	end-ground	barrel, small	1	0.8	0.7
	split oval	split oval	1	0.8	0.7
	lipped	thin lipped	4	3.0	2.8
		round thin lipped	19	14.4	13.2
		oval thin lipped	5	3.8	3.5
		full lipped	6	4.5	4.2
Subtotal (lipped)			34	25.8	23.6
	saucer	saucer	2	1.5	1.4
		tiny saucer	29	22.0	20.1
		small normal saucer	2	1.5	1.4
Subtotal (saucer)			33	25.0	22.9
	disk	ground	17	12.9	11.8
		semiground disk	8	6.1	5.6
		chipped disk	4	3.0	2.8
Subtotal (disk)			29	22.0	20.1
	callus	cupped	13	9.8	9.0
		bushing	15	11.4	10.4
		cylinder	2	1.5	1.4
Subtotal (callus)			30	22.7	20.8
	whole shell	small drilled whole shell	2	1.5	1.4
Subtotal (olivella)			132	100.0	91.7
Red abalone	disk	disk	7	87.5	4.9
	cylinder	cylinder	1	12.5	0.7
Subtotal (red abalone)			8	100.0	5.6
California mussel	disk	disk	2	50.0	1.4
	cylinder	cylinder	2	50.0	1.4
Subtotal (California mussel)			4	100.0	2.8
Total			144		100.0

SR-23, and the upper historical-period portion was referred to as SR-6. Because LAN-1932 was redeposited and lacked stratigraphic and contextual integrity, chronostratigraphy was not determined for the site.

A total of 42 shell beads and other worked-shell artifacts recovered from LAN-1932 was previously reported (see Gibson et al. 2003) (Table 100). The collection included 38 shell beads and 4 other worked-shell artifacts. Eleven Olivella bead types composed the bulk of the collection, in addition to 2 California mussel disks. Two of the olivella cupped beads were incised with diagonal or crosshatch designs. Collectively, bead dates indicate bead-related activities at LAN-1932 occurred between the late prehistoric and Mission periods, with most dates overlapping between the Protohistoric and Mission periods.

The LAN-1932 shell artifact collection also included four miscellaneous shell disks. Three disks were white to cream colored, likely manufactured from mussel or abalone shell, although they were harder than typical for these shell types (Gibson et al. 2003:214). One specimen exhibited chipping or weathering along the margin. Shell type could not be determined for the remaining disk (Gibson et al. 2003:214).

Considering the small sample size recovered from LAN-1932, it remains unclear whether it represents redeposited site material from LAN-211. Similar bead types were recovered from both sites; however, relative proportions were different. LAN-211 yielded mostly olivella disks, followed in decreasing frequency by callus and lipped beads. Comparisons of bead types and relative proportions with other sites indicate that LAN-1932 is similar in overall composition to LAN-62 A/G general midden contexts, as well as the LAN-2676 collection. Considering the similarities, LAN-1932 and LAN-2676 may have been redeposited from the same site, LAN-62.

Table 100. Previously Reported Shell Beads Identified in LAN-1932 (Gibson et al. 2003:207)

Shell Type	Bead Class	Bead Type Grouping	Shell Beads (n)	Percent within Shell Type	Percent of Shell Beads
Olivella	spire-lopped	oblique	1	2.8	2.6
	lipped	lipped	1	2.8	2.6
		thin lipped	1	2.8	2.6
		round thin lipped	3	8.3	7.9
		oval thin lipped	4	11.1	10.5
		full lipped	10	27.8	26.3
		deep large lipped	1	2.8	2.6
Subtotal (lipped)			20	55.6	52.6
	callus	cupped	7	19.4	18.4
	saucer	tiny saucer	5	13.9	13.2
	disk	semiground disk	1	2.8	2.6
	wall disk	wall disk	2	5.6	5.3
Subtotal (olivella)			36	100.0	94.7
California mussel	disk	disk	2	100.0	5.3
Total			38		100.0

Conclusions

The PVAHP worked-shell artifact collections offer diverse and sizable data sets allowing for continued exploration of past lifeways in the Ballona and greater southern California region. In general, shell-bead and other worked-shell artifact typologies and chronologies developed largely based on data from Chumash sites appear to be applicable to the Ballona region. In fact, worked-shell artifact types and distributions dating between the Late to Protohistoric period transition and the Mission period in the LAN-62 burial area reflect remarkable similarities with those in Chumash burial grounds at the Medea Creek and Malibu sites. These parallels bring into question whether similar mortuary practices, and perhaps other ritual or domestic practices, were widely shared throughout the southern California coastal mainland region.

Collectively, the analyzed shell-bead and other worked-shell collections offer insight into domestic and ritual activities in the Ballona over a span of at least 3,000 years. Variability in the worked-shell artifact collections reflect differences in the types of activities carried out in the Ballona, groups occupying the area, the timing of activities, or a combination of one or more of these factors. The collection from LAN-54 provides insight into a combination of ritual and domestic activities during the late Millingstone and early Intermediate periods, whereas activities at LAN-2768 largely occurred during the early Intermediate period. Worked-shell collections from LAN-2676 and LAN-1932 are difficult to interpret, as they represent redeposited site materials, possibly from LAN-62. The most extensive of the worked-shell collections, recovered from LAN-211 and LAN-62, provide evidence for activities dating as early as the Intermediate period, with the most intensive use of the sites during and following the Late period. The collection recovered from LAN-62 provides an unprecedented wealth of knowledge centering on mortuary and other ritual practices.

Use of Worked Shell in Ritual Contexts

By far, the majority of worked-shell artifacts from PVAHP sites highlights ritual activities. Nearly 90 percent of the analyzed PVAHP worked-shell collection was recovered from the LAN-62 burial area, in addition to a single specimen identified in a burial at LAN-54. Additionally, LAN-211 contained worked shell that may be associated with ritual activities at LAN-62.

For the most part, shell-bead types identified in ritual contexts were similar to those recovered from nonritual contexts, including midden and nonburial features, such as rock clusters, hearths, and artifact concentrations. Similarities in types suggest that certain bead types were not necessarily restricted to ritual (or nonritual) use. However, shell beads in ritual contexts were found in much higher frequencies, including certain bead types, such as Pismo clam cylinders and tubes, California mussel disks, and giant rock scallop tubes. Based on their distributions within the Malibu and Medea Creek burial grounds, King (1974) characterized these bead types as high status, reportedly associated with community leaders or wealthy individuals. Their relatively widespread distribution within the LAN-62 main burial area, however, does not appear to reflect differential distribution based on social status. Rather, their distributions likely reflect temporal patterns with intensive use of these bead types concurrent with heightened use of the burial area following the Late period.

Shell-bead caches and strands were rare outside of ritual contexts. Shell beads recovered from LAN-62 burials were identified in strands and piles, often placed on the individual's head, chest, around the neck, and legs. This placement was also noted at the Medea Creek and Malibu burial grounds. Some beads recovered from the feature matrix may have been broadcast offerings, although some may have also been present in the underlying matrix at the time of interment. Frequencies of shell beads in burials varied dramatically. Although many subadults were buried with no or few worked-shell artifacts, a few were buried with high frequencies. This pattern was also identified at the Tongva Late to Mission period LAN-1575 burial ground and the prehistoric and historical-period Malibu and Medea Creek burial grounds. The similarities suggest a regionally shared mortuary practice honoring infants and children.

In general, LAN-62 burials with high frequencies of beads tended to be clustered in the central and southern portions of the main burial area, whereas those with low frequencies were much more widely distributed, including along the periphery and in the northern portion of the burial area. Burials with high shell-bead frequencies contained mostly Mission period beads, particularly late Mission period semiground disks. The clustering of these burials within the central and southern portions of the main burial area suggests that, by the early Mission period, a circumscribed burial area was established at LAN-62.

A small proportion of LAN-62 burial features contained most of the shell beads. This pattern was also found at the Malibu burial grounds. In the case of the Malibu burial grounds, 6 percent of the burials yielded 75 percent of the beads in the Late period burial ground, whereas 9 percent of the burials contained 69 percent of the beads in the Mission period burial ground (Gamble et al. 2001:206). This similar distribution over time suggests a continuity in cultural practices that was shared by groups in the Los Angeles Basin as well as Santa Barbara Channel regions.

FB 3, the area adjacent to the LAN-62 main burial area where mourning-ceremony activities may have occurred, contained concentrations of shell beads dating predominately to the Mission period. Nearly half of the shell beads (48.2 percent) had been burned, and four artifact concentrations and pit features yielded caches of shell beads with frequencies greater than 100. Beads recovered from FB 3 excavation units were much more dispersed, possibly the remnants of offerings that were broadcast during ceremonial activities. Additionally, the recovery of shell containers and scoops from FB 3, as well as burned items and FAR, provide evidence for food-consumption activities and offerings at FB 3.

In addition to shell beads, the burial area contained more than 70 percent of the shell pendants recovered from LAN-62, including most of the abalone pendants. Perforated whole shells were unique to the LAN-62 burial area and LAN-211 FB 1 area. The shells appeared to have been ritually perforated or killed.

Use of Worked-Shell Artifacts in Domestic Contexts

Worked-shell artifacts recovered from nonmortuary contexts are suspected to have been part of daily or domestic activities. Compared to the LAN-62 burial area, worked-shell artifacts were widely distributed across the PVAHP sites. The association of shell beads in nonmortuary-related features, such as rock clusters and hearths, remains unclear. The shell beads may have been intentionally deposited in these features or inadvertently discarded or lost. In some instances, beads recovered from these features were burned, whereas others appear to have been deposited following thermal activities. Again, whether or not the beads were intentionally burned is unclear.

Worked-shell artifacts recovered from LAN-211 provide exceptional insight into domestic activities in the Ballona. Although shell beads were identified in feature and nonfeature contexts, 60 percent were recovered from excavation-unit contexts located outside of FB 1. Considering this distribution, shell beads do not appear to have been integral to feature-related activities at LAN-211. Other worked-shell artifacts, however, were most common in FB 1, which was defined as a large activity area. Most of the other worked-shell artifacts were recovered from excavation units adjacent to subfeatures within FB 1. Artifacts included shell containers, scoops, asphaltum-coated shell, indeterminate worked shell, and a few ornament blanks. Many of the asphaltum-coated shell and indeterminate worked shell with cut, ground, or chipped marks highlight processing of materials. The overall distribution suggests congregation of worked-shell-related processing and manufacturing activities adjacent to hearths and rock clusters.

In general, other worked-shell artifacts identified in PVAHP sites were manufactured from locally available shell taxa, including different varieties of clam and scallop, California mussel, and red and black abalone. Following shellfish consumption, the shells were likely reserved for artifact manufacture. Fragments of chipped, ground, and cut shell attest to on-site local manufacture. The PVAHP collections also contained extremely low frequencies of shell-artifact blanks, including red and blank abalone fishhooks, Pismo clam beads, and clam and scallop pendants. In general, finished shell fishhooks and fishhook blanks were extremely rare, suggesting that they were either infrequently discarded at PVAHP sites or were not commonly used in the Ballona, perhaps owing to the enclosed lagoon environment rather than open waters for which the shell fishhook may have been technologically bettered suited. Other than 10 whole olivella shells recovered from LAN-62 and LAN-211, there was no direct evidence for local olivella shell-bead manufacture. The occupants of the Ballona appear to have been largely consumers of shell ornaments rather than manufacturers. The Ballona occupants likely obtained shell beads from manufacturing locales on the Channel Islands.

Use of Worked-Shell Artifacts over Time

The analyzed worked-shell collections provide insight into both continuity and change in worked-shell-related activities over time in the Ballona. Although limited, worked-shell use in the Ballona occurred by the early Intermediate period and increased over time, peaking during the Mission period at LAN-62 and LAN-211. Increased use over time was coupled with a fluorescence of shell-bead and ornament types. Non-ornament worked-shell artifacts, however, such as shell containers, scoops, and cutting and abrading tools demonstrated remarkable continuity in form over time. This continuity suggests a basic, well-adapted coastal tool kit.

By contrast, the types of shell used to manufacture ornaments, as well as overall ornament forms, changed over time. Shell pendants identified in Intermediate period contexts consisted of mostly perforated whole valve shells manufactured from clam and scallop. During and following the Late period, shell pendants were commonly manufactured from abalone. The iridescent nacreous shell was worked into a variety of forms, including disks, geometric designs (e.g., rectangular, trapezoidal, and triangular), and offset rings. Most of the analyzed shell pendants were recovered from burial contexts.

During the Intermediate period, use of shell beads was limited and consisted of mostly clam beads and a few olivella bead varieties, including spire-lopped, saucer, thick rectangle, ring, and oblique spire-lopped beads. Low frequencies of shell beads dating to the early Intermediate period may reflect limited use of the Ballona during this time, limited access to shell beads, a lack of preference for shell beads, or a combination of more than one of these factors. In the case of bead preference, a preference for stone beads over shell beads during the Intermediate period might indicate the presence of desert cultures occupying the Ballona. A preference for stone over shell beads, however, does not appear to be the case, considering the low frequencies of stone beads recovered from PVAHP sites (see Chapter 2, this volume). For example, of the 22 stone beads recovered from LAN-62 datable contexts, 3 dated to the Intermediate period. This contrasts with the more than 420 shell beads dating between the Intermediate and early Late periods.

The Intermediate period marks the earliest evidence of integration of worked-shell artifacts in mortuary contexts in the Ballona. A female burial at LAN-54 contained a single scallop ornament fragment. As evidenced at LAN-62, over time, worked shell became an integral part of mortuary contexts in the Ballona. The Late period marks the first evidence of shell beads associated with burials at LAN-62. In general, beginning in the Late period, ca. A.D. 1150, shell-bead frequencies and their distributions dramatically increased at LAN-62 and LAN-211. This increase likely reflects intensified use of the Ballona, as well as increased availability of shell beads with the introduction of olivella callus beads in southern California exchange networks.

Use of worked shell at LAN-62 and LAN-211 continued into the Protohistoric and Mission periods. As noted previously, concentrations of Mission period shell beads associated with burials located within a 10-by-10-m area suggest that, by the Mission period, a formal burial area was established at LAN-62. In many cases, shell-bead frequencies in Mission period burials far exceeded those in Intermediate and Late period burials, with counts ranging between 700 and 6,600 shell beads. In part, the dramatic increase in shell-bead frequencies in Mission period burials stems from increased availability of mass-produced shell beads drilled with metal needles.

Future Research

In all, the shell-bead and worked-shell artifact collection recovered from LAN-62 provides a glimpse of past ritual and domestic activities carried out over significant periods in prehistory and history, during times of possible climatic fluctuations, changes in social complexity and development, and the dramatic changes caused by the arrival of Europeans. Shell beads and other worked-shell artifacts provide insight into aesthetic preferences, ritual practices, domestic activities, social status, wealth, manufacturing techniques, and chronology. Intrasite and intersite comparisons of shell -artifact types and frequencies in PVAHP feature and nonfeature contexts have provided a wealth of knowledge regarding the types of domestic and ritual activities carried out at PVAHP sites and where these occurred on the landscape. Shell beads were clearly an integral part of ritual activities as well as social and economic exchange, and less so with respect to food preparation and hearth-maintenance activities. Use of shell containers crossed both domestic and ritual realms, whereas scoops, tools, and indeterminate worked-shell fragments appear to have been confined to domestic activities. Future research should focus on an understanding of worked-shell artifacts within a larger social context, integrating worked-shell artifacts with other artifact and ecofact classes, and examining the relationships between shell, glass, and stone beads, other European artifacts, botanical offerings, and aspects of burial treatments.

Animal-Bone and Antler Artifacts from Playa Vista

Janet L. Griffitts, Tina M. Fulton, and Justin E. Lev-Tov

The worked-bone collection from Playa Vista includes more than 1,000 artifacts from five sites: LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768. This large, well-preserved collection includes a range of artifacts such as tools, ornaments, and manufacturing waste that provide an opportunity to understand human behavior at the sites, and to reconstruct activities that took place there. Animal-bone tools are frequently used to make other tools, which are frequently not preserved. Therefore, detailed study of bone technology may help researchers to indirectly identify and trace other past technologies such as basket making, leather working, or woodworking. Animal bone, antler, and horn can also be used for many nonutilitarian purposes. Analysis of these ornaments, musical instruments, gaming pieces, and other nonutilitarian objects provides clues to extend our picture of social and ceremonial life.

In this chapter, the results of the worked-bone analysis are presented. Following a short background, the methods used to analyze and record the data are discussed. This methods section includes discussions of manufacturing techniques and defines the typologies used in this project. Manufacturing techniques are given different names by various researchers; therefore, the methods and the traces left by different manufacturing strategies are defined and described here in detail. This study includes high-power optical microwear analysis, and a discussion of use-wear procedures and experimentally produced use-wear patterns is therefore included. The theoretical orientation is then briefly discussed, and an overview of the life history approach is included in the following section.

Basic summaries of the animal-bone and antler artifacts are presented in the next section; summaries and specifics of numbers, types, and characteristics of these items are in the accompanying figures, tables, and appendixes. The recorded features include summaries of tool shape, type, and use. Most of this information is presented in the appendixes; figures and tables within this chapter provide at-a-glance overviews of how much of which types were found where. Subsequently, a more in-depth discussion of specific tool uses and pertinent ethnographic information is presented. The results of use-wear analysis are compared to the traditional typological interpretations of use to investigate correlations between form and function. The collections are also compared with other bone-artifact collections in southern California and elsewhere. Appendixes D.1–D.22 contain the detailed data on worked-bone artifacts.

Research Background and Analytical Context

Animal-bone artifacts can provide detailed data on some aspects of resource use. Some artifacts, such as abalone pries, fishhooks, or bone projectile points, were directly used to acquire subsistence resources. Others were used to process plant or animal resources. Bone tools are often used to produce other tools from more-perishable materials, and use-wear analysis can help to identify indirectly the presence of some of the perishable technologies. Nonutilitarian bone artifacts also may provide important information concerning symbolic or recreational behaviors. Use-wear analysis provides an in-depth look at specific activities and can help to broaden our reconstructions of day-to-day life in the Ballona.

Studies of California bone technology rely heavily on a systematic summary of bone artifacts compiled by Gifford (1940). Orr (1947) supplemented Gifford's original typology, and a few years later, Bennyhoff (1950) provided a summary focusing on one aspect of technology—fishing spears and harpoons. Research in California bone-artifact technology seems to have slowed after the productive decade between Gifford's and Bennyhoff's publications. Thirty years later, Hudson and Blackburn (1982, 1983, 1986, 1987) produced a multivolume compilation of Chumash material culture, drawing from copious notes collected by Harrington and placing his notes into context using ethnographic and ethnohistoric sources (Nabokov 1989). These volumes, too, provide much useful information on bone-artifact technologies. The publications of Gifford, Bennyhoff, Hudson and Blackburn, and Orr still form the backbone of California bone-tool research and provide most of the ethnographic data used in this chapter as well. There is, therefore, a surprising amount of ethnographic information concerning bone-tool use and potential tool uses among the Chumash.

Although these publications are excellent, Wake (2001) noted that little has changed in California bone-tool studies since Gifford proposed his typology in 1940. As is common in many regions, bone tools are often given cursory treatment and may be simply included as a list of undefined or poorly defined types. Consequently, animal-bone-and-antler-artifact technology is an understudied research issue in California and elsewhere. This situation is changing, and researchers throughout the world are conducting more in-depth bone-artifact technology studies. In this chapter, we show that considerably more information can be gained than a simple typological list.

Methods

Several analytical approaches are used in bone-artifact technology research, and each has advantages and drawbacks. The most frequently used system involves simply classifying artifacts with form-based typologies. These typologies vary from region to region, within regions, and between researchers. Other analytical approaches focus on detailed analysis of bone-tool-manufacturing techniques (Wake 1999a), replicative studies, and use-wear analysis. This study combines several such approaches: form-based typology, replicative work, and use-wear analysis. As is true in lithic-technology research, typologies for bone and antler artifacts vary in the degree to which artifacts are split into specific categories. Two primary typologies were employed: one "splits" artifacts into many smaller groupings and the other "lumps" artifacts into only a few types. The approach employed here serves to compare the correspondence between classification systems and use-wear analysis and reflects analytical preferences of researchers involved in this study.

Analytical Techniques

Analysis took place in several stages and at multiple levels. The most basic level of analysis included recording taxon, element, size class, and bone condition of each bone and antler artifact during the initial faunal analysis (see Chapter 10, this volume, for discussion of analytical methods used to identify unworked bones). After initial faunal analysis, bone and antler artifacts and potential artifacts were set aside for additional work. The second level of analysis was performed by Fulton, who recorded artifact length, width, and thickness in millimeters using a set of electronic Mitutoyo Digimatic calipers and recorded weight in grams using a Scout Pro electronic scale. Extremely fragmentary objects were not measured, and highly deteriorated artifacts were not weighed. Linear measurements were obtained for 96 percent of the artifacts, and 91 percent were weighed.

In addition to recording standard measures of length and width, Fulton measured the broken ends of bone-artifact fragments, which were compared across sites to identify possible matching fragments. This procedure proved effective in reconstructing three tools, one of which had been broken into four fragments recovered from different contexts at LAN-62. Three of these fragments were recovered from adjacent excavation units and a burial feature, spaced no more than 1 m apart, though the one fragment from a burial was found in Level 60 (the other three fragments came from Levels 49 or 50 of the excavation units). The fourth fragment came from an excavation unit approximately 3–4 m away from the others.

Any manufacturing traces still present were noted, as were macroscopically visible residues such as asphaltum or ocher, and any decoration. The most detailed level of analysis was performed on awls and other pointed tools, tool midsections, and the spatulate tools identified as abalone pries. These tools were set aside for high-power optical microwear analysis, described below.

Awl-tip cross section, shape, and sharpness were recorded on intact tool tips to investigate possible correlations between tip morphology and use. Tip shape was recorded as tapered, constricted, intermediate, or convex sided, and sharpness was recorded as sharp, intermediate, or blunt. These categories are subjective but nonetheless provide general descriptions of overall tool tip shape.

The width and thickness of intact awl tips and other pointed tools were recorded with mechanical calipers. Awl-tip width and thickness were measured at 5 mm from the tip. This location was chosen because, with the exception of very blunt tools, most awls measured at the end or 1 mm from the end have more or less the same measurement—between 1 and 2 mm. Measuring a short distance from the end, however, provides a better indication of the robustness of the tip. Tip cross section was noted for intact tool tips. Tip cross sections were also taken 5 mm from the tip, because the cross sections of most awls or other pointed tools are round or oval when examined only at the extreme tip.

Typologies

Artifacts were initially placed into a morphology-based typology designed by Fulton. The categories employed were primarily derived from Gifford (1940), Bennyhoff (1950), and Hudson and Blackburn (1982, 1983, 1985, 1986, 1987). The defining characteristics of each category are described in Appendix D.1, and select artifacts are illustrated in Figures 84–111. Figures 112 and 113 summarize use wear and tip shape on certain types of bone tools.

Figure 84. Seal-tusk tubular bead (Type A) from LAN-211, EU 409, Level 67.

Figure 85. Bird long-bone tubular bead (Type B) from LAN-62, EU 645, Level 66.

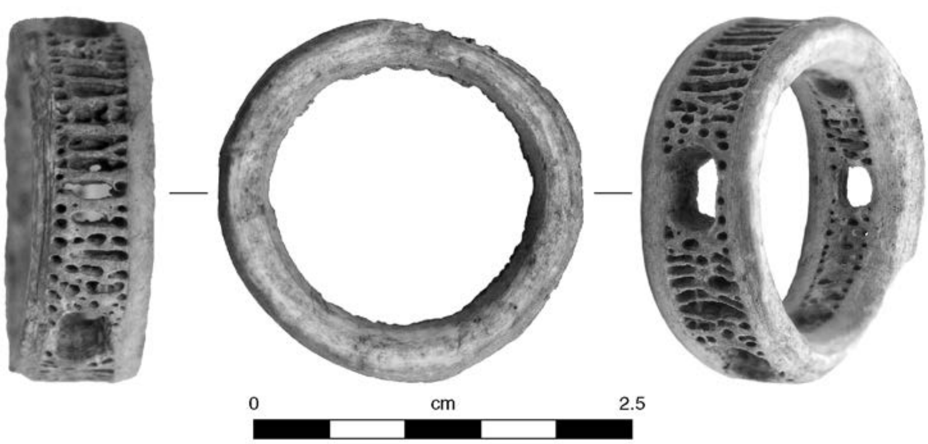

Figure 86. Shark-vertebra bead or gaming piece from LAN-62, EU 323, Level 64.

Figure 87. Fish-vertebra bead from LAN-62, EU 600, Level 53.

Figure 88. Drilled disk from LAN-62, EU 204, Level 60.

Figure 89. Pendant from LAN-211, EU 159, Level 62.

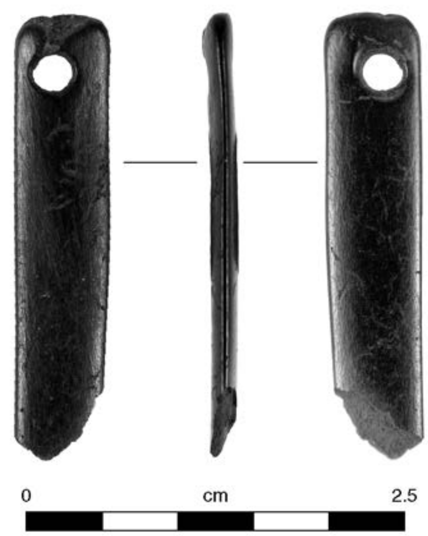

Figure 90. Pendant from LAN-211, EU 128, Level 60.

Figure 91. Predatory-bird-claw pendant or amulet from LAN-211, EU 110, Level 61.

Figure 92. Simple whistle from LAN-62, EU 601, Level 58.

Figure 93. Deer-tibia whistle, Gifford type FF 1a, from LAN-62, Feature 459.

Figure 94. Deer-tibia whistle, Gifford type FF 1c, from LAN-62, EU 601, Level 49.

Figure 95. Flute from LAN-62, EU 502, Level 49.

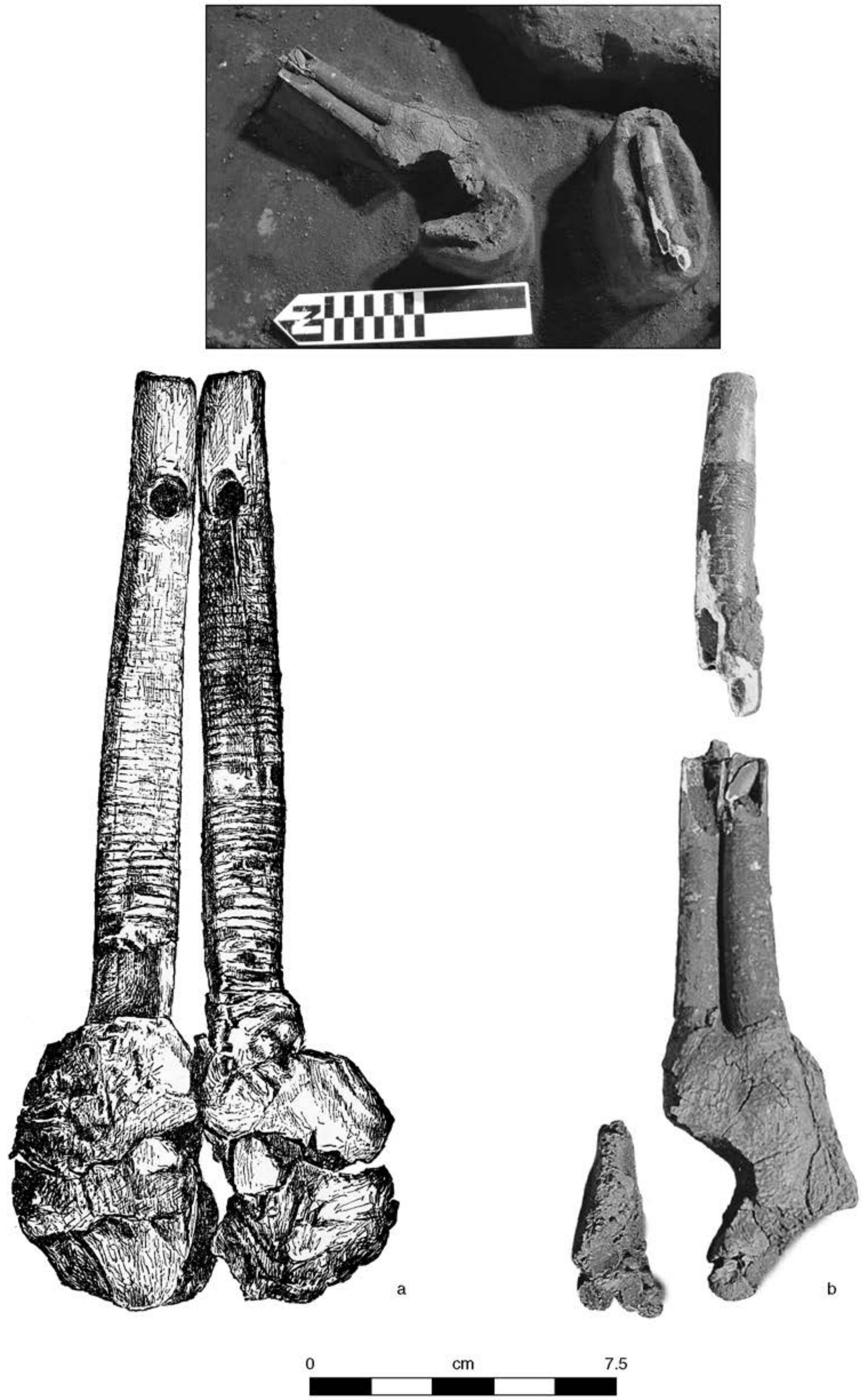

Figure 96. **(*a*) Drawing of a Chumash double flute; (*b*) double bone “flute” in situ at LAN-62, BF 537d from Hudson and Blackburn 1986; (*c*) close-up of in situ flute extracted from *b*.**

Figure 97. Turtle-shell rattle from LAN-211, EU 425, Level 60.

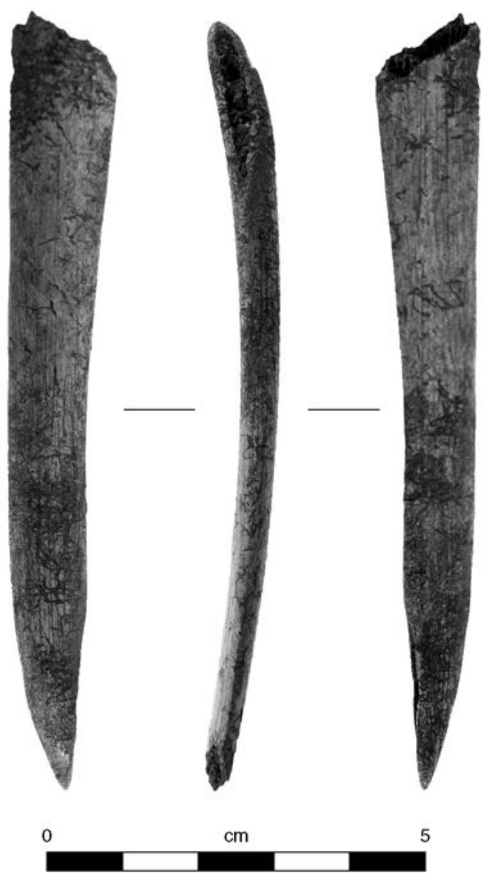

Figure 98. Strigil from LAN-211, EU 408, Level 58.

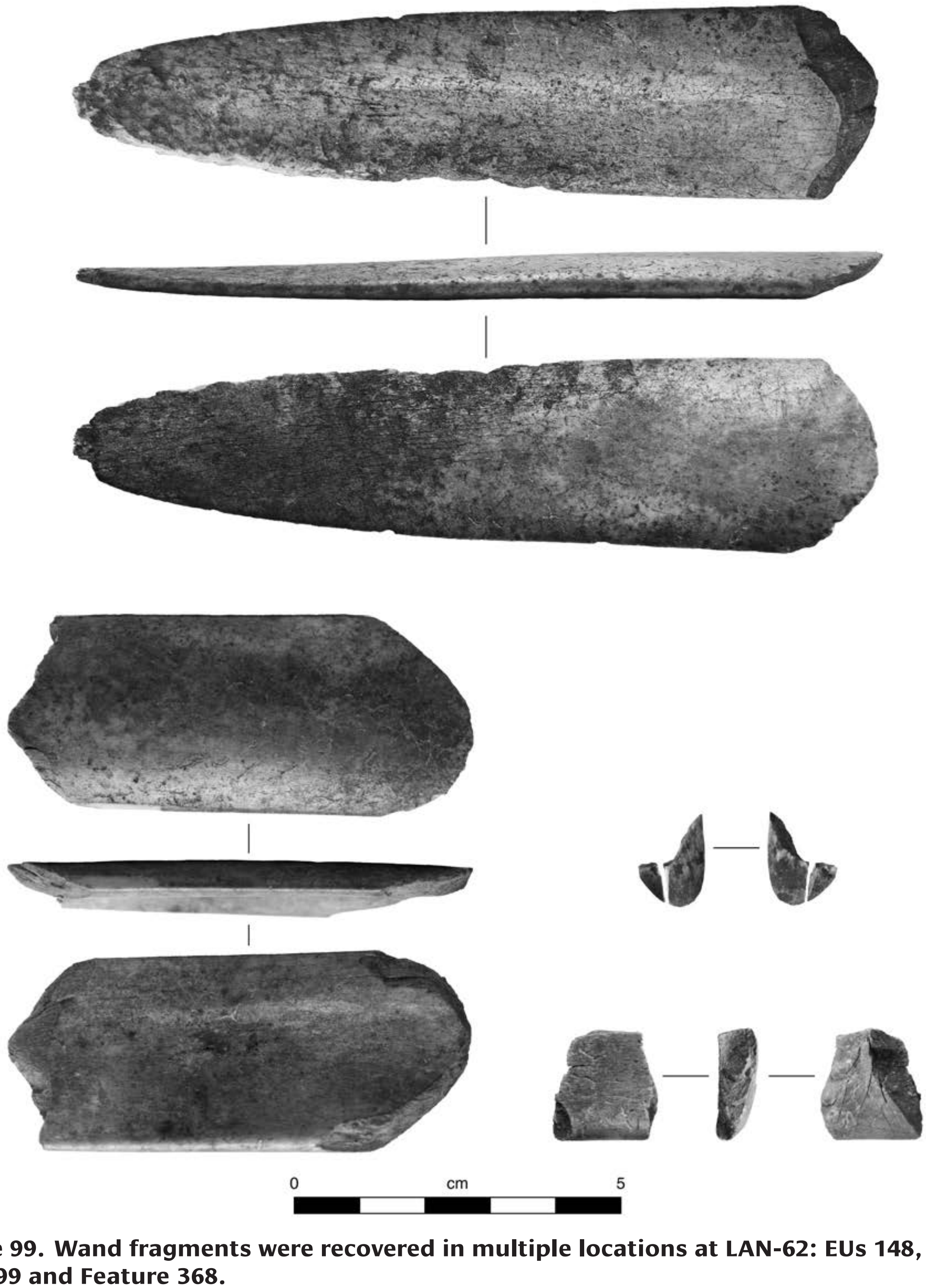

Figure 99. Wand fragments were recovered in multiple locations at LAN-62: EUs 148, 158, and 399 and Feature 368.

Figure 100. Indeterminate pin from LAN-62, EU 712, Level 69.

Figure 101. Hairpin from LAN-211, EU 105, Level 65.

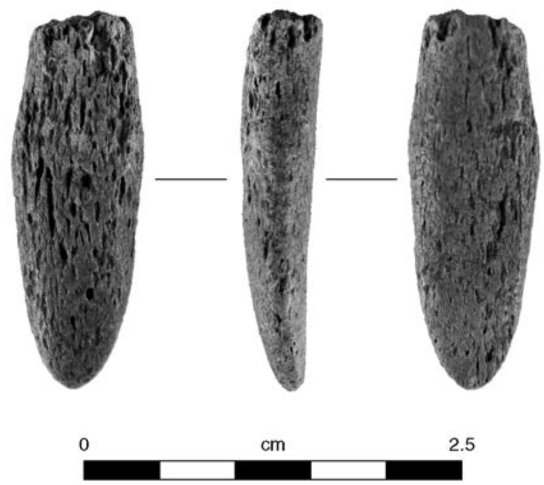

Figure 102. Clothing pin from LAN-62. EU 689, Level 53.

Figure 103. Composite fishhook from LAN-54, Feature 12.

Figure 104. Barb from LAN-62, EU 125, Level 77.

Figure 105. Harpoon from LAN-211, EU 206, Level 60.

Figure 106. Pry or chisel from LAN-54, Feature 12.

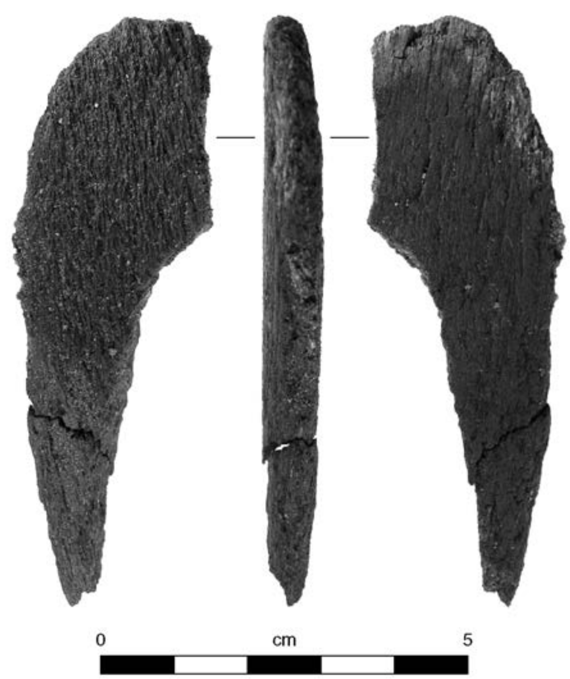

Figure 107. Applicator or spatula from LAN-62, Feature 458.

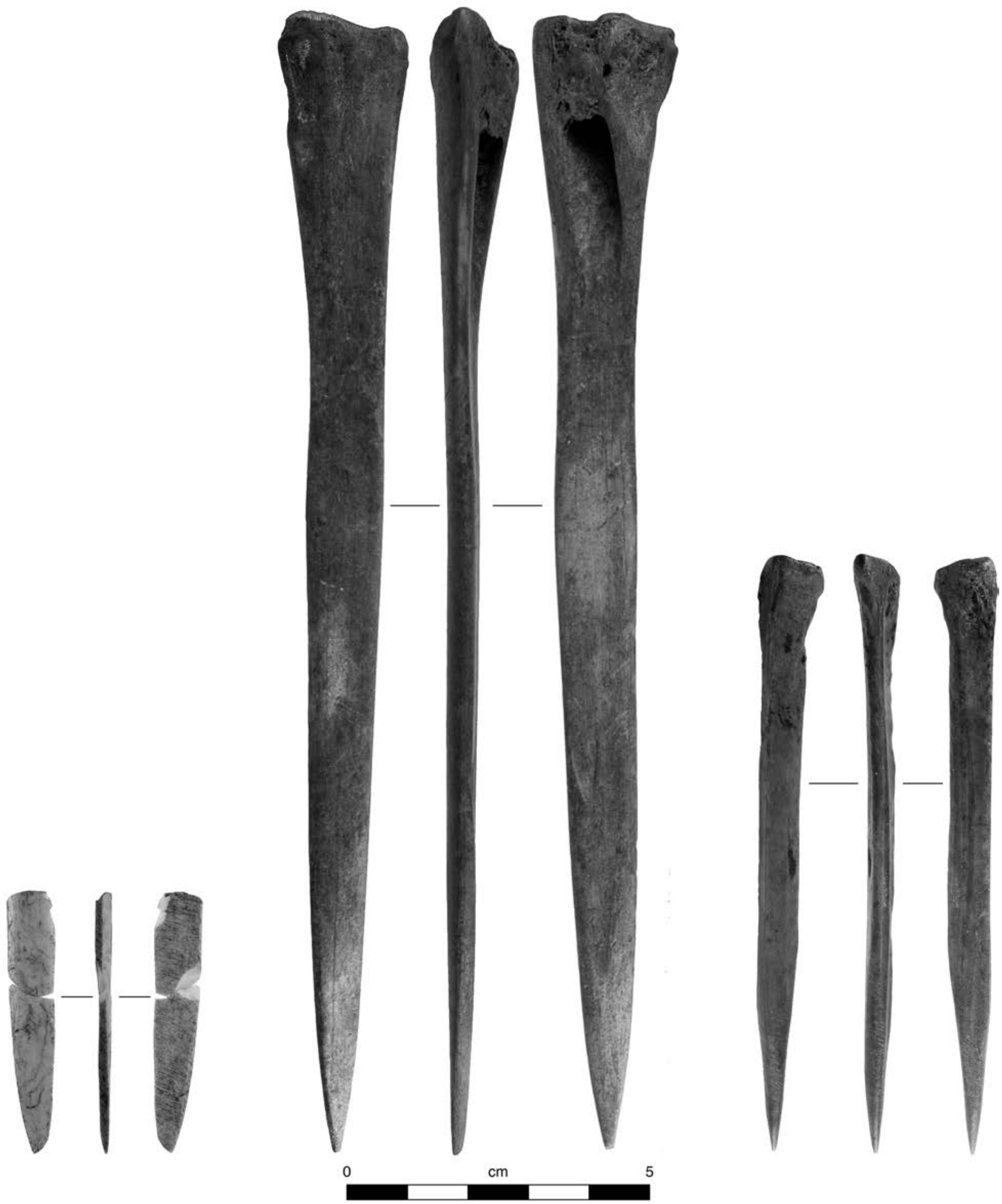

Figure 108. Examples of awls from LAN-62, EUs 25 and 805.

Figure 109. Flaking tool from LAN-211, EU 104, Level 62.

Figure 110. Punch from LAN-211, EU 403, Level 65.

Figure 111. Needle from LAN-193, nonburial Feature 7.

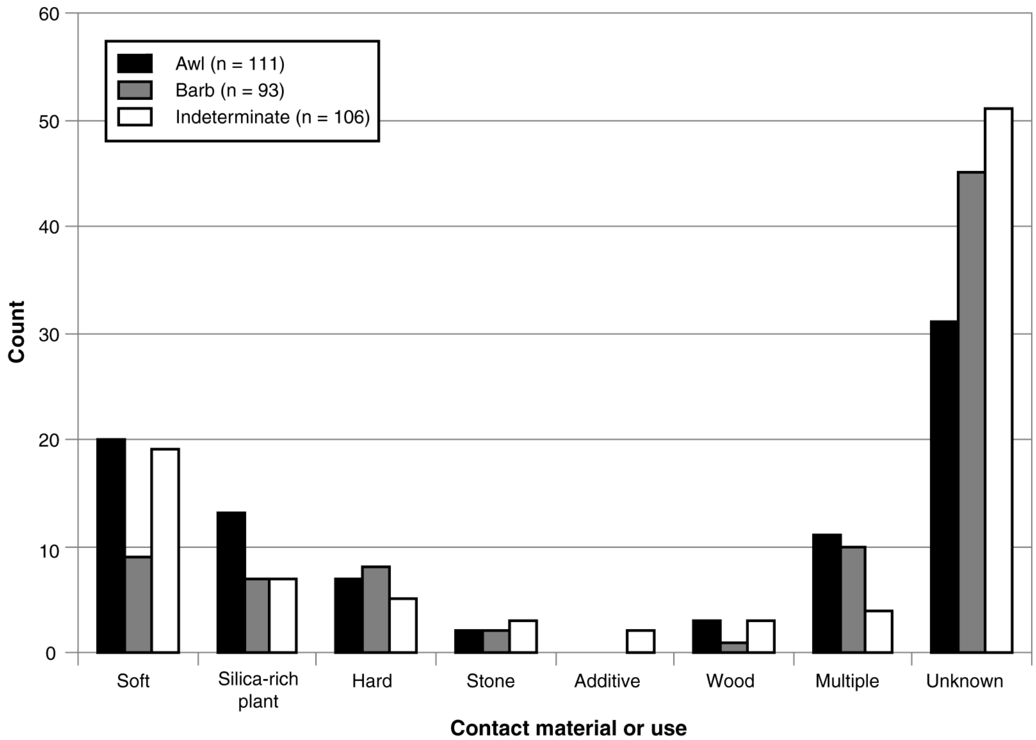

Figure 112. Microwear analysis of awls, barbs, and indeterminate pointed fragments.

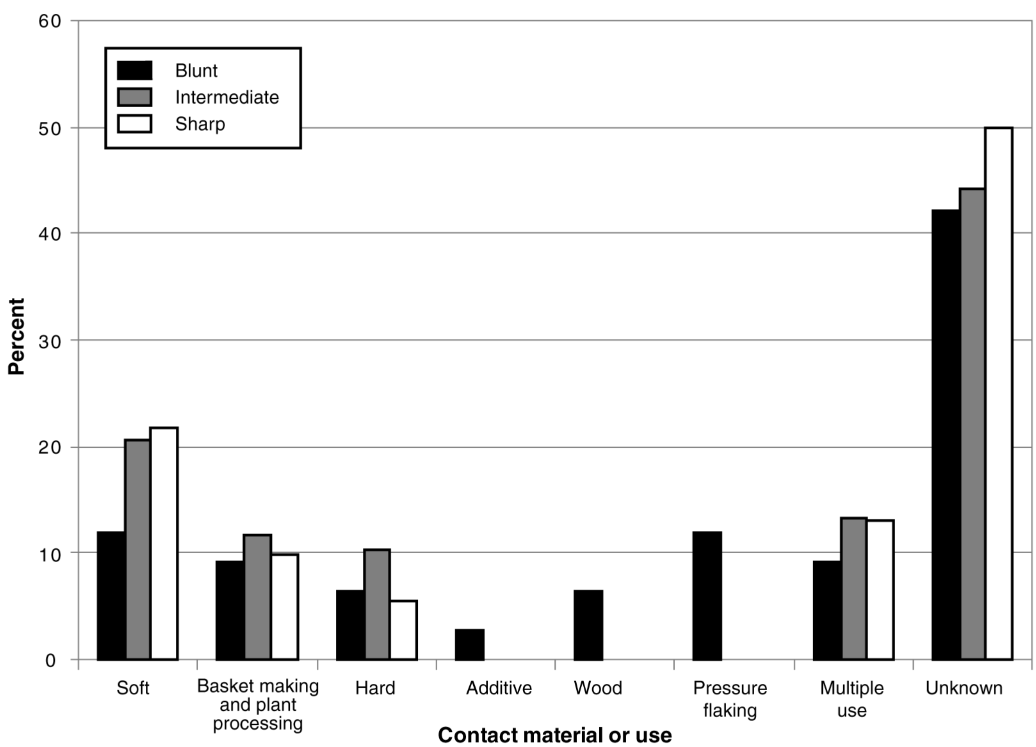

Figure 113. Tip shape and use of pointed tools.

Typology 1: Pointed and Spatulate Tools

Researchers have noted that bone artifacts are often problematic "because their forms vary widely, and distinctions between apparent types are subtle" (Hintzman and Abdo-Hintzman 2006:133). The uses of pointed tools in particular are difficult to interpret on the basis of morphology alone (DiGregorio 1985a:183). One solution to this problem is to avoid trying to distinguish the subtle types and to use larger groups. The term "awl" is used by many researchers as an overall category to describe pointed tools of unknown function (Dean 2005; James 1993), and this precedent is followed here. The second stage of analysis uses a much simpler typology and groups all pointed tools together as awls, or pointed tools. All objects initially identified as barbs, awls, punches, needles, pins, and so forth were considered tips, shafts, or handles of pointed tools. Use-wear analysis was conducted on pointed tools and tool fragments, and the uses suggested by the wear patterns were compared with the earlier form-based use assignments to investigate how well the form-based categories corresponded with different wear patterns. These tools are subdivided further in this study into a few categories, when it seemed appropriate, based on use wear, shape, or manufacturing technique, or to be consistent with previous research (described below).

Many researchers in the Southwest (Bullock 1992; Miles 1993; Olsen 1980; Sparling 1986), the Plains (Calabrese 1972; Chomko 1975; Sperry 1995; Wood 1967:89), and elsewhere use the Kidder (1932) Classification or a modified Kidder Classification. Gifford's Types A–E (Gifford 1940:161) correspond with Kidder's types A–E, and many California researchers follow Gifford's lead and use these types. The present study also employs this system to be consistent with earlier research.

This classification system classifies awls, and sometimes other tools made from long bones, into categories according to the degree of work on the handle end. This provides a shorthand way to communicate general morphology and basic manufacturing techniques. Using a widely known and accepted typology also facilitates comparisons between publications of collections in different regions. The Kidder typology is described in detail below in the discussion of awls and other pointed tools.

Tool Types Represented in the PVAHP Collection

The animal-bone and antler artifacts in the PVAHP collection represent a variety of activities (Table 101; see Appendix D.1). The most common identified artifacts were pointed objects such as awls and barbs, although indeterminate, miscellaneous bone made up the highest single category. Pointed tools include awls, barbs, flaking tools, needles, and punches. Fishing equipment includes pieces identified as portions of composite and single-component harpoons and fishhooks. Ornamental bone includes beads and pendants. Gaming pieces consist of modified fish vertebrae and artiodactyl phalanges. Less common artifacts include objects identified initially as pries and strigils, and one each of the following artifacts: wedge, mortar, scraper, whalebone container plug, flute, and drilled disk.

Theoretical Orientation

This study employs a simplified perspective from behavioral archaeology and life history to examine tool use in southern California. Behavioral archaeology addresses a wide range of topics and human activities, but this study has a much narrower focus on technology and concentrates primarily on artifact life history. A life history perspective involves examining an artifact throughout its life; raw-material procurement, manufacture, use, reuse, and discard and any technology are influenced by decisions made during all stages of its life history (Schiffer 1972).

Analysis of Artifact Life Histories

The life histories of even relatively simple technologies often involve multiple stages, and each of those stages may require particular tools. For example, a person who wishes to make a net must acquire the fiber, either in person or from another party. A person needing fiber must first find and cut fibrous plants using a sharp-edged tool, then strip the fibers from the leaves. Fiber stripping may require special preparation such as retting (soaking leaves or stems until the fibers loosen); if leaves are to be retted, some kind of container probably will be needed. Some varieties of yucca (*Yucca*) and agave (*Agave*), for example, are allowed to dry (Almstedt 1968) or are roasted before processing (Russell 1908:142), but others can be processed without pretreatment (Parsons and Parsons 1990). Red milkweed (*Asclepias rubra*) was boiled in a stone mortar and then pounded to loosen the fibers, which were twisted and used to make small carrying nets (Hudson and Blackburn 1986:156–157). Additional discussions of fiber processing can be found later in this chapter (see also Chapter 5, this volume), but the present discussion is intended only to provide a brief illustration of artifact life history.

The net maker may use additional tools to pound or strip the fibers from the leaf pulp, to comb or straighten them, and to twist fibers into cordage, although she (or he) may also use her fingers instead of tools. If fibers are to be colored, additional treatment and other tools are needed. Finally, she may choose to use a netting needle or a shuttle to help knot the cord, and a gauge or spacer to keep the size of the mesh loops evenly spaced. Bone tools can be brought into play in several steps of the procedure (discussed in more detail in following sections).

Table 101. Summary of All Artifact and Tool Types for All PVAHP Sites

Artifact Type	Tool Types Included	LAN-193	LAN-2768	LAN-54	LAN-62	LAN-211	Total	Percentage
Points, handles, wedges	awl, handle/haft, needle, punch, pin	3	1	1	101	36	142	12.3
Scrapers, spatulas	applicator/spatula, scraper, strigil	—	—	—	10	4	14	1.2
Musical	rattle, flute, whistle	3	1	—	43	4	51	4.4
Food preparation	mortar, container plug	—	—	—	2	—	2	0.2
Gaming piece	gaming piece	—	—	—	3	2	5	0.4
Decorative	vertebrate bead, tube or bead, drilled disk, drilled nondisk, pendant, pin	1	8	—	107	14	130	11.3
Ritual	area markers (including unmodified whale bones), wands	—	—	3	93	45	141	12.3
Manufacturing	flaking tool, preform/blank	2	1	—	16	12	31	2.7
Fishing related	barb, fishhook, harpoon composite, harpoon one piece, pry	8	8	2	81	12	111	9.7
Indeterminate	indeterminate, miscellaneous	18	26	10	320	153	527	45.8
Total		35	45	16	776	282	1,154	100.0
Percentage		3.0	3.9	1.4	67.5	24.5		

Note: Whale bones at LAN-54 (n = 3) may or may not be ritual related.

The net maker may choose to skip some stages by acquiring the fiber from another person or can circumvent the entire process and acquire a net already made. Raw materials and partially completed objects can pass through several hands before an object is completed. In the Historical period, some people produced plant fibers and sold coils to others to make mats and other products (Hudson and Blackburn 1987:156). The finished object may also be transferred from person to person, but some artifacts were restricted and could be accessed or used only by specialists. Deer-tibia whistles were restricted in this way (Hudson and Blackburn 1980), and their appearance may indicate the presence of these specialists.

Technology can be considered to be made up of utilitarian and nonutilitarian objects and to include both the physical objects and the knowledge concerning those objects (Schiffer 1992). Nonutilitarian technology can be divided into two more categories: tools with primarily social functions and those with mostly ideological functions (Schiffer 1992). The distinction between utilitarian and nonutilitarian artifacts is somewhat artificial, and these categories are flexible, because even everyday tools can have important symbolic functions (Schiffer 1992). As Schiffer (1992) noted, many objects are likely to have both utilitarian and social, or social and ritual, functions. Musical instruments such as flutes may be used for personal enjoyment or in a ritual context. An awl is a utilitarian object during some parts of its use life, but once it becomes a burial offering, it shifts to a more symbolic role (although it may be included as a burial offering to fulfill a utilitarian role in the afterlife). A good example of the way in which a single bone-tool type can shift back and forth through several functions is found in Colony Ross, California.

Wake (1999a) suggested that the Native Alaskan sea otter hunters brought to Colony Ross by the Russian-American Company persisted in making bone implements by means of metal tools, though the metal tools were at times employed using traditional native strategies. He suggests that although there are utilitarian reasons for bone objects to be used, they may also have helped to reinforce cultural identity. The tools certainly retained their utilitarian functions, but their symbolic functions were also very important.

Artifacts that we often identify as primarily decorative objects also can have important utilitarian functions. For example, even highly decorated clothing pins can provide an important function to keep one's clothing from falling off. Although hairpins may be decorative, and that decoration might show one's status in the community, they can also keep a person's hair out of his or her eyes and off the back of the neck. In this study, for the most part, nonutilitarian objects are classed together because of the difficulty of separating the socially symbolic and the ideologically symbolic functions from one another. In spite of the overlap, the distinctions are nonetheless a useful and convenient way to divide tools, bearing in mind that these divisions are made simply for heuristic purposes and are not a direct reflection of the reality in the minds of the users.

Manufacturing Methods

Methods for bone-artifact manufacturing include cutting, grinding, polishing, and breaking. These techniques leave traces on the bone that can be used to help understand some decisions made by the tool manufacturer. Manufacturing traces are large and often visible with the unaided eye, 10× hand lens, or low-power microscope. In the present study, manufacturing traces were observed with the unaided eye and with 10×, 20× and 30× hand lenses. Although manufacturing traces usually provide little information about tool use, they provide information on decisions made by toolmakers, and these decisions may reflect other factors such as the availability of cutting tools or the scarcity or abundance of artiodactyl bone (Griffitts 2006). Manufacturing methods for specific tool types have been extensively discussed elsewhere (Griffitts 2006; Hodge 1920; Newcomer 1974; Olsen 1979, 1980). This discussion provides a summary of commonly employed methods for several reasons. First, it is important to define techniques and how they can be recognized. Second, bone-technology studies are not standardized, and the same process is referred to with different words by different researchers; this practice produces a sometimes confusing proliferation of terminology.

Cutting

Traces of cutting can remain from initial bone butchering, and defleshing marks are often seen on tool cortical faces. Cut edges often retain traces of sawing: a form of cutting using a back-and-forth motion with a blade of stone or other material, producing a smooth cut surface with long striations in the direction of the cutting (Griffitts 2006:168). When evidence is sufficient, sawing, sometimes called grooving (LeMoine 1991), can be subdivided further into the groove-and-snap and the groove-and-splinter techniques.

Groove-and-Snap

One of the most common types of bone cutting is given several names by different researchers. It is most commonly called the groove-and-snap method (Knecht 1993:152; Olsen 1979, 1980) but is also known as groove-and-split (Cairns and Shelley 1998:169; Campana 1980), score-and-snap (Wake 1999a), or saw-and-snap (Margaris 2006). This technique is widely used to reduce bones to tool blanks. In this technique, a groove is cut only partway through a bone until it can be snapped by pressure or by a blow. The depth of the groove varies according to the type, size, and thickness of the bone and the desired end product.

Groove-and-Splinter

Long, splinter-shaped tools can be made using the groove-and-splinter technique, a method often employed in the manufacture of antler tools. In this method, the toolmaker cuts two grooves through the cortical surface of antler or bone, outlining a splinter. The splinter thus formed can then be levered out with wedges. Experimental production of antler tools using this technique has been described by Griffitts and Bonsall (2001:210). Tools made by this method usually have a characteristic wedge-shaped cross section (Margaris 2006), but this cross section can also be produced by grinding and by the more common groove-and-snap technique, and it is therefore difficult to identify this technique in the absence of manufacturing debris.

Whittling, Shaving, or Scraping

After bones are reduced to blanks by breaking, groove-and-snap, groove-and-splinter, or some other technique, they may be reduced further by several techniques. Whittling (Olsen 1980), shaving (Olsen 1979), and scraping (LeMoine 1991; Newcomer 1974) differ from sawing because the knife or flake edge is held across the bone and is slid along using the broad edge to cut, whereas sawing involves movements parallel to the long axis of the cutting tool. Bone tools that have been worked thus exhibit wide, shallow cut marks on the face of the tool, as well as the edges. Tools whittled, shaved, or scraped with stone tools often exhibit "chatter marks": wide striations crossed by waves running perpendicular to the direction of movement (Newcomer 1974:149; Olsen 1979:345).

Drilling

Objects can be drilled from one or both sides. Drilling with a tool that is wider at the top then at the tip leaves a cone-shaped hole; if the object is drilled from one side, there will be one cone on the side from which it was drilled; if it is drilled from both sides, the result will be biconical. A relatively straight-sided tool will produce less of a cone, or a straight-sided hole.

Grinding

Many bone artifacts are finished by grinding, a process that shapes and smooths surfaces. Grinding marks are usually large and are visible with the unaided eye or with low powers of magnification. They consist of sharp, parallel, V-shaped striations when fresh and gradually become more rounded and less visible as a tool is used.

Breaking

Tools made using percussion or breaking may be made from bones fortuitously broken during butchering or from bones that are flaked or otherwise incorporate breaking. Flaking and breaking are generally less common than cutting and grinding in many parts of North America but are present in low numbers of artifacts. Butchering and food processing may result in fortuitously shaped bones that can be modified into tools. Butchering a large mammal may include breaking open long bones to extract marrow, and the sharp-edged spiral fractures are potentially useful as cutting or scraping tools. Bone splinters produced by butchering can also provide blanks for awls and other objects. Some archaeological bone tools are produced by flaking, although unlike stone, bone is an isotropic material, and in addition, the breakage patterns change as bone dries (Johnson 1985).

Bones can be reduced by splitting with wedges (Knecht 1993:144–146) or with a stone chisel or punch (Ahler and Falk 2003) and by controlled breaking with hammerstone and anvil (Griffitts 2006:172–174). Impact marks on bison ribs on the Northern Plains were split by breaking and then cut and ground to shape, and this technique may have been employed in California as well. This technique was not identified in the present project, but some of the split rib tools illustrated by Hudson and Blackburn (1986:141, Figure 432-2) may have been shaped by controlled breaking.

Battering and hacking are also employed to shape bone artifacts. Hacking involves using an ax or other sharp object to chop material away (Olsen 1979:345), whereas battering reduces bone by impact with a heavy, blunt object.

Decoration

Ornaments and other bone and antler objects are sometimes decorated by several methods. Decoration can be an additive or a reductive process; objects are decorated by carving, or by incising and drilling into the surface. Punctation, a form of decoration composed of small inscribed dots, is found on many California bone ornaments (Gifford 1940). Both utilitarian and nonutilitarian objects may be inlaid, or materials such as pigment, feathers, or beads may be applied to the surface.

Intentional Polish

Polish forms on artifacts through several mechanisms. Artifact surfaces can become more reflective through use or through noncultural formation processes, but people also intentionally polish objects to make them more decorative or perhaps to make them smoother against the hand and the surface being worked. Olsen (1980:41) found that a bright polish similar to that found on archaeological materials could be produced on bone by alternating grinding on sandstone and rubbing with leather.

Use-Wear Analysis

Pointed tools and tools identified as pries were examined for microwear with an Olympus OHM-J metallurgical microscope with incident light using 50×, 100×, 200×, and 400× magnifications and dark-field capability at 50× and 100×. Our analysis also employed two "Peak" pocket microscopes of 25× and 50×, and a "Research" pocket microscope with variable magnifications of 20×, 40×, and 60×.

This research leans heavily on the methods developed and used by lithic researchers (Keeley 1980; Vaughan 1985), who have found that a combination of low- and high-power magnification is best suited for examining different sizes and kinds of traces (see Odell 2004 for discussion of advantages and disadvantages of low- and high-power microwear analysis of flaked stone tools). Previous bone-tool research (Griffitts 1993) showed that traces visible to the unaided eye or with a 10× hand lens are usually related to manufacture, rather than use. Therefore, this analysis focuses on traces visible at high magnifications to identify potential tool use and employs lower magnifications to identify manufacturing traces.

The wear on the archaeological tools was compared with that produced on a collection of experimentally replicated and ethnographic tools. At the time of this analysis, the comparative tool collection included 180 tools with experimentally produced wear and 7 ethnographic tools with known uses. The tools were used for a variety of tasks in contact with a range of materials and with different motions. Descriptions of the experimental procedures and details of tool use can be found elsewhere and need not be repeated here (Griffitts 1993, 1997, 2001, 2006; Griffitts and Bonsall 2001; Mobely-Tanaka and Griffitts 1997). The comparative collection was initially designed to help interpret tools in the southern Great Plains, but additional experiments were added when research expanded to sites on the Northern Plains, northern New Mexico, southern Arizona, highland Guatemala, and coastal Scotland. This collection should be suitable for the sites in this study because it includes many of the bone-tool uses that were observed ethnographically in the area or that have been interpreted by other researchers, including plant and fiber processing, basket making, hide working, shell fishing, woodworking, and stone-tool manufacture.

Site Summaries

All bone tools recovered from each site (LAN-193, LAN-2768, LAN-54, LAN-62, and LAN-211) were analyzed. These tools were recovered from a variety of contexts including control units, excavation units, stripping units, nonburial features, and burial features. Specific contexts from which these bone tools were recovered are presented in the appendixes dedicated to the individual sites. In some cases, however, when portions of sites or different types of excavation units produced markedly different collections and/or numbers of tools, specific contexts are discussed in the text and are presented in accompanying tables or figures.

LAN-193

Thirty-five fragments representing 33 animal-bone artifacts were recovered from LAN-193 (see Appendix D.2). Three of those fragments could be refitted to form a single pointed tool. Bone artifacts were recovered from CU 21, four activity areas (Features 7 and 8, FB 9, and Feature 100), and Feature 101 (human burial). The 35 artifacts include awls (n = 2), barbs (n = 8), flaking tools (n = 2), needle (n = 1), tubular bead (n = 1), whistles (n = 3) and indeterminate (n = 18). Whistles may indicate ritual behavior, as do the goods included in the burial. The artifacts from the burial included a tubular bead and an indeterminate tubular fragment.

Use-wear analyses were conducted on a sample of the tools from all the features. In most cases, the use-wear analysis produced indeterminate results with respect to determination, with confidence, of what materials the tools were used on and thus of their principal function. The detailed results of this analysis are listed in Appendix D.2 and are summarized in Figure 114. As in most of the PVAHP sites, utilitarian tools such as various types of pointed objects are more common than nonutilitarian ones such as beads, tubes, and musical instruments.

Twelve bone and antler artifacts and fragments were examined for microwear; all were pointed tools. Three tools had been in contact with some hard material, probably silica-rich plants, and one may be a multiple-use tool. Four tools exhibit wear, but the contact material is unknown. Two were used on fine-textured unknown materials, in primarily longitudinal motions, as are found in perforating tools, and in twisting motions.

Worked bones from this site, as determined from radiocarbon dating of associated materials, date to both the early Intermediate and the late Millingstone periods. Most of the artifacts were recovered from early Intermediate contexts of Feature 8 and FB 9 (both activity areas) (n = 25) (see Appendix D.2). There is no distinct trend in artifact types and temporal associations. As determined from the worked-bone collection, the activities associated with these tools included lithic-tool production and repair activities.

LAN-2768

All together, 44 animal-bone artifacts were recovered from LAN-2768, of which 31 were from Locus A and 13 were recovered from Locus B. All bone artifacts were recovered from midden contexts (control units and excavation units). Both utilitarian and nonutilitarian objects were recovered. Appendix D.3 provides detailed observations on each bone tool and worked-bone fragment recovered from this site. Figure 115 displays the relative frequencies of bone-tool classes across the site, in each of the two loci. This collection is perhaps less well preserved than others, given that in each locus the functions of most tools were unidentifiable because of their fragmentary state. With respect to identifiable tool types, pointed barbs and awls were the most common in both loci. However, what is interesting is that, although the collection

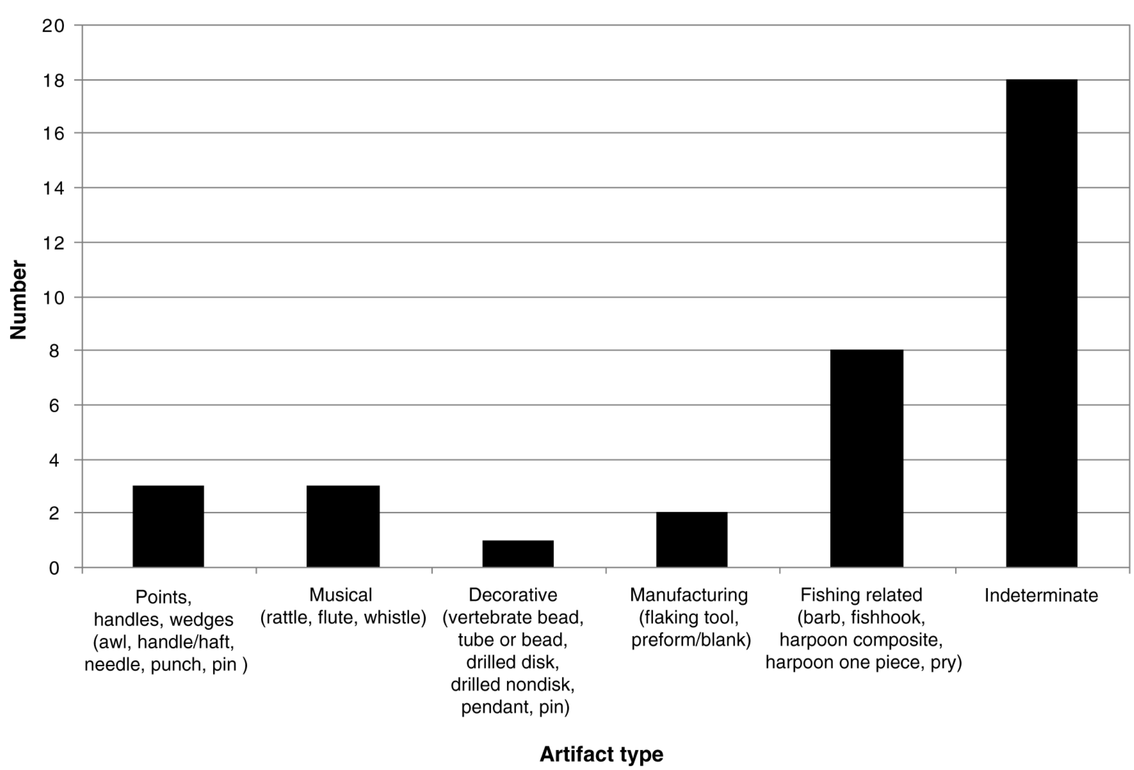

Figure 114. Classes of bone tools found at LAN-193.

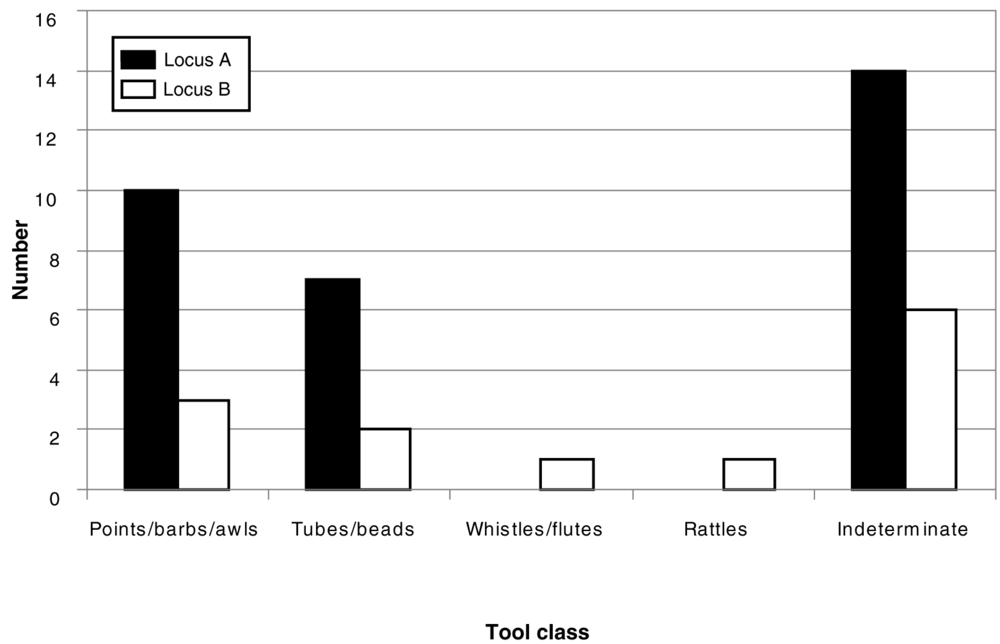

Figure 115. Classes of tools found at LAN-2768: Locus A vs. Locus B.

of tools from Locus B (n = 6) is approximately half the size of that from Locus A (n = 14), the former has a greater variety of tool types. The two areas of LAN-2768 produced very similar percentages of bone-tool classes; utilitarian tools were the most frequent class of tools recovered.

Locus A

Thirty-one animal-bone artifacts were recovered from four control units, five excavation units, and eight stripping units in Locus A (see Appendix D.3 for contexts). Eleven of these 31 artifacts were recovered from early Intermediate deposits. The 31 artifacts include awl (n = 1), barbs (n = 6), beads (n = 7), harpoon composite (n = 1), indeterminate (n = 8), and other (n = 8). The other category includes bone fragments that have alteration that cannot be determined. The harpoon artifact (recovered from EU 206) is a tip that suggests fishing or sea-mammal hunting (see Figure 105). No obvious pattern is observed in the distribution of these artifacts. Use-wear analysis was conducted on 9 bone tools from Locus A. This analysis provided clues to several activities, including possible woodworking, complex motions in silica-rich plants, and multiple uses (see Appendix D.3).

Locus B

Thirteen fragments were recovered from five control units in Locus B, located in the northeast part of the site. Use-wear analysis was not conducted on any of the artifacts from Locus B, and all interpretations are therefore based solely on artifact form. Unfortunately, it is unclear to which period these artifacts belong. The 13 artifact fragments include 1 barb, 1 bead, 1 flaking tool, 1 rattle, 1 other, and 8 indeterminate fragments (see Appendix D.3).

Summary

Artifacts with primarily symbolic functions include tubular beads and musical instruments. In all, eight beads were found: seven in Locus A and one in Locus B. Three were made from leporid metapodial shafts and a fourth from a medium-sized bird. The remainder was made from long bones of indeterminate mammals or of unknown taxa. None of the beads was decorated. None was found in association with any other; all were recovered in different control units and excavation units.

Musical instruments include a turtle or tortoise shell rattle and a possible flute. Both were recovered from Locus B. Four partially burned turtle or tortoise shell fragments refitted to form a portion of a rattle made from a perforated carapace with at least eight holes that were drilled from one side only. One tubular fragment, incised with five lines, was identified as a possible flute fragment. This fragment was recovered from an excavation unit (EU 516), which also yielded a tubular bead, an antler flaking tool, and an indeterminate fragment. Tubular beads and pointed tools were recovered from both loci; however, relatively more were recovered from Locus B.

Overall, the early Intermediate collection of worked bone from LAN-2768 consists of 1 awl, 7 barbs, 8 beads, 1 flaking tool, 1 harpoon fragment, 1 rattle, 17 indeterminate tools, and 9 pieces of other worked bone. All of them were recovered from midden contexts and generally suggest a range of activities including fishing, drilling, and nonutilitarian tasks. There is some spatial distinction in the distribution of the tools; beads were found in higher frequencies in Locus A, but musical instruments were recovered from Locus B only.

LAN-54

A small collection of 16 animal-bone artifacts was recovered at LAN-54; it includes 3 whale-bone fragments recovered from midden contexts (2 vertebrae fragments and 1 rib fragment). It is unclear whether these were grave markers; therefore, they will not be discussed further. Most of the worked bones were utilitarian; only 2 may have been used for nonutilitarian purposes. Eight of the 13 pieces were examined for microwear, including 2 pointed tool tips, 5 midsections, and 1 spatulate tool initially identified as a pry (see Appendix D.4). None of the tools examined microscopically bore traces of asphaltum. Artifacts were recovered from CU 11, EU 12, EU 13, six features including one rock cluster (Feature 1), and five artifact concentrations (Features 8, 12, 19, 33, and 34). Only a few objects were found in each feature. With the exception of EU 12 and EU 13, all other contexts have temporal associations to either the late Millingstone (Feature 1), the early Intermediate (CU 11, Features 8, 12, 19, and 34) or the modern/Historical period (Feature 33). A single bone-tool fragment (an indeterminate type) was recovered from late Millingstone deposits, and 9 are from early Intermediate period deposits. The modern/Historical period feature yielded a single worked-bone fragment that may be related to tube-bead manufacturing. As at LAN-193, utilitarian tools with pointed shapes are the most common identifiable class of tools (Figure 116). A notable difference between this and other sites, however, is the near lack of nonutilitarian tools. The collection from LAN-54 contains no musical instruments; instead, the only nonutilitarian items were a pair of tubes or beads.

Particularly interesting artifacts include a small, cylindrical, burned bone fragment from CU 11, which probably represents the medial part of a long awl tip, and an awl made from a deer-sized long-bone fragment with a thick, blunt end and a round cross section from EU 12. This object from EU 12 exhibits use wear similar to that produced on tools used experimentally to make baskets, as noted by experimental wicker-basket making and mat making, which produce longitudinal striations at the tip resulting from using the tip to open areas to insert new warps and to tuck under the ends of exhausted wefts (see Griffitts 2006). From Feature 1 (a rock cluster) was recovered a rodent or similar-sized long-bone-shaft fragment with no visible manufacturing marks but with a bright polish. Surprisingly, under high magnification this object has transverse striations that are visible as fine striations at 50× magnification and that encircle half of the shaft. This type of wear appears to reflect heavy or repeated contact with fine-textured material. This bone fragment could be a fragment of a bead that was polished by twisting it on plant matter (which acted as the abrasive material).

Another pair of interesting tools was recovered from Feature 12. One artifact was identified as the tip and midsection of a J-shaped fishhook (see Figure 103). This artifact was made from a fragment of an unidentified mammal bone.

Also found was a spatulate tool, possibly a pry as determined from morphology (see Figure 106), but it could

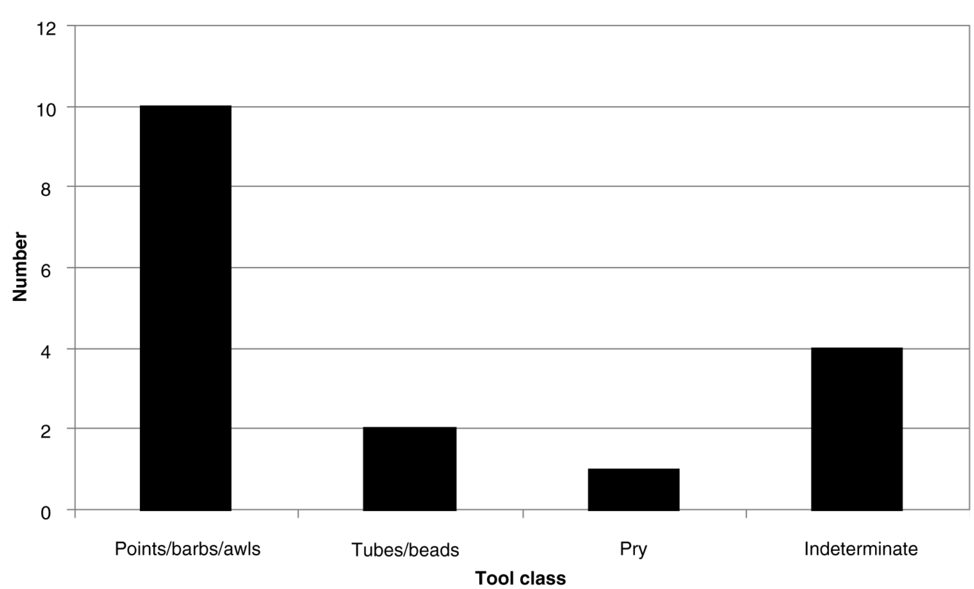

Figure 116. Classes of tools found at LAN-54.

also could be classified as a chisel or wedge with Gifford's (1940:171, 211) typology. This artifact was made from very dense, heavy bone that may be partially mineralized. It is heavily worked and consists mostly of thick cortical bone with only small traces of cancellous bone remaining. The edge is ground down to a broad, beveled, spatulate edge, and most manufacturing marks are now worn away. The outer surface is stained dark brown. Some caliche or other concretion clings to the tool; therefore, analysis could be conducted only on the exposed areas. Tools of this shape could be used for shell fishing, woodworking, or many other tasks such as hide scraping. In this case, however, use-wear analysis indicates that this particular tool is similar to bone chisels used for woodworking. The polish, pitting, and cracking seen at 100–400× are consistent with woodworking. Striations run longitudinally and diagonally, as do those found on experimental chisels. The wear does not indicate contact with shell, and it is not similar to wear on archaeological limpet scoops examined in an earlier study (Griffitts and Bonsall 2001).

One large flake was removed from the proximal end on the cancellous-bone side of this spatulate tool. There are also several smaller flake scars on the same end on the cortical side, but the exact number is unclear because caliche remains firmly deposited on this end. It would have been difficult to remove the caliche without damaging the underlying bone surface and thereby altering any wear. The flake scars could reflect thinning to facilitate hafting. Alternatively, these flake scars may be the product of use, if, for example, the person using the chisel hit the end with a rock or hammer while working. As this piece is partially mineralized and does not exhibit additive polish, the use-wear interpretations should be taken as tentative because experiments do not include work with mineralized or partially mineralized bone. Even so, this is unlikely to have been used to pry abalone from rocks, because the additive polish formed by contact with shell appears on both bone and stone implements (Griffitts and Bonsall 2001), and it would also be deposited on partially mineralized bone.

Summary and Chronology

This collection is small but nonetheless provides a few tantalizing glimpses of activities conducted at this small site. In particular, the large spatulate tool with woodworking wear indicates that people engaged in woodworking of reasonably substantial products. The wide tip of this tool would probably not be useful for working delicate objects beyond the roughing-out stage. Other activities suggested by use wear include basket making. LAN-54 has deposits dating to the late Millingstone, early Intermediate, and modern/Historical periods. The early Intermediate contexts yielded the higher frequencies of worked bone artifacts (9 of the 13 total). The 9 artifacts included the awl, the pry (spatulate), the J-shaped fishhook, and 6 indeterminate fragments.

LAN-62

LAN-62 had the largest animal-bone artifact collection and includes more than 700 bone artifacts and artifact fragments. Bone tools were recovered from control units, excavation units, stripping units, auger probes, nonburial features, and burial features. Most (n = 682; 97 percent) of the artifacts were recovered from Locus A/G. Only 22 bone tools were recovered from Locus C/D. Detailed observations on the bone tools from this site may be viewed in Appendixes D.5–D.9; a summary discussion is presented below.

Locus A/G

Animal-bone tools were recovered from control units, excavation units, stripping units, nonburial features, and burial features within LAN-62, Locus A/G. Appendix D.5 provides a detailed list of all the modified bones and observed characteristics. This discussion provides a summary of noteworthy trends and particularly interesting finds. The worked-bone collection from this locus is primarily from the excavation units. The excavation units yielded 477 pieces of worked bone; burial features yielded more bone tools (n = 103) than the nonburial features (n = 42) or the control units (n = 53). Seven pieces of worked bone were recovered from other contexts (mechanical trenching and stripping units). No doubt sample size is the reason why the collection from the excavation units contained a greater variety of broadly classified types of tools than did the other types of units. Table 102 summarizes the recovered classes of bone tools found in excavation and control units. As at other PVAHP sites, the most prevalent identifiable types of tools are utilitarian: either pointed implements such as barbs and awls or various types of blunted instruments such as pries or spatulates. Nonetheless, there is an interesting diversity to the collection. Part of this diversity is the array of ritual or decorative implements, which included rattles, wands, beads, whistles, and a gaming piece made from a vertebra of a great white shark (*Carcharodon carcharias*).

Looking at the classes of bone tools excavated from within the burial and nonburial features (Table 103), an interesting similarity emerges. Both types of features contained more nonutilitarian than utilitarian tools. Not entirely unexpectedly, that trend is most pronounced in the burial features, which contain more ritual/decorative than functional implements. More surprising, the nonburial features demonstrated a similar trend with more ritual/decorative tools than utilitarian tools. Features, whether burial or not, clearly were locations chosen for ritual acts at this site. As additional support for that assertion, it is worthwhile to note that of the 42 bone tools recovered from nonburial features, 9 were whistles/flutes. That is approximately half as many as were discovered in the burial features and significantly more than were found at any other PVAHP site (see Appendix D.6 for detailed information on musical instruments from all these sites).

Table 102. Classes of Tools found at LAN-62, Locus A/G, within Control and Excavation Units

Tool Class	CU (n)	EU (n)	Total	
			n	%
Points/barbs/awls	12	117	129	24.3
Needles/pins	1	18	19	3.6
Punch	1	13	14	2.6
Flakers	—	7	7	1.3
Tubes/beads	6	49	55	10.4
Pendants	2	13	15	2.8
Whistles	1	12	13	2.5
Flute	—	1	1	0.2
Rattles	—	4	4	0.8
Wands	—	6	6	1.1
Harpoon	—	1	1	0.2
Gaming pieces	1	1	2	0.4
Fishhook	1	9	10	1.9
Pries/spatulates	—	6	6	1.1
Handles/hafts	—	1	1	0.2
Grave/area markers	—	3	3	0.6
Drilled items	—	2	2	0.4
Preform/blank	1	5	6	1.1
Indeterminate and manufacturing debris	27	209	236	44.5
Total	53	477	530	100.0

Key: CU = control unit; EU = excavation unit.

Table 103. Bone-Tool Classes from Burial and Nonburial Features at LAN-62, Locus A/G

Tool Class	Burial		Nonburial	
	n	%	n	%
Points/barbs/awls	11	10.7	4	10.8
Needles/pins	8	7.8	—	0.0
Strigil	—	0.0	1	2.7
Flakers	1	1.0	1	2.7
Tubes/beads	3	2.9	1	2.7
Pendants	2		3	
Whistles	14	13.6	9	24.3
Wands	6	5.8	1	2.7
Gaming pieces	1	1.0	—	0.0
Handle	—	0.0	1	2.7
Wedge	—	0.0	1	2.7
Grave/area markers	2	1.9	1	2.7
Pries/spatulates	—	0.0	2	5.4
Indeterminate and manufacturing debris	55	53.4	17	45.9
Total	103	100.0	42	100.0

In fact, within burial features, the single-most-common specific tool type is whistles (n = 14). Generally, as mentioned above, the burial features contained a large number—but also a great variety—of nonutilitarian bone implements. These included beads, one ring-shaped gaming piece (Koerper et al. 2009), pendants, and a pair of whalebone grave or area markers. In addition, we identified several portions of wands and a number of pins (seven hairpins and one clothing pin).

Limited use-wear analysis was performed on 25 pointed tool fragments from LAN-62 burials. The artifacts could be examined only with a hand lens and a pocket microscope; therefore, only the largest traces of wear were visible. These results suggest that some tools were used before burial and were not made specifically as a burial offering. Detailed results of the use-wear analysis can be viewed in Appendix D.8. Seven tools display basket-making wear, and 8 others possibly show such traces. One of these 7 was recovered from an excavation unit within the burial area, making it Late or Mission period in date. Three others date to the late Millingstone deposits. Although only a relatively small number of bone tools were recovered from nonburial features, their spatial distribution is interesting. Only 11 (30 percent) of the artifacts were found in five features located within the burial area, whereas all other artifacts were found outside it.

Another intriguing facet of this site is the number of whale bones found here. There are far more such elements at LAN-62 than at any of the other PVAHP sites (see Appendix D.7). Purely from the standpoint of bone-tool analysis, however, their use and meaning are difficult to understand: few of them appeared to have been modified in any way, which suggests their use, specifically, as grave or area markers. However, many of the whale bones were poorly preserved, in a crumbling state. Sea-mammal bones tend to degrade much more than do those of other mammals. There is no evidence from archaeological or ethnohistoric sources that the Gabrielino were whale hunters. Therefore, most or all of the whale bones found at Ballona-area sites must come from beached carcasses, scavenged for their skeletons (and perhaps for food as well). It is, therefore, important to examine the bones' distribution with respect to the site's principal burial area. In fact, as Figure 117 shows, most of the whale bones were found in the burial area. In all, 113 pieces of whale bone were found at this site; 22 came from burial features and 35 from nonburial features. All but 1 from the remaining portion of the whalebone collection were found in excavation units either within or immediately surrounding the burial area. The 1 piece from outside the burial area came from a rock cluster found within a stripping unit. There is clearly a strong correlation between the placement of whale bones and the burials, such that, modified or not, the bones appear related to the act of burial and/or mourning. One caveat, however, is that whale bones (n = 43) were also recovered from LAN-211 (discussed below), a site that contains very few human burials.

Locus C/D

Twenty-two bone-tool artifacts were recovered from LAN-62, Locus C/D (for details, see Appendix D.9). Fewer than half of the bones (n = 9) were identifiable. The 22 artifacts include 2 awls, 2 barbs, 1 bead, 1 fishhook, 1 flaking tool, 1 mortar, 1 strigil, and 13 indeterminate fragments. The fish-vertebra bead and an indeterminate pointed fragment were recovered from animal burial Feature 201. Two tools were made from whale bones, 1 apparently a container plug (stopper) and the other possibly a mortar. The use-wear analysis performed on 8 of the tools suggests that all were used to process silica-rich plants, as detailed in Appendix D.9.

Summary and Chronology

The collection of animal-bone artifacts from LAN-62 is larger by far than those from other PVAHP sites. Therefore, we were able to extract information relating to a broad spectrum of ancient lifeways.

Many of the artifacts were found in undated contexts, but others were recovered from late Millingstone, early Intermediate, Late, and Late/Historical period contexts. Of these dated artifacts, most were assigned to the late Millingstone period; the next-largest number of artifacts was assigned to the Late/Historical period, and a few pieces were assigned to each of the other periods. Most of the wear found on pointed tools dating to the Millingstone period suggested contact with silica-rich plants or a similar hard material, but use-wear analysis of both dated and undated materials provides evidence of woodworking, plant processing, and leather working. Interestingly, woodworking seems relatively common. Wear suggesting woodworking was seen on only seven tools in the project area, and of these, four tools with wear suggesting woodworking were recovered at LAN-62. Four additional tools have wear similar to that produced by soft wood or hard leather. Unfortunately, all woodworking or possible woodworking tools were found in undated contexts.

Bone beads were common in the late Millingstone period, but more variety in nonutilitarian objects was found in the Late/Historical period; these objects included a pendant, a whistle, and a gaming piece. Bone beads and pendants were relatively common at the site as a whole, as were whistles, in particular deer-tibia whistles (described in greater detail below). Less frequent artifacts include a possible whalebone mortar or container and a shaped whale vertebra that might be a plug or lid for another object. Given that this is a mortuary site, there is very clear evidence of symbolic and ritual behavior in the bone-tool collection. Much of the crumbling whale bone probably relates to burial or mourning rituals. In addition, people were interred with both utilitarian and nonutilitarian artifacts, and at least some of the tools had signs of wear on them. In other words, people were not necessarily buried with new implements made especially for burial and (presumed) afterlife; rather, they were interred with some of the tools that they may have used in life.

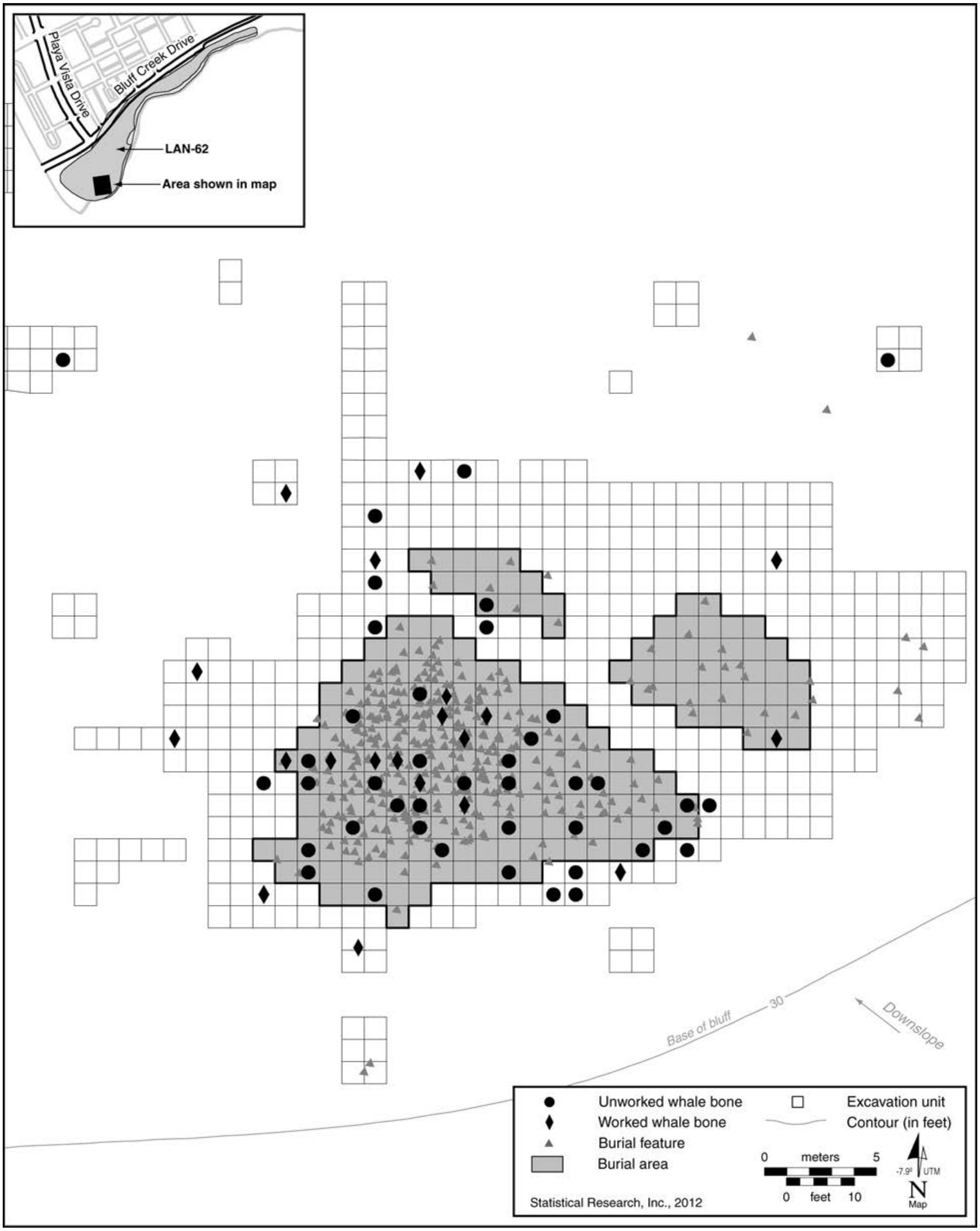

Figure 117. Distribution of whale bones at LAN-62.

LAN-211

In total, 282 animal-bone and antler artifacts, including 43 whale bones, were recovered from LAN-211. The exact types of tools recovered as well as their dates and individual characteristics are summarized in Appendix D.10. In general, more artifacts were recovered from contexts within FB 1 than outside it (Table 104). Only 11 percent of the collection was recovered from the control units, 30 percent from outside FB 1, and 59 percent from FB 1 contexts. Finally, individual features contributed relatively few specimens to the collection: features inside and features outside FB 1 each contributed less than 1 percent to the sample.

Of the 251 artifacts recovered from outside and inside FB 1, most are indeterminate tools (51 percent) and include unidentifiable fragments and manufacturing debris (see Table 104). Table 104 shows the range of identifiable artifacts recovered. The two contexts do not differ significantly in the diversity of artifacts represented or relative frequencies within each context (see Table 104; see Appendixes D.13 and D.14). In both contexts, only a few nonutilitarian artifacts were recovered (see Table 104). Among these are a rattle from EU 425 (Level 60) and a whistle from EU 480 (Level 64). Musical instruments were not recovered from FB 1. Utilitarian tools are generally more abundant within the feature block: for example, several flakers were discovered there. This finding underscores the supposition that LAN-211 was not primarily a ritual locale but instead one of (intensified) domestic activity.

One of the rare and intriguing recoveries from EU 123 (Level 61) inside FB 1 is a canid mandible covered by asphaltum and shell beads (Figure 118). The bone itself was not visibly modified: it was not polished, cut, drilled, or otherwise altered. However, it was intentionally covered with a piece of asphaltum, rounded to form a ball-like shape that entirely covered the posterior surface of the mandible. Embedded into the asphaltum are 38 shell beads (see Chapter 3, this volume). The mandible is not complete, and what is probably the underside of the object is actually the anterior aspect of the mandible. From the anterior perspective, one can see that only the distal portion of the mandible was selected to form the supporting structure for the asphaltum object. The proximal portion of the mandible, as well as at least the canines and first premolars, broke off or were purposely removed. Certainly, at the time of the object's manufacture, the remainder of the jaw was either already missing or purposely cut away; the tooth sockets not covered by the asphaltum may or may not have held teeth within them at that time.

Similar artifacts were recovered from Mikiw, a Historical period Chumash site a few kilometers north of Santa Barbara next to Dos Pueblos Canyon (Harrison 1965:100–101). One artifact, a pair of rodent incisors protruding from an asphalt-covered partial mandible (see Harrison 1965:138, Figure 58),

Table 104. Classes of Bone Tools Found at LAN-211 (Excavation Units and Features)

Tool Class	CUs		Outside Feature Block 1		Inside Feature Block 1	
	n	%	n	%	n	%
Points/barbs/awls	2	6.5	14	16.7	16	9.6
Needles/pins	—		2	2.4	2	1.2
Strigil	—		—		1	0.6
Punch	—		4	4.8	3	1.8
Flakers	—		2	2.4	7	4.2
Tubes/beads	3	9.7	2	2.4	2	1.2
Pendants	—		1	1.2	6	3.6
Whistles	2	6.5	1	1.2	—	
Rattle	—		1	1.2	—	
Wands	—		1	1.2	—	
Gaming piece	—		—		2	1.2
Harpoon, composite	—		—		2	1.2
Pries/spatulates	—		2	2.4	1	0.6
Handle	—		1	1.2	2	1.2
Grave/area markers	—		1	1.2	43	25.7
Preform or blank	—		1	1.2	2	1.2
Indeterminate	24	77.4	51	60.7	78	46.7
Total	31	100.0	84	100.0	167	100.0

Key: CU = control unit.

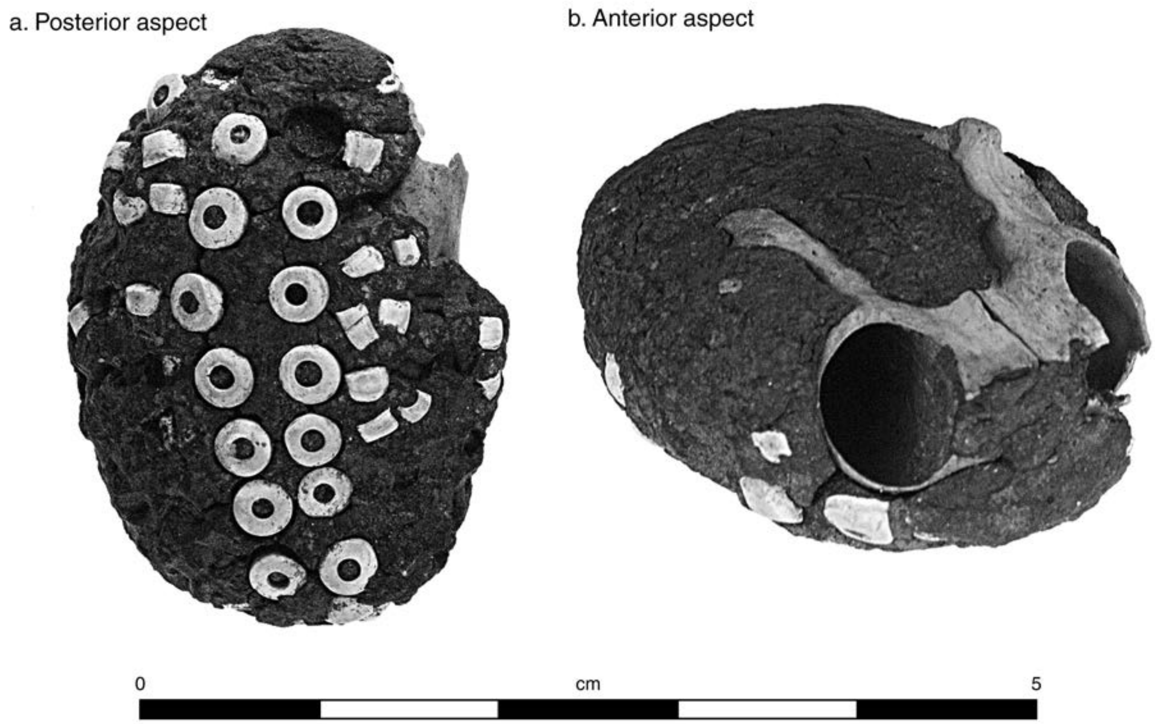

Figure 118. Canid mandible covered by asphaltum and shell beads from LAN-211, EU 123, Level 61, inside FB 1.

is similar in design but is formed from a rodent mandible instead of one from a canid. The second asphalt-covered bone at Mikiw (Harrison 1965) is a modified carnivoran mandible. The mandible was ground down on its "lower" (i.e., posterior) edge but, as was true for the specimen from LAN-211, no longer held any teeth. The posterior surface of this bone also showed traces of asphaltum, leading Harrison (1965:138) to suggest that the mandible was probably "mounted into another object but with the teeth protruding, and held in position with asphalt." By contrast, on the basis of string impressions on two tar knobs, one located on either side of the jaw, it seems that the asphaltum-covered rodent mandible was not mounted but rather suspended from a string, either "for decorative purposes, or suspended as a pendant" (Harrison 1965:138).

Harrison (1965:138) suggested that the rodent mandible could have had a decorative function. As to the choice of bones and animals to incorporate into the finished objects, the use of jaws in both examples (Mikiw and LAN-211) may simply be a choice related to decorative value, the dramatic impact of large, pointed teeth jutting out from a pendant or other object. Whether the choice of carnivoran mandibles is of significance is unclear. On the one hand, these animals' mandibles are larger and hold longer, more fearsome teeth. On the other hand, coyotes, at least, featured frequently in southern California Native American mythology (Kroeber 1925:626–627). Certainly, the similarities between the objects found at Mikiw and those at LAN-211 further demonstrate the cultural connections and economic transactions known between the Gabrielino and the Chumash (McCawley 1996:114, 144–147).

Most of the bone tools (150) were found within dated deposits. In all, 132 bone artifacts date to the Historical period; most of these were recovered within FB 1. In addition, 15 date to the Intermediate period, 1 to the Intermediate/late Intermediate period, 1 to the late Intermediate, and 1 to the Late/Historical period. Apart from frequencies, differences among the types of artifacts recovered from these temporal contexts are small.

As was true at LAN-62, a considerable amount of whale bone was found at this site. Forty-three pieces of bone, all unmodified, were recovered across the site. All but three of these bones were found within the confines of FB 1. However, of the three that were found outside that area, two came from levels underlying the feature block as defined. The remaining piece of whale bone came from a nonburial feature at the eastern edge of the feature block. Therefore, all the pieces of whale bone essentially came from the FB 1 area and are associated with whatever set of activities created this dense accumulation of material. This sample of whale bone is important, because it demonstrates that these skeletal elements were used for purposes other than marking graves.

Summary of Use-Wear Analysis

Use-wear analysis was conducted on 96 artifacts from LAN-211 (see Appendixes D.15–D.18); 95 of them came from nonfeature locations. The tools examined for use wear were from excavation units inside FB 1 and excavation units and features outside FB 1. Use-wear studies were not conducted on bone artifacts from the features of FB 1. Use wear indicates that 13 of the pointed tools from nonfeature contexts in FB 1 were used in contact with soft materials; an additional 4 have wear suggesting that they were multiple-use tools with both soft and hard contact materials. Use-wear analysis also demonstrates evidence for basket making and other activities involving silica-rich plants. A few other tools (n = 7) exhibit wear indicating contact with an indeterminate hard material. Interestingly, 2 punches from excavation units outside FB 1 appear worn in a fashion similar to that seen on implements used for experimental production of wicker baskets. This process produces overlapping striations grouped along the shaft from pressing weft fibers down between the warps; these striations are separated in space from longitudinal striations at the tip. One final type of wear in evidence within the collection is that apparently resulting from the bones' use in pressure flaking; this was observed on 5 flaking tools, 1 awl, 1 barb, and 1 handle/haft.

Summary of Worked Bone from PVAHP

In all, approximately 1,150 animal-bone artifacts were recovered from the Playa Vista sites (see Table 101). The sizes of the collections vary greatly. Only a few bone tools were recovered at LAN-54 (16 artifacts). The collections from LAN-193 and LAN-2768 were larger with 35 and 45 artifacts, respectively. Substantial collections were recovered from two sites: 282 fragments from LAN-211 and 776 from LAN-62. Researchers (Erlandson 1994:91; Wake 2001:183) have noted that California bone-artifact collections are often small and fragmentary. The collections from LAN-62 and LAN-211 are exceptions. These combined collections provide an opportunity to examine bone-tool use in far more detail than do smaller collections. As is true for many other bone-tool collections from California, the material is mostly fragmentary; few complete artifacts were recovered from any of the sites.

Indeterminate or miscellaneous tools constitute 46 percent of the total worked bone. The most common artifacts are pointed tools, tool midsections, and unidentified fragments that may have been portions of pointed tools, which constitute 12 percent of the collection (see Table 101). Decorative items are an equally common artifact type, also making up 12 percent of the total bone artifacts. Fishing-related artifacts such as hooks and harpoons or barbs are nearly as common as decorative and pointed objects, constituting about 10 percent of the bone-tool collection.

Ethnographic Artifact Use and Archaeological Materials

Researchers in southern California are fortunate in the wealth of available ethnographic and ethnohistoric data that focus on material culture. These data can be supplemented with observations from outside the immediate culture area. The following discussion provides a brief overview of bone-artifact use as relevant to the artifacts recovered in the PVAHP.

Musical Instruments: Whistles, Flutes, and Rattles

The Chumash distinguished among flutes, deer-tibia whistles, and whistles, using different terminology for the three types of wind instruments (Corbett 2004). Single-holed whistles were made from reeds or bone; flutes had multiple holes and could be made from elder (*Sambucus*) wood or bone.

Simple whistles are small tubes cut from reeds or long bones with only one hole or notch, which may be located in the center or near an end. These had both ceremonial and secular functions. Reed whistles were carried by seed gatherers to alert and warn bears (Corbett 2004:67). Bone whistles were used in the Blackbird Dance, in which the dancers imitated the song of the blackbird (Corbett 2004:67). Whistles made from black reeds were used in the Devil Dance, and whistles of bone were continuously played during the Barracuda dance (King 1981:117). Dancers wore two whistles suspended on a cord. Several small whistles could be tied to create a panpipe (Greenwood 1978:522, Figure 3; Hudson and Blackburn 1986:349–353). Unlike whistles, flutes were not used ceremonially. They were instead used for pleasure (Hudson and Blackburn 1986:363).

Musical instruments recovered in the PVAHP include simple whistles (see Figure 92), deer-tibia whistles (see Figures 93 and 94), a flute (see Figure 95), and rattle fragments (see Figure 97). Wind instruments include 25 flute or whistle fragments made from mammal and bird long bones and 28 deer-tibia whistles (see Appendix D.6). A flute with two holes from LAN-62 was made from a bird ulna (see Figure 95). One whistle from LAN-62 had asphaltum traces suggesting that it may have been attached to a second whistle, and a double flute, still with plant wrappings and the bones stuck into asphaltum, was found at this same site, in a nonburial feature (see Figure 96). The find is very similar to a double flute found in a burial on Santa Catalina (Abbott and Putnam 1879:237–238).

Ethnohistoric Use of Deer-Tibia Whistles

Spanish explorers and Franciscan priests observed that deer-tibia whistles were used in Chumash *'antap* ceremonies (Corbett 2004; Hudson and Blackburn 1986:354–355). The whistles were valuable objects that were strongly associated with ritual. The whistles "played a central role in the organization of ceremonies" (King 1981:117). In the Historical period, deer-tibia whistles were played during dances by two old men who stayed out of view within the *siliik,* a sacred enclosure made from poles and mat screens (Corbett 2004:68). During the ceremony, the whistles were put into a basket of water between the two men when not in use (Hudson and Blackburn 1986:354–362).

These artifacts were made by removing one end of a deer tibia, drilling near the cut end, and cutting a larger, ovoid hole near the other end to remove the marrow. The larger opening was closed with asphaltum and covered with a piece of shell inlay. Two of the whistles from the PVAHP retained the shell inlay. Corbett (2004:69) found that whistle length and width increased through time and that the average deer-tibia whistle from the Late period was more than 18 cm long. Corbett suggested that the increasing size produced a louder sound that would travel farther and that the number of participants in ceremonies increased over time. The overall object shape and manufacturing techniques changed at the same time. Earlier whistles were made by removing the proximal end of the tibia, whereas later toolmakers removed the distal end. The two types of whistles overlap between about A.D. 900 and 1150 (Corbett 2004:70).

Green (1999) wrote her dissertation on ritual paraphernalia found in southern California burials and discussed the presence of deer-tibia and other types of whistles. She concluded that whistles, as well as other ritual artifacts, are linked to adult males from high-status families. This conclusion is based on the idea that only wealthy, high-status families could afford the costs of apprenticing their children to become *'antap* (Green 1999:96). Further, she argued that ritual items were deposited with their deceased owners—in other words, that at least these people had personal possessions and took these things with them at death. The archaeological evidence mustered to support these conclusions is, however, thin. The dissertation features only two deer-tibia whistles and another made from a bird bone. All three whistles were discovered in a burial of an adult of indeterminate sex. Green, however, assumed that the burials were males, because of the ritual goods placed with the bodies. Although Green's conclusions were based on and generally in agreement with ethnographic evidence compiled by Harrington (1980) and Hudson and Blackburn (1986), her sample size was much too small and her argument is tautological.

Although whistles were made most commonly from deer tibiae, occasionally other bones were used. Mountain lion–femur whistles were recovered from an Obispeño Chumash site (SLO-2, Diablo Canyon) (Greenwood 1978:523, Figure 4). Like the deer tibiae, these objects were inlaid with abalone shell. Harrington, too, noted that a Gabrielino consultant reported a mountain lion–tibia whistle (Hudson and Blackburn 1986:355), and that human femora may have occasionally been used as well (Hudson and Blackburn 1986:357). Whistles and flutes were reported in burials excavated at Malibu, as were turtle-shell rattles (Gamble et al. 2001), and two deer-tibia whistles recovered from burials at the Medea Creek cemetery were suggested to indicate a high-status individual (Gamble 2008:212). Status can be measured in several ways. No clear patterning was seen in the frequency of glass beads and the presence of deer-tibia whistles at LAN-62. Glass beads were recovered in eight burials that also contained deer-tibia whistles, but none contained large quantities (see Chapter 6, this volume). One glass bead was found in each of Burials 120, 361, and 453. Burial 10 contained 272 beads. The remaining three burials (Burials 59, 33, and 76), contained 26, 75, and 91 beads, respectively. No whistles were recovered in the seven burials containing more than 1,000 beads. If bone beads are a measure of social standing, then the status accorded individuals entitled to tibia whistles does not necessarily correspond with that of those buried with very large numbers of bone beads. People can attain high status through economic, ritual, hereditary, gender, age, or other factors, and these may have different archaeological signatures.

Archaeological Materials

The deer-tibia whistles from the PVAHP were all recovered from LAN-62. Twenty-three were found; 13 were found in mortuary contexts. Two retained abalone-shell inlays. Eight whistles were identified as Gifford type FF 1a (the distal end removed; see Figure 93), and seven were Gifford type FF 1c (both ends removed; see Figure 94) (see Appendix D.1 for definitions of Gifford types). The seven whistles identified as Gifford type FF 1c may be associated with a late date in the Mission period.

The longest complete whistles recovered from Playa Vista sites measured 24–25 cm in length. This is notably greater than the average length of 18 cm discussed by Corbett (2004) and could very well place the deer-tibia whistles in the Late period (1000 B.P. to European contact in A.D. 1542). One pair of deer-tibia whistles (Gifford type FF lc) was recovered from Feature 537, a human burial. The distal portion of both tibiae retained traces of asphaltum and a plant material wrap, probably rush (*Juncus*). One of the pair retained an asphaltum plug and abalone-shell inlay.

Ethnohistoric Use of Rattles

Rattles were made from turtle or tortoise shells (Gifford 1940) and from other materials including deer hooves, bear claws, and, in the Historical period, cowhide (Hudson and Blackburn 1986). Pebbles were placed within the turtle shells, and the head and tail holes were plugged with asphaltum. The shells were sometimes threaded on a wood or bone handle (Hudson and Blackburn 1986:329–332). Rattles were sometimes decorated with shell beads attached with asphaltum (Gifford 1940:176).

Archaeological Materials

Nine rattle or possible rattle fragments were recovered from three sites: LAN-62, LAN-211 (see Figure 97), and LAN-2768. Most were identified as turtle or tortoise carapace, but one from LAN-62 was made from the cranium of a large indeterminate mammal. The tortoise-shell rattle fragments were all drilled from the outside of the shell inward, as were the examples described by Gifford (1940:176). One rattle fragment from LAN-211 exhibited ocher staining.

Ethnohistoric Use of Strigils/Scratchers

Strigils are bone, wood, or horn objects used to scrape away sweat; they are long, flat objects, often curved, with one sharp and one blunt end (Hudson and Blackburn 1986:107–109). They were used in the sweathouse, and are therefore associated with ritual activities as well as with personal hygiene. Font recorded in 1776 that people carried sticks about with them to remove their sweat (Hudson and Blackburn 1986:107). Strigils were passed between people in the sweathouse, but not everyone used them.

Body scratchers are of a similar shape and were also made from bone, as well as shell and wood (Hudson and Blackburn 1986:110). Women did not scratch their bodies with their fingernails during menstruation and pregnancy because their fingernails were thought to be poisonous during these times. For example, if a woman scratched her head with her fingernails during menstruation, her hair might fall out. Therefore, they used tools (Hudson and Blackburn 1986:110–114). Some tools served both functions, as head scratchers and as body scrapers. Shell scratchers were sometimes worn as pendants and in the hair (Hudson and Blackburn 1986:110). Objects of similar shapes have been called beaming tools in other regions, and it is possible that some rib midsections could be used as hide-processing tools instead.

Archaeological Materials

Four possible strigils were identified in the PVAHP (see Figure 98). All four were made from large mammal ribs: three were found at LAN-62 (two from nonfeature contexts and one from Feature 603, a rock cluster) and one in Feature 28, a hearth at LAN-211. All are polished; one is decorated with incised crosshatching. Use-wear analysis was not conducted on any of the strigil fragments.

Ethnohistoric Use of Wands

Wands are ceremonial objects, carried in processions and used in ritual exchanges (Hudson and Blackburn 1980). Various forms were made and used, some from wood, others from bone, and some may have been made from stone. Hudson and Blackburn (1980:256) suggested that some may have had specific functions (Hudson and Blackburn 1980:256). Waterman (2004) noted that near the end of the adolescence ceremony, Diegueño boys were given flat, painted sticks that they were to carry in dances. It is unclear whether these sticks were made from wood or bone, but they were pointed at one end and sometimes inlaid with shell. He noted, too, that older dancers carried similar sticks, but that those carried by the older men had flint attached to the ends. In addition to ritual exchange, some wands were carried in funeral processions or were attached to the tops of grave poles. Inlaid wands are short, flat objects tapering from a spatulate end to a point, made from wood or bone with shell or quartz inlay near the wide end. Some may have been made from stone (Hudson and Blackburn 1980).

Archaeological Materials

Fourteen wand fragments made of bone were recovered, one from LAN-211 and the remainder from LAN-62 (see Figure 99). Four of the fragments could be reassembled into a single artifact. Use-wear analysis was conducted on one of the wands, a tip fragment from LAN-211. The wear on this artifact suggested that it was used in diagonal or transverse motions, probably on a soft material. Such use wear could have been the result of wrapping and moving the object within the soft material during transport or storage.

Ethnohistoric Use of Beads, Tubes, Pendants, and Gaming Pieces

Culin (1907) recorded that people in many parts of North America used bone tubes as gaming pieces, but tubes are also used decoratively as beads for necklaces and bracelets

(Wheeler 1980) and tinklers (Olsen 1980). In the Southwest, they also may have been used as wrist guards (Hodge 1920), hair and clothing ornaments (Di Peso 1956; Rohn 1971), and turkey calls (Morris 1928). Bone or reed tubes were added to noose snares to serve as a slip loop. Several examples of noose snares with reed or bone slip loops have been recovered in southwestern or Great Basin sites (Janetski 1979:309–310).

Others may have been used in medical procedures. Closer to the project area, sucking tubes were made from wood, bone, or stone (Hudson and Blackburn 1986:285–288). Some were incised or inlaid. These were "used to remove a foreign object from the body of a patient by means of suction or to create a counter-irritant" (Hudson and Blackburn 1986:285). Bird bone, elder wood, or cane tubes were attached to animal bladders and were used in the Historical period as enema syringes, but this technology was probably introduced at some point during the Historical period (Hudson and Blackburn 1986:297).

Recovered Beads, Tubes, and Gaming Pieces

In total, 127 such pieces of worked bone recovered from PVAHP were categorized as beads/tubes (n = 121) and gaming pieces (n = 6) (see Appendix D.20). Of these, nearly 100 beads, tubes, and miscellaneous tubular bone fragments may be the by-product of bead manufacturing. The 121 beads/tubes and pendants were cut from bones of rodents (15.7 percent), birds (15 percent), mammals (10 percent) and fishes (8.3 percent) (note that taxa could not be identified in 38 percent of the collection). Tubular beads at these sites were cut from bird or small-mammal long bones; other beads were made from fish vertebrae. Nine drilled fish vertebrae from LAN-62 and one fish vertebra from LAN-211 could have been strung as beads or used as gaming pieces. A drilled disk from LAN-62 could be a bead, pendant, or gaming piece. A pendant from LAN-211 made from a drilled canine tooth was discussed in an earlier report (Gibson et al. 2003). An owl-talon pendant or amulet was identified from LAN-211 and a red-tailed hawk (*Buteo jamaicensis*) talon was found at LAN-62 (Koerper and Fulton n.d.).

Gaming Pieces

Many discussions of Native American games and gaming pieces rely heavily on Culin's (1907) classic study. The present study is no exception. Culin's extensive study provided details of the material culture and described how many games were played. In southern California, these discussions can be supplemented with material collected by Gifford (1940) and others (Hudson and Blackburn 1986).

Gaming pieces were recovered from LAN-211 and LAN-62 (see Appendix D.20). All were made from either fish vertebrae or artiodactyl foot bones. As noted above, tubular bone fragments were used as gaming pieces on occasion, and some of the bird or mammal long-bone tubes may have served in this function rather than as ornaments. No bone dice were identified. Four fish vertebrae were identified as gaming pieces, all from LAN-62. Of these, one was made from the centrum of a bony fish; the rest were from made from shark, skate, or ray vertebrae. All are interpreted as components of the ring-and-pin game which was found in many forms throughout North America (Culin 1907). Koerper et al. (2009) discussed two of the fish-vertebra gaming pieces and their possible symbolism and reason for placement within a grave.

Two artiodactyl toe bones (first phalanges) displayed evidence of human modification other than marks related to butchery/meat processing and taphonomic processes. The two bones came from different sites: LAN-62 and LAN-2768. One, identified as a mule deer (*Odocoileus hemionus*) bone, was found at LAN-62 (see Chapter 11). The specimen was recovered from midden in the burial area (CU 304, Level 56). The mule deer phalanx from LAN-62 displays marks characteristic of carnivore chewing: namely, pits and scratches in addition to a large, ragged hole that pierces the medial shaft's surface. Human modification is also clear: a somewhat ragged hole approximately 4.5 mm in diameter is visible within the groove of the proximal articulation.

Another modified first phalanx, from a pronghorn (*Antilocapra americana*), was found at LAN-2768, in CU 19, Level 5, dated to the Intermediate period (see Chapter 11). This phalanx also had a hole bored into it. Pronghorn no longer inhabit the Los Angeles area (although they still did in the early twentieth century [Jameson and Peeters 1998:218–220]). The modifications visible on this specimen are superimposed on one another, at the ventral surface near the proximal end of the bone. The first marks are butchering scars. The cut marks on the ventral surface were nearly obliterated by the drilled hole. Culin (1907:556) illustrated the use of deer phalanges in ring-and-pin games, on the basis of a specimen collected from living Native Americans in South Dakota. Pieces for the game were prepared by taking a number of phalanges and drilling holes into their proximal and distal ends. After preparation, the phalanges were strung together with loops of beads at one end and a long needle at the other. Other archaeological examples of such gaming pieces have holes bored into both their proximal and their distal ends (Koerper and Fulton n.d.; Lev-Tov 2002), as Culin's (1907) illustration also does. Each of the PVAHP specimens has only one hole drilled into it near or in the proximal end. With only one hole, it is unclear how a string could have been inserted into and fastened to the bone; thus, a gaming piece may not be a valid interpretation of these objects. The bones could have been modified to function as rattles or strung talismans (Hudson and Blackburn 1980), though, again, how they could effectively have been strung with only one hole remains a problem.

Ethnohistoric Use of Whale-Vertebra Dishes and Mortars

Whale vertebrae were partially hollowed and shaped into containers, variously interpreted as dishes or mortars. Some were lined with asphaltum; some have circular lids (Hudson and Blackburn 1983). Hudson and Blackburn (1983) suggested that vertebrae as a raw material would not be strong enough for use as a mortar and therefore proposed that these objects could be dishes and serving ware. Gifford (1940:178) described whale vertebrae as mortars, dishes, and covered dishes but did not suggest what might have been ground within the mortar.

Archaeological Materials

One whale-vertebra container was recovered at LAN-62 (EU 799). The centrum was shaped into a dish, mortar, or other container and was finished by grinding. No asphaltum was present. Another vertebra centrum of a small whale was recovered from the same site. This object was ground around the edges and may have been used as a plug for a container.

Ethnographic and Ethnohistoric Use of Whale Bones as Area Markers and House Supports

The Chumash used various whale elements as markers and in constructing graves and even houses. Whale jaws were used to mark areas for ritual activities (Hudson and Blackburn 1980:67). Burials were marked with wooden poles, painted planks, baskets, stones, and whale scapulae (Hudson and Blackburn 1980:74–75), and whale bones were used to line and to mark some graves among the Eastern Coastal Chumash. Whale ribs were widely used as structural supports for houses on the Channel Islands, where timber was difficult to obtain.

Crespí noted whale bones driven into the ground in graveyards (Gamble et al. 2001:190). In 1792, Longinos Martínez wrote that "they also lay the rib of a whale, bent like a bow" lengthwise over the grave (Grant 1978:511). Crosscut sections of whale ribs and scapulae lined some graves (Grant 1978:511).

Accounts of the last remaining person on San Nicolas Island present ethnographic accounts that whale bone was used as supports for huts covered with brush (Heizer and Elsasser 1963). This is important evidence that demonstrates that the tremendous bones of whales had uses beyond rituals; therefore, we must be cautious in our interpretations of the bones' meaning when they are found at these sites.

Archaeological Materials

Eight possible whalebone markers were recovered from feature and nonfeature contexts at two sites, although a much larger number of whale bones, all or almost all probably grave markers, was found, most from LAN-62 and LAN-211, in addition to a few from LAN-54 (see Appendix D.7). It is unclear whether the whale bones from LAN-211 and LAN-54 are markers because they are fragmentary. An unburned, asphaltum-stained whale mandible was recovered in burial Feature 268 at LAN-62, but no other worked bone was found in this burial. As noted above, mandibles were among the elements used as area markers. One whalebone marker recovered in burial Feature 280 at LAN-62 was unidentifiable to element. Another whalebone fragment from the same site, in Feature 458, was coated with asphaltum and burned. This object was identified as a possible whalebone area marker. Six other bone artifacts were recovered in the same feature.

In parallel to these finds at LAN-62, we note that two nonburial but evidently ritual-related features (Features 11 and 58) produced whale/large-sea-mammal bones at LAN-63, a site located on the Westchester Bluffs above this and other PVAHP sites (Douglass et al. 2005:7.4–7.5, 7.10). Many very large mammal bones were found at ORA-262 in a cremation feature (Hildebrandt and Carpenter 2007:268). Rather than whale bones, however, most of these were identified as partially fossilized bones of mammoths (*Mammuthus*) and/or giant ground sloths. These finds lend further evidence to support our hypothesis that the whale bones found at Ballona-area sites did not originate from whaling but were collected for ritual or other purposes from beached whales or even fossils (the Westchester Bluffs just next to and above the Ballona Lagoon contain fossil-bearing deposits).

Pointed Tools

The most common artifact type by far was pointed tools, tool fragments, and possible pointed tool fragments. Pointed tools are among the most common artifacts recovered in the Southwest (Cairns and Shelley 1998), the Plains (Wood 1967), and California (Wake 2001:186). High-power optical microwear analysis was conducted on a sample of bone artifacts, including many of the pointed tools (see Figure 112). The analysis focused primarily on pointed tools because other studies show that tools of that shape often have many uses, and one of the objectives of the use-wear analysis was to investigate the correspondence between form and function (see Figure 113). A few pries were also examined. The wear on archaeological tools was compared to that found on a collection of replicated tools used for various tasks and on a few ethnographic tools. Details of microscopy are described above and in appendixes presenting use-wear characteristics of PVAHP bone tools.

The following discussion groups tool uses into several large categories: leather/hide working and other contact with soft

Table 105. Use Wear on Needles, Pins, Punches, and Indeterminate Handles

General Contact Material or Activity (Microwear)	Detailed Tool Use	Typology 1 Designation				Total	
		Needle (n)	Pin (n)	Punch (n)	Handle (n)	(n)	(%)
Soft materials	leather/hide-working awl	1	—	1	—	2	3.6
	soft material, exact use unknown	—	1	—	—	1	1.8
	complex motions in soft material	—	—	—	—	—	0.0
Silica-rich plant	basketry awl	—	1	3	—	4	7.3
	plant-fiber stripping	—	—	1	—	1	1.8
	plant scraper	—	—	1	—	1	1.8
	twisting in plant	—	—	1	—	1	1.8
Indeterminate hard material	twisting in hard material	1	—	1	—	2	3.6
Additive	longitudinal motions in additive	—	1	—	—	1	1.8
Stone working	pressure flaker	—	2	1	1	3	5.5
Multiple use	multiple use with uses unknown	1	1	2	—	4	7.3
	multiple use, soft and hard materials	—	—	1	—	1	1.8
Unknown	twisting in unknown material	2	1	—	—	3	5.5
	complex motions in unknown material	1	1	1	—	3	5.5
	unknown use in transverse motions	—	—	1	—	1	1.8
	unknown use in longitudinal motions	—	2	1	1	3	5.5
	unknown	—	1	—	1	1	1.8
	microwear analysis not conducted	—	17	6	3	23	41.8
Total		6	28	21	6	55	100.0

materials, silica-rich plant processing and basket making, woodworking, and pressure flaking. The overall pointed-tool uses are summarized in detail in Table 105.

Experimentally Produced Use-Wear Patterns

Tool use was interpreted through differences in direction, distribution, size, and intensity of striations; the presence of pitting, rounding or flattening, and cracking; and the appearance of polish. Most tools were examined using 50×, 100×, and 200×, whereas 400× was employed for a few tools. The scale of magnification is important. Certain traces, such as pitting and cracking, are usually visible only at levels of 200–400×, whereas others are visible at lower magnifications, such as 50–100×. In the following tables, when scale of magnification is included, the magnifications reported are the lowest powers at which diagnostic traces appeared.

The following discussion includes an overview of what were considered the types of activities that are most relevant to the PVAHP sites. Far greater detail can be found for these and other activities in other publications (Griffitts 1993, 1999, 2001, 2006; Griffitts and Bonsall 2001; Mobely-Tanaka and Griffitts 1997).

It is possible to make a few basic generalizations about the patterns formed on bone-tool surfaces, materials contacted by tools, and the motions used in the activities. The orientation of striations indicates the direction in which tools were used; the size, distribution, and intensity provide clues to the texture of the material contacted or the amount of grit present. Surface rounding and flattening indicate whether tools contacted hard or soft materials. LeMoine (1991) created an extensive microwear collection for use with collections from the Arctic area; she found that when bone tools are used to work wet materials, particular identifiable patterns emerged.

Use-Wear Patterns Produced by Contact with Soft Materials

Experiments involving soft materials include hide processing, skinning a goat, leather work, weaving homespun and commercially produced cotton on backstrap and inkle looms (both tabletop and floor varieties), crocheting cotton, quill work on leather, and rubbing against rawhide. The surfaces of tools that contacted soft materials become rounded as the wear follows the contours of the bone surface, extending into the lower areas of the bone. LeMoine (1991) referred to this kind of polish as invasive. Pitting is often present on tools used to work leather or hide, but not on tools used to weave or crochet cotton. The wear on tools used to work wet hides is often more widespread than that found on tools that contacted dry hide or leather. Tools used to weave or crochet cotton have rounded surfaces and have fine surface cracking visible at 200–400×, whereas leather-working and hide-processing tools exhibit this cracking much less frequently.

Use-Wear Patterns Produced by Contact with Silica-Rich Plants

Experiments involving contact with silica-rich plants include wicker and coiled basket making; corn (*Zea mays*) husking and shelling; yucca, agave, and beargrass (*Nolina*) processing; and willow-bark (*Salix*) stripping. Silica-rich-plant processing produces a wear pattern different from that of contact with soft materials, but both may have macroscopically visible polish. The bone surface appears flattened, rather than rounded, and the high points of the contours may become shaved off. Surface cracking is often visible at 400× and may be seen at 200×. The degree of polish varies with the kind of plant worked, and the amount of moisture present can affect the appearance of the use wear.

Awls used for basket making develop slightly different wear patterns depending on whether they are used for coiled or wicker baskets. Wear forms on different areas of an awl depending on the task. Southwestern basket makers use awl tips to split yucca leaves (Bartlett 1949) and to strip the black covering from devil's claws (*Proboscidea)* (Newman 1974), both activities that produce wear on both the tip and the tool shaft of experimental tools. The edge of a flat-sided awl can be used to tamp down weft between warp spokes of wicker baskets, creating transverse striations on the edge well up the shaft. These striations are not connected to the tip by longitudinal striations, as is found with yucca splitting and corn husking. The striations along the edge of wicker-basketry awls can concentrate and create a slightly wavy or grooved surface. Eyed needles used to sew coiled baskets or mats develop long, longitudinal striations. For additional details of basket-making and plant-processing wear patterns, see Griffitts (2006:184–190).

Use Wear Produced by Woodworking

Woodworking experiments include contact with pine (*Pinus*), juniper (*Juniperus*), willow, and mesquite (*Prosopis*) by chisels, bark-stripping tools, and an awl used to weave a garden trellis. Two ethnographic *tapiscadores*, or corn-husking tools, from Guatemala are included. Woodworking produces a polished surface, but the polish is not as bright as that produced through contact with silica-rich plants. Pitting is often present, and cracking may also be seen. The wear extends farther into the lower parts of bone contours than that formed through plant processing, but the surface is not as rounded as on tools used in contact with soft materials. Woodworking wear grades into leather-working wear, and several tools in the present study could be identified only as having contacted either hard leather or soft wood.

Use Wear Produced by Pressure Flaking

Bone and antler tools used for pressure flaking have battered ends with deep, wide, sharp-edged striations, and a faint patchy polish. Stone flakes are sometimes lodged in the surface (Griffitts 1993; Olsen 1989). This activity is one of the few identified thus far that produces wear traces visible to the unaided eye.

Shell Wear and Other Additive Polishes

Additive polishes are found on tools that contacted shell and on some tools used with fresh, juicy plants. Additive polishes appear to sit on the surface of the bone, when viewed under high magnification. For instance, d'Errico et al. (1995) found silica residues on bone sickles. Experimental tools used for corn husking that were left uncleaned after use acquired bright patches of polish that were not found on tools used for the same task that were rinsed after use. The polish on these tools is probably hardened plant juices. Experimental basket making using pine needles produces a bright, very cracked polish that may be additive as well.

As a cautionary note, some additive "polishes" can also be produced by indiscriminate use of nail polish, glue, and other laboratory materials, as can tiny patches of oil from the analyst's fingers. The latter polishes are easily wiped away, but the other materials reduce the ability of the analyst to identify tool use.

Taphonomic Considerations

Certain taphonomic agents can produce patterns that mimic signs of tool manufacture or use. As bones are heated, their surfaces are altered, acquiring a glassy appearance at 285°C (Shipman et al. 1984). This change occurs with unmodified bone and with bone tools. Consequently, bone tools or possible tools often become much shinier when they are heated until blackened, and the increased reflectivity produces a surface that appears to be heavily polished when viewed macroscopically (Griffitts 2006). When viewed under high magnification, the surface appears warped or partially melted from heat. Sometimes the surface is bubbly and more or less featureless under magnification but is highly reflective macroscopically. This surface alteration can cause unused bone fragments to appear polished and to be mistakenly identified as tools. In this chapter, "polish" refers to surface alteration resulting from human modification, whereas reflective surfaces caused by burning are referred to as shiny.

Heating can also alter existing microwear patterns. In an experimental study (Griffitts 2006), the surfaces of experimental tools that were first used with silica-rich plants and then burned became more rounded and similar to tools used to work soft materials. Caution must, therefore, be used when assigning use to burned tools with such rounded surfaces. The use wear on these burned tools with flattened surfaces probably reflects contact with harder materials. In collections with a high percentage of burned material, this problem may lead to an underestimation of tools used with soft materials. As experimental tools were heated, their surfaces first became shinier and then dull. When calcined bones are viewed microscopically, the surfaces appear to have peeled away. Large traces such as those formed by manufacturing may remain, but the fine use wear is gone. Cremated long-bone-shaft fragments may also become checked or cracked, and the cracking thus produced can be remarkably regular in appearance and distribution and may be confused with cut marks. In all, 41 percent of all worked and possible worked bone from the PVAHP was burned or partially burned. The least burning was found on bone from LAN-193, where 85 percent of the bone was unburned. Only 54 percent of the artifacts and possible artifacts from LAN-54, LAN-62, and LAN-2768 were unburned, and 68 percent of the possible bone artifacts from LAN-211 were unburned. The checked or shiny surfaces of nine bone fragments led them to be initially identified as possible tools, but after microwear analysis, these were eventually determined to be probable nontools.

Rodents and carnivores can also damage worked and unworked bone by gnawing, and the comparative collection includes bones chewed by pack rats (woodrats, *Neotoma*) and domesticated dogs. When dogs chew on bones, they can create puncture marks that may be mistaken for drilling, as well as rounded and slightly polished scalloped edges. These traces are relatively easy to distinguish in well-preserved tools but may be more difficult to identify in weathered specimens.

Ethnographic Uses of Tools for Working Hides, Leather, and Other Soft Materials

People throughout North America used animal skins to make a variety of products. Leather and hide working is a multiple-stage process, and different kinds of artifacts may be used for each stage. Stone scrapers, bone fleshers, or other tools are used to remove soft tissue clinging to the underside of the skin. The hide may be treated with fat, brains, or other substances, or it may be smoked. Awls or other perforating tools are needed to make holes for lacing the hide to a frame and to sew the finished leather into a variety of goods. Use-wear analysis was not performed on bone scrapers, defleshers, or skinning tools; therefore, this discussion focuses primarily on uses of pointed objects.

Pointed tools were necessary equipment for sewing buckskin (Harrington 1980) and other leathers into clothing. The "Lone Woman of San Nicolas Island" wore a dress sewn of cormorant (*Phalacrocorax*) skins. George Nidever, one of the men who witnessed her removal from the island, reported that the sewing was done with bone needles (Heizer and Elsasser 1963), but it is unclear whether he simply assumed this upon seeing bone needles among her belongings or whether he actually saw the tools in use. Yurok and Hupa used pointed tools to slit lampreys (Petromyzontidae) before drying them (Gifford 1940:168). It is also possible for some plant fibers to create the same kind of rounded surfaces that are suggestive of contact with leather.

Basket Making and Silica-Rich-Plant Use in Ethnographic Sources

Plants and plant fibers played an important part in many Native American technological systems. Many southern California groups were renowned for their basket making, and ethnographic sources document a wide range of relevant activities in which tools contact silica-rich plants (see Chapter 5, this volume). Basket makers of southern California made hats and twined and coiled baskets of rush, deergrass (*Muhlenbergia rigens*) or bunchgrasses, sumac (*Rhus*), native palm, pine needles, yucca root, and bulrush (*Scirpus*) (Moser 1993). In the Historical period, Pomo weavers crafted twined and coiled baskets from willow, sedge (Cyperaceae) roots, redbud (*Cercis*), and bulrush (Newman 1974). Acorn granaries were woven of willow (Hector 2006). The Chumash used at least two methods to construct their mats. Some mats were made by first piercing tule (*Schoenoplectus*) stems with an awl and then using a rush needle to sew the stems together. Mats were also made by weaving or by sewing, but woven mats were considered to be "lazy people's style" (Hudson and Blackburn 1983:376). Some people sat on the ground and did not use a mat at all.

Awls were used in different ways in different kinds or different stages of basket making. Different kinds of basket making required different kinds of tool-manipulation methods, and the different methods of manufacture sometimes left distinctive use-wear traces. Awl points slip between weft fibers to open spaces to insert warp fibers in coiled baskets, or to create a space to add a new spoke in wicker baskets. Both of these actions create longitudinal and transverse striations circling the tip of the awl (Griffitts 2006:185, Figure 4.1). The edge of a flat-sided awl can be used in wicker-basket making to tamp down the weft between spokes, creating transverse striations on the edge midway up the tool shaft. Eyed needles can also be used in the production of plant-fiber textiles. When they are used to sew coiled baskets, they acquire long, longitudinal striations, first on the tip and on the widest part of the tool, and eventually over most of the surface. Wear also forms at the eye of the needle.

Basket makers making twined baskets use their awls only to push stitches closer together (Newman 1974:35); therefore, awls that were used primarily for such a task would be more likely to acquire transverse striations and other wear on the edges of the tip or shaft, rather than longitudinal and twisting striations at the tip as found on awls used to open spaces.

Cecilia Silva, a Wikcahmni woman of the San Joaquin Valley, California, used a metacarpal awl to help construct her coiled baskets. The awl was made in a fashion similar to that used to make many archaeological tools: it was cleaned, scraped with a knife, and split lengthwise, producing two awls from one bone. The point was made with a knife of unspecified material and was ground on a sandstone slab that had belonged to her mother. The awl that she used had a long, narrow, tapering, sharp point (Gamble et al. 1979:271–272, Figure 2).

To produce their nets, net makers use a variety of tools, many of which can be made from bone, including needles, shuttles, gauges, and winders. Wallace (1978:168) illustrated a bone net winder made from a more or less rectangular rib segment used by the northern Californian Hupa fishers. European and Euroamerican net makers used and still use bone and other materials for needles, shuttles, and gauges (Beaudry 2006:65). In general, a wide range of fiber processing and stripping can be accomplished with the edges of awls, but other tools may also be used.

Use Wear from Basket Making and Silica-Rich Plants on Archaeological Tools

Use-wear analysis of pointed tools demonstrates the importance of bone tools for processing plant foods and manufacturing items from plants, as most tools show significant wear from contact with plants (Figure 119; see Appendix D.19). Although use-wear analysis cannot determine the exact kinds of plants contacted, it is sometimes possible to identify differences in texture. This can be understood from the variation in sizes and depths of striations, indicative of either different-textured plants or of varying amounts of grit present. The tools showed expected patterns of wear; for example, pendants demonstrated wear exclusively from soft materials. More surprising was that a number of wands also showed that they had been used with or on silica-rich plants, an unexpected result given that such tools are generally classified as ritual objects.

Bone awls and needles are often interpreted as basket-making tools (Chartkoff and Chartkoff 1984:130, 198; Gamble 1990:9-3, 9-5), and indeed, use-wear analysis supports this interpretation in part, but they had many other uses as well. Use-wear studies reveal that some pointed tools also have wear consistent with other plant-processing tasks. The tools used in complex motions have striations running in all directions. They probably contacted silica-rich plants in several different ways, perhaps making different kinds of plant-based products. In contrast, the tools designated basketry awls have wear similar to that on experimental basket-making tools and, because they lack other wear patterns, may have been tools with more specialized uses. Although only a few basket-making tools were identified in this collection, their low frequencies may be related in part to tool fragmentation—fiber-processing wear is often found on tool shafts or midsections, as are some traces of wear from basket making, but many of the midsections were not examined for microwear.

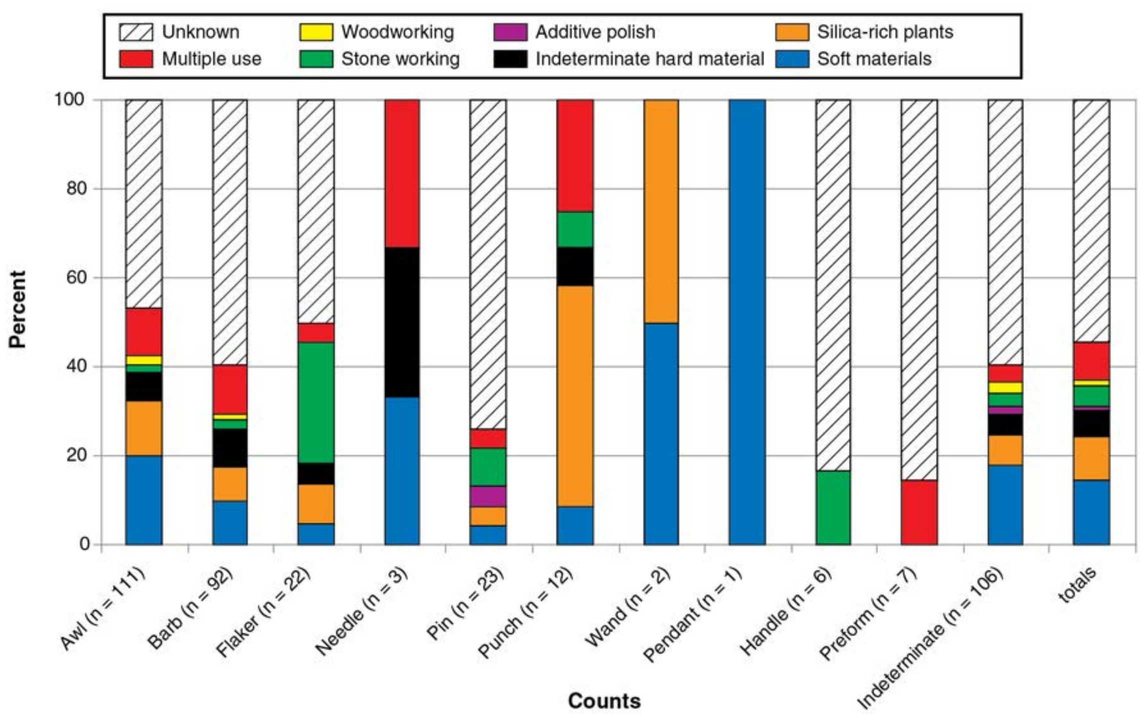

Figure 119. Relative frequency of different types of use wear on bone-tool types from all PVAHP sites.

Tools classified into the unknown-use category were unusually numerous in this study: more than 50 percent of tools in the sample were so designated. This undoubtedly is related in part to tool fragmentation, as well as to obscuring factors like burning and/or the presence of a substance such as caliche or asphaltum.

Manufacturing Techniques

The most common manufacturing traces visible in this collection are grinding and cutting. Bones were reduced to blanks by the groove-and-snap method and then were ground to shape. Various manufacturing techniques were noted, including the groove-and-snap process, flaking and breaking, grooving, and shaving/whittling.

Investigating Form-Function Correlations

Uses of awls, barbs, pins, needles, punches, and indeterminate pointed tools were compared (see Appendix D.19; see Figure 119). When tool-tip fragments were included, no strong correlation was found between tool shape and tool use.

Barbs and Awls

Father Antonio de la Ascensión recorded in 1602 that the Gabrielino made harpoons of fish bones (McCawley 1996:5), and later observers noted that the Chumash used wood, bone, and composite harpoons to obtain large fishes and sea mammals (Hudson and Blackburn 1982). Bone and wood tips were used on fish spears, and bone points were lashed to hardwood or bone foreshafts with vegetable fibers (Hudson and Blackburn 1982). Composite hooks were made by tying two or more points together. Some, illustrated by Hudson and Blackburn (1982:181), were covered with red ocher. Gorges may retain asphaltum traces with cord marks on the center (Hudson and Blackburn 1982). Small bipointed artifacts are often identified as barbs, parts of composite fishing implements. Bipointed and curved-shafted tools, both complete and complete enough to tell the original shape, were recovered at LAN-2768 (n = 3) (early Intermediate), LAN-211 (n = 5) (late Intermediate), and LAN-62 (n = 13) (Intermediate to Mission periods).

When use wear was compared among the complete or nearly complete barbs, more than half had light wear with unidentifiable weak polish (Table 106). The uses of some tools assigned to the "unknown" category are entirely unknown, but striation patterns are visible on others indicating that tools were used in longitudinal, transverse, twisting, and complex motions. When the "unknown" uses are examined in detail, a higher proportion of barbs and indeterminate pointed tools had uses that were entirely unknown, often as a result of very light use. Six complete or nearly complete barbs have transverse striations at the midpoint that may reflect hafting, one each from LAN-211 and LAN-2768 and four from LAN-62.

DiGregorio (1987a:171) suggested seven attributes that can identify whether broken tips were barbs or awls, including cordage impressions, asphaltum stains, and several aspects of the tool shank and base. Several tools from the PVAHP sites had traces of asphaltum, which could indicate use as barbs, or represent traces of hafting in some other fashion. Unfortunately, most of the broken tips in the present collection are very short; therefore, attributes related to shank and base usually were not visible.

Tapered-ended, bipointed wood and bone ear rods (Hudson and Blackburn 1985) might also be identified as barbs.

Table 106. Use Wear on Complete or Nearly Complete Barbs

Use	Site			Total	
	LAN-2768 (n)	LAN-62 (n)	LAN-211 (n)	n	%
Unknown	1	1	—	2	9.52
Light use, generic weak polish	—	7	4	11	52.38
Longitudinal motion in soft material	1	4	—	5	23.81
Possible wood gouging	—	1	—	1	4.76
Possible additive material	1	—	—	1	4.76
Multiple use, first use unknown, reused as pressure flaker	—	—	1	1	4.76
Total	3	13	5	21	100.00

Note: Complete barbs with use wear not found in LAN-193 and LAN-54 samples.

It would be difficult to identify use as an ear or nose ornament solely on the basis of microwear analysis because articles worn in this way would probably acquire a light polish. Also, Hudson and Blackburn (1982:210) noted that bone barbs resemble atlatl hooks, and this, too, is another possible use for some pointed artifacts.

Use-wear analysis was conducted on three of the six tools initially identified as handles; all three were recovered from LAN-211. Of these, one appears to have been used as a pressure-flaking tool. This piece is more properly identified as a broken ulna awl or a probable pointed tool. It consists of the handle and shaft of a canid ulna with the extreme tip broken away. The broken end is slightly battered, with wide, shallow longitudinal striations as are found on pressure-flaking tools, suggesting that it was reused for knapping after breakage. The end of a second tool was broken; a long, robust shaft and handle were left, and the tool was evidently reused after the break. The broken end is chipped. The high points of the sharp, broken edges are rounded, with parallel diagonal and longitudinal striations in a weak, nondiagnostic polish indicating that it probably was used in a longitudinal motion, such as scraping or gouging an unknown material. The use of the third tool is entirely unknown. The tool was recently broken and has no identifiable wear.

Tool Fragmentation, Recycling, and Resharpening

Four tools appear to be broken tips of larger tools, but on closer inspection, these were all cut short rather than broken. Two of these short cut tools were recovered from LAN-62 and two from LAN-211. Three of the four were ground before they were cut, and at least one from LAN-62 appears to have been used before it was cut. None of the four has strong wear patterns suggesting heavy use after being cut. These four tools raise a question: could old or broken tools be reused in some way in a shorter form? It is clear that at least a few of the many tip fragments were deliberately cut off to their current short length. Some of the other fragmentary tips may have been awls that were accidentally broken, and the tips were saved for use as fishing tools. An alternative explanation is that toolmakers may have made their tools longer initially because it is difficult to hold a very short piece of bone and to work it for an extended period, and it would be more comfortable to shape a slightly longer tool and then cut or break it off to the desired shorter length. Other very short but complete pointed tools were noted: for example, one artiodactyl vestigial metapodial was recovered from LAN-62.

An unusual blurring of wear patterns was noted on the surfaces of at least 16 tools. The blurred wear could come about through several actions: for example, from subsequent reuse, either light use or an activity that does not produce strong wear patterns. It could be caused by contact with containers or other objects during transport (Griffitts 1993; LeMoine 1991). It could also form through trampling or noncultural formation processes.

Tip fragmentation was noted at other sites in the area (DiGregorio 1987a, 1987b); therefore, it is not an uncommon phenomenon in coastal sites of southern California. Possible explanations include ritual discard processes. Diegueño funerals in the Historical period included burning clothes and baskets belonging to the deceased (Waterman 2004). One explanation is that perhaps tools were symbolically "killed" before discard, but there could be more-utilitarian reasons as well. DiGregorio (1987a) suggested that tool fragmentation found at the Del Rey site may relate to breakage during fishing, and that the weakest point of a tool tip would be near the place where components were bound together. The presence of short cut awl tips may suggest that at least some tool tips were reused. If they were reused as fishing tools, they might not acquire strong, diagnostic wear patterns. These explanations are not necessarily mutually exclusive—some could have been broken during fishing, some cut and reused, and others "killed," and in fact, given the bone-artifact fragmentation in both coastal and inland sites in southern California (Strand 1997), it is likely that multiple processes were involved. Some noncultural formation process may also have contributed to the fragmentation.

Reuse or resharpening was noted on other tools from the project. Resharpening marks were seen on 20 pointed tools. Pressure flaking appears to have been the last use for 5 tools. This is a common pattern and has been noted in bone-artifact collections from the Northern Plains (Griffitts 2006) and the Southwest (Griffitts 2001). Use-wear patterns on 1 tool from LAN-211 and 1 from LAN-62 indicate that they were used for at least one activity and then reused as a pressure flaker after the ends were chipped.

Tip Sharpness and Tool Use

Tip shape was recorded as tapered, constricted, convex sided, or unknown. Researchers have suggested that certain tip shapes had particular uses; for example, DiGregorio (1985a:184) suggested that pointed tools with needlelike tips could be specialized tools used for sewing feathers together. No feather-sewing experiments were conducted in the present study, but it is nonetheless possible to look for overall patterns of tool use across different tip shapes.

Results

It was not possible to identify the sharpness of many of the pointed tools because of their fragmentary condition. Some possible correlations were found between tool use and tip sharpness. All pointed tools with wear indicating woodworking had blunt points, but not all blunt-pointed tools were used for woodworking. All tools with wear suggesting pressure flaking were blunt pointed, as were the three tools with wear suggesting a longitudinal motion in a material causing additive-polish accumulation. Blunt-ended tools also had a variety of wear types visible on them, making their purpose difficult to identify.

Awl-tip shapes are likely to vary depending on their use and their users. Because awls had many kinds of uses, it is unlikely that there would be only one standard shape for pointed tools. Some tasks require a stronger tool tip, whereas others require a sharper or a finer tip. It is unlikely that a single shape would be optimal for making sleeping mats, wicker, winnowing trays, and weaving blankets. Tip shapes may vary even for a particular use, depending on different peoples' motor habits and personal preferences. A Ventureño basket maker in coastal southern California discussed how different women use their hands and their awls in slightly different ways as they make their coiled baskets. She also reported that some basket-making awls expanded away from the thin tip, whereas others remained "slender all the way" and that "some women like a lean awl, some a flat one" (Hudson and Blackburn 1987:231).

Most pointed tools were fragmentary, and it is unclear whether their present length reflects their length at discard. How long were tools originally? Hector (2006) suggested that basket-making awls were not much longer than 10 cm because a longer tool would be less comfortable to use. She based her conclusions on discussions with modern California basket makers. Felger and Moser (1985:182), on the other hand, reported that some of the awls used by the Seri begin at about 25 cm long and are discarded when they wear to about 10 cm. This is supported by additional work among the Seri by Soto-Toral and Polaco (Cairns and Shelley 1998:171). At least one vestigial metapodial of a deer-sized artiodactyl was made into a multiuse awl recovered from LAN-62. The vestigial metapodial is very short, and the tool would have been well under 10 cm at its longest. These contradictory data suggest that tool length at discard is likely to vary according to cultural and personal preferences, the type of basket manufactured, and resource availability. The ease of replacing a worn-out or discarded tool also may influence the person's decision to discard a tool. The optimal length of a tool is also likely to vary depending on its primary purpose.

The Chumash used more than one kind of hairpin (Hudson and Blackburn 1985). Both were made from bone, but they had different functions. Men wore their hair at the crown of their head, held with a wood or bone pin. Headdress pins were shorter, made from wood or bone with a sharp end decorated with feathers (Hudson and Blackburn 1985:187). Archaeologists often attempt to identify nonmortuary artifacts as hairpins on the basis of their shape. According to one source (Hudson and Blackburn 1985:76), hairpin form varied greatly. Hollow-ended hairpins were made from bird bones (Hudson and Blackburn 1985:81). Fragments of such objects could easily be misidentified as beads or tubes, as well as other pointed artifacts.

Researchers in California and the Southwest have often been concerned with distinguishing awls from similar-appearing hairpins. In the southern Southwest, Hohokam pointed tools are often classified into two groups, awls and hairpins, based on length, morphology, and recovery context (James 1994:282). Long tools (more than 15 cm long) are interpreted as hairpins, shorter tools as awls. Tip morphology is also used to distinguish awls from hairpins. Awl tips are about as wide as they are thick, whereas hairpins are about twice as wide as they are thick (James 1994:283–286). In addition, awls may have round cross sections and a more restricted range of tip shapes, whereas there will be more variation in the tip shape of hairpins (Glass 1984:908). Pointed tools with drilled or decorated handles are thought more likely to be hairpins than awls (Theil 2001). These inferences are based in part on data from burials. Long, decorated pointed bone tools are found placed at the top of the head in Hohokam burials, especially of males (James 1994). Most pointed objects recovered from the present project were fragmentary, and length therefore cannot be used as a determining attribute.

Kidder Types

Table 107 shows Kidder (1932) types for Playa Vista bone artifacts by site. Type A tools have largely unmodified epiphyses,

Table 107. Kidder Tool Types, by Site[a]

Kidder Type	Site				Total	
	LAN-2768 (n)	LAN-54 (n)	LAN-62 (n)	LAN-211 (n)	n	%
A	—	—	1	3	4	9
B	—	—	5	6	11	25
C	—	—	4	6	10	23
D	1	1	—	1	3	7
E	—	—	2	7	9	20
F	—	—	2	5	7	16
Total	1	1	14	28	44	100

[a] No Kidder tool types identified in LAN-193 sample.

and the epiphyses and shafts of Type B awls are split longitudinally. The epiphyses are partially modified in Type C tools and are completely removed from Type D tools. Type E designates splinter awls. Splinter awls are often categorized into two groups based on whether tools were made on broken or cut splinters. When splinter awls are so categorized, Type E awls are cut awls (cut from sections of bone, often long-bone shafts) (Olsen 1980), and splinter awls, made from minimally modified broken bone fragments, are designated Type F. The present study uses Types E and F because cut and splinter awls represent different behaviors on the part of the toolmakers.

Kidder types could be determined for only a small percentage of awls because of fragmentation. Although there were fewer awls or other pointed tools at LAN-211 than at LAN-62, twice as many of the tools examined for microwear were complete enough to determine Kidder type. About half of the awls from LAN-211 fell into the less modified stages (Types A, B, and C), whereas nearly 75 percent of the tools from LAN-62 were placed in these categories. Only 9 percent of the tools were assigned to Type A. The total number of tools for each site is very low, and the difference of one or two tools could make a large difference. Splitting a tool, as discussed above, into Kidder Type B awls produces two to four awls from a single bone. If large-mammal bone is in short supply, this is a way in which to conserve raw material (Griffitts 2006).

Kidder Types and Tool Uses

Tools with use wear showing contact with soft materials and multiple uses were distributed across the Kidder types, but none of the artifacts with wear indicating contact with silica-rich plants as a primary use was assigned to Types A or B. Multiple-use tools with use wear suggesting contact with hard materials such as silica-rich plants were found in these types. This probably is a result of fragmentation and analysis. Use-wear analysis was not conducted on all of the tool midsections and handles; therefore, the Kidder type also was not recorded for all. Plant-processing wear and wear from some kinds of basket making are often found on the midsections of tools, and more of these traces may be present on the unrecovered parts of the tool fragments. As noted above, these are also very small samples. Earlier studies (Griffitts 2006; Griffitts and Waters 2001) in other regions have shown little or no correlation between Kidder type and tool use.

Pries

Abalone pry bars were made from whale bones or hardwood. Harrington noted that "a good abalone stick should be 3 feet long" (Hudson and Blackburn 1982:253–254). Spatulate bone objects identified as pries at San Nicolas Island measure 3–4 feet long. Spatulate-ended tools can be assigned to various categories, which in this study include spatulas and possible pries. Far fewer pries or spatulate tools (from mammal bone) than pointed tools were identified, and only a few pries or spatulate tools were examined for microwear. Two artifacts initially identified as pries were examined for use wear, one from LAN-54 and a second tool from LAN-211. Upon microscopic examination, however, neither of the two tools identified as pries has wear consistent with that activity.

Comparisons with Other Sites

Collections of bone and antler artifacts from sites elsewhere in the Ballona have, overall, compositions similar to those from the sites examined in this project. Pointed tools and pointed-tool fragments usually make up the greatest proportions; the rest of each collection usually is a few beads, tubes, and other ornaments. A greater variety of artifacts were recovered from LAN-62 and LAN-211 than at many nearby sites, but this may be related to sample size; these two sites are large, and the chance of having one or two of the less common artifact types may be higher in larger sites.

Before the PVAHP, Troncone and Altschul (1992) noted that bone artifacts were far more frequent from sites on the Westchester Bluffs than in lower elevations in the Ballona. For instance, only 21 tools were recovered from the Admiralty site, located at the lagoon edge. Although the frequency of bone tools from the Admiralty site was much lower than at LAN-211 and LAN-62, the artifact types largely follow the same pattern. More than half were pointed tools (13 of 21), and the remainder consisted of tubes, beads, or miscellaneous items. By contrast, large numbers of bone artifacts and fragments were recovered from the bluff-top sites (DiGregorio 1985a, 1985b): 558 bone artifacts or artifact fragments were recovered from the Loyola site (LAN-61A), 985 from Marymount (LAN-61B), and 15 from LAN-61C (DiGregorio 1985b:111). The highest proportion from all three sites was assigned to pointed tips, midsections, and fragments. These large numbers of bone artifacts are partially the result of large-scale data recovery efforts.

As is true for the PVAHP sites, bone artifacts from nearby sites are fragmentary. Most of the 202 tool tips from the Loyola site were broken and less than 2 cm in size. The broken tips were assigned to several forms: spatulate, wedge, sharp, blunt, and fine pointed. Tools from the Marymount site were also fragmentary, and the 322 tool tips averaged less than 2 cm long (DiGregorio 1985a:176). The fragmentation noted at the PVAHP sites is found at other coastal sites, and bone artifacts from inland sites are also broken (Strand 1997:158). The 48 artifacts from the inland Elsinore site were similar to those found at smaller PVAHP sites—awls, beads, and fragments of pointed and spatulate tools (Strand 1997). Several tool types recovered at the PVAHP sites were absent from the Elsinore site, including gorges, fish-vertebra beads, turtleshell rattles, strigils, whistles, and flaked bone artifacts.

Far fewer barbs, gorges, and fragmentary tool tips were noted at LAN-61 than were recovered from the PVAHP sites. This could be a temporal factor, given that LAN-61 is an Intermediate period occupation and larger quantities of fish remains were recovered from it, suggesting that fishes were an important resource. It is important to note that some differences among sites could easily be related to differences in analytical procedures: some analysts may have been more conservative than others in assigning function to pointed tools and tool fragments. The present study has shown that, although complete barbs generally seem to have the same wear patterns, wear on fragments identified as barb-tip fragments varies greatly, suggesting that not all the tools were used for the same tasks.

Large modified-bone collections were also recovered from the Del Rey site (LAN-63) (Cairns 1994; DiGregorio 1987a), which produced 261 awls but only 3 gorges and 5 barbs, as well as manufacturing debris. In all, 97 bone artifacts were recovered from test excavations at the Hughes site (LAN-59), located on the bluffs (Colby 1984). Of these, 50 were awls and awl fragments. A few tubes and tubular beads were also found (Cairns 1994; Colby 1984).

Far fewer artifacts were recovered at the Bluff site (LAN-64) (Cairns 1994; DiGregorio 1987a, 1987b), including 14 awl fragments (7 tips, 7 midsections), 1 barb, and 1 drilled bone. Only 18 fragments of worked bone were found at the Centinela site (Cairns 1994), including 2 fragmentary awl tips, another pointed tool, and 1 possible fishing gorge. Seven artifacts, all pointed, were found at LAN-1575 (Moslak 1999). These objects were recovered from burials.

In summary, awls and awl fragments are nearly always the most common reported bone artifacts, and many, if not most, are highly fragmentary. Barbs, gorges, and tubular beads are reported in smaller numbers. Other artifacts have been found even less frequently. Flutes, rattles, and deer-tibia whistles were not reported at Loyola/Marymount or Del Rey; these are found only in low frequencies within the PVAHP sites.

Bone beads may be less common at lowland sites than at bluff-top sites. Gibson et al. (2003:216–217) noted that stone and bone beads were present in greater numbers at sites on the bluff top than at lowland sites, but they noted that the lowland sites are also more recent and suggested that there may be a temporal component to the numerical variation.

Summary and Temporal Trends

This chapter provides an overview of bone and shell artifacts recovered during the PVAHP. Bone-tool analysis is often limited to a simple list of morphological types, many of which have implied functions, but far more information than that can be obtained. Bone tools are frequently used to create other tools and objects from perishable materials, and detailed studies can therefore tell us about other technologies.

Bone artifacts in southern California are an underused research resource. One of the goals of this study has been to show that far more information can be derived about human behavior using bone artifacts than is commonly assumed. Many of the tools in this study were used in contact with silica-rich plants, and several were interpreted as basketry or fiber-processing tools. The frequency of this type of tool suggests that plant products were important, a suggestion supported by the ethnographic literature; unfortunately, however, plant-fiber cords, nets, baskets, cloth, and other textiles are perishable and preserved only under certain circumstances. Because of this, Hector (2006:107) recently suggested that basket making is archaeologically invisible. She postulated that textile production requires few or no tools, but her discussion suggests that she actually meant, not that no tools are required, but that the tools may be unrecognized in archaeological assemblages. She argued that textiles are invisible in the archaeological record for several reasons, including unfamiliarity with textile-making techniques and technology on the part of archaeologists. This study shows that by adding use-wear analysis to the bone-tool researcher's tool kit, we can help to ensure that textiles, as well as leather work, woodworking, and other technologies involving perishable materials, will no longer be hidden from archaeological research.

Most of the bone tools recovered in the present project were awls, or pointed objects, and pointed tools are found in all of the sites examined in this project. These tools are extremely common through time, and they are therefore not good temporal indicators. Awls and needles have been recovered in southern California sites dating at least to the early Millingstone period, becoming more common at the end of the San Dieguito tradition (Chartkoff and Chartkoff 1984:102). Their presence is at times interpreted as indicating the growth of basket making (Chartkoff and Chartkoff 1984:102), but these tools could have had other functions, such as sewing clothing or many other uses. Spatulate tools are also seen at early sites and are therefore not time diagnostic. DiGregorio (1985a:179) noted that barbs and gorges are found in late and early contexts, and therefore the simple presence or absence of these artifacts cannot be used as a temporal indicator. A few tool types are more restricted in time. As discussed above, deer-tibia whistles have considerable time depth, but their form changes over time, perhaps reflecting increasing popularity of the rituals with which they are associated. Changes in deer-tibia-whistle form and size are therefore temporally diagnostic, and their presence in later periods suggests greater involvement in certain ritual activities.

There are some differences in kinds of tools found across sites. Larger numbers and higher proportions of musical instruments and decorative items were found at LAN-62 than at the other sites. This is not surprising given the site function, and given that some musical instruments and decorations probably overlap with ritual activities, as may gaming pieces. No strong temporal patterns were seen in pointed-tool use as determined by use-wear analysis.

Use-wear analysis indicates that some of the traditionally used classifications of pointed tools correlate with use-wear patterns: for example, in complete barbs. But, the use-wear patterns on fragmentary tool tips did not match morphological types well. A few activities seem to be restricted in use to broad, blunt pointed-tool tips, but pointed-tool tips were used for a variety of tasks.

The bone tools examined in this study were part of larger tool kits that include tools of other materials, such as flaked stone, wood, and other materials, and these results should therefore be considered along with discussions of other technologies. But even without examining other tools, detailed analysis of bone-artifact technology allows us to expand our reconstructions of everyday life in the past. It is easy to focus too much on the tools themselves and to overlook the humans who made and used them in their day-to-day lives. People of the past used their bone-artifact technology to create and maintain other tools. They used bone or antler to make the stone tools needed for hunting and butchering. Soft materials such as leather or hide provided clothing and other necessities, and some bone tools appear to have been used to work leather. Craftspeople used bone to work fine- and coarse-textured plants in a variety of ways, to prepare fibers, and to make baskets and, possibly, nets or mats as well. The bone-artifact technology examined here also provides glimpses of woodworking. People used bone artifacts in their social interactions and their ceremonial lives. Decorative bone objects include pendants, several kinds of beads, and possible clothing pins or hairpins. Recreational activities are represented by bone gaming pieces and musical instruments, and some of these probably had ceremonial importance.

It is our hope that future research will continue to examine bone-artifact technology in detail and to build on this and other research. For example, researchers (Griffitts 2006; Wake 1999a) have found that in-depth analysis of manufacturing techniques can provide information concerning human decisions in contact situations. It would be very interesting to see if similar patterns are found in other sites and regions. This study raised questions that could not be satisfactorily answered with the available data, such as whether the short pointed tips represent artifacts broken and discarded, or whether awl tips were reused as components of fishing technology. It is possible that we may be able to answer these questions by examining material from other sites in the region.

Textiles from LAN-62

Judith K. Polanich

Introduction

Basketry does not typically survive into the archaeological record; so, the rich collection from LAN-62 provides a rare opportunity to address research questions related to this perishable cultural material. In prehistoric contexts, basketry is preserved under limited conditions: carbonization, caves (Great Basin), and anaerobic conditions (British Columbia and the northwest coast of North America). Basketry remains have been rarely recovered from pre-contact sites in coastal southern California. Given these preservation issues, analysis in this study was tailored to address a range of research questions:

- What are the characteristics of the basketry in terms of typology and function?
- What percentage of the PVAHP basketry collection can be classified as funerary (in mortuary contexts and with burials) as opposed to nonfunerary (in thermal features/pits/artifact concentrations)?
- How does the collection from the PVAHP compare to other Mission period coastal southern California basketry collections?
- What can we learn about the ethnicity and cultural heritage of the basket makers of Playa Vista? Does the basketry demonstrate cultural associations with the islanders or the inlanders?

Discussion of the PVAHP basketry in this chapter will include identification of textile types and specific techniques of textile manufacture. Functional interpretations of the PVAHP basketry will be presented through comparison to ethnohistoric reports, ethnographic collections, and archaeological remains from the region. Ethnic associations of the basket makers will be inferred through comparative analysis, as will the preferences for specific type(s) of basketry by the Mission period occupants of the PVAHP. In the following discussion, a background to the study of basketry in southern California is presented, including ethnographic and archaeological backgrounds; then, the typological terms used in this study are presented. The PVAHP data are presented subsequently, with discussions of types of basketry, manufacture techniques, and ethnic correlations. The final sections of the chapter present the regional and comparative syntheses. For additional information regarding the information presented in this chapter, please see Appendixes E.1–E.12 on the accompanying disk.

Background

Basketry was unquestionably the most developed art in aboriginal California (Kroeber 1925:819). Baskets were made by women for their own use as the primary tools for seed gathering and preparation, on which traditional life depended; as a means of social or ritual exchange of gifts of effort and artistry; and as an affirmation of cultural identity through practice of the craft handed down to them by their mothers and grandmothers. Cordage, so essential to hunting and fishing, was often made by men, providing binding, netting, and fastening for their daily tasks. In the examination of textiles from LAN-62, we are not only examining techniques and materials of these early Californians; we are exploring their lives.

Southern California Peoples, Cultures, and History

Ethnographic southern California is the region bounded on the north by the Transverse Ranges, on the south by the Mexican border, on the east by the Great Basin, and on the west by the Pacific Ocean (Kroeber 1925:913, Figure 73). The region was historically occupied by Chumash and Takic peoples who practiced the *toloache* ceremony for initiation into communal societies (*'antap* for the Chumash and *chingichnich* for the Takic Gabrielino/Tongva and Luiseño). They also practiced the more widespread annual mourning ceremony, burning possessions to honor the dead. In general, their artifacts were fairly uniform and included sandals, basketry (with a coiled-basketry cap), clamshell and olivella beads, portable mortars, lashed plank boats on the coast, pottery among the Luiseño and southern Takic, and steatite bowls among the Chumash and the Gabrielino/Tongva (Kroeber 1925:700).

Within this uniformity, there was enough variety for Kroeber to propose two "climax areas," one for the coast and island Chumash and the island Gabrielino/Tongva and another for the mainland Gabrielino/Tongva, Juaneño, and Luiseño (Kroeber 1936:102, Map 1). Disposal of the dead varied, even among ethnic groups. The Takic Gabrielino/Tongva, for example, both cremated and buried their dead, and the Chumash (an isolated language group) generally only buried their dead. With the arrival of the Spanish in 1769, the coastal populations were decimated, their cultures disrupted, and their futures forever changed; they were first missionized by the Spanish, then peonized by the Mexicans, and finally marginalized on reservations by Euroamericans (Castillo 1978). Our knowledge of these people depends on fragments of ethnohistoric accounts and meager archaeological remains.

Ethnohistoric Data

Early explorers left cursory accounts of Gabrielino/Tongva and neighboring basketry traditions. These accounts were summarized by Blackburn (1963) for the Gabrielino/Tongva and by Hudson and Blackburn (1982–1987) for the "Chumash interaction sphere," those tribes surrounding the Santa Barbara Chumash. For the Gabrielino/Tongva, the earliest records were typical travelers' accounts. Basketry water bottles received special note, and cordage was admired. Despite their somewhat cursory descriptions, eyewitness accounts have been of great value in recording what was actually present and how it was used, because neither type survived in ethnographic collections.

Reliable information for the Gabrielino/Tongva came from Hugo Reid, married to a Gabrielino/Tongva woman. Reid published a series of popular accounts in 1852 and was responsible for the widely quoted characterization of Gabrielino/Tongva basketry: "Their baskets of split rushes are too well known to require description" (Reid 1926:26–27). Evidently, coiled baskets of split rushes were still available in the mid-nineteenth century, but almost no information about them was gathered until 1900, when the twin forces of anthropological fieldwork among the "vanishing races" and craftsman-era collecting for the "Indian corner" created a boomlet in basket making and "salvage" ethnography.

The best and most detailed information about Gabrielino/Tongva basketry and textiles came from the field notes of John P. Harrington (Hudson and Blackburn 1982–1987). Although collected more than 100 years after Euroamerican contact had devastated the Gabrielino/Tongva people and devastated the culture, his field notes have been mined by several generations of scholars and native descendents. In the 1980s, Thomas Blackburn, who used Harrington's notes in his *Ethnohistoric Description of Gabrielino Material Culture* (Blackburn 1963), joined Travis Hudson of the Santa Barbara Museum of Natural History in an ambitious five-volume compendium, *The Material Culture of the Chumash Interaction Sphere*. These volumes provided much of the basis for the interpretations of functional forms found below.

Function, Types of Basketry, and Worked Botanicals in Southern California

Basketry served culinary needs throughout southern California: gathering, preparing, serving, and storing food. A large, bucket-shaped basket was used for gathering, carrying (with the aid of a net), and storing food. It may once have been used for stone-boiling of food but, in historic times, was supplanted by pottery or stone bowls. Coiled plates and bowls were used in milling acorn, as mortar hoppers and winnowing trays, and in serving prepared foods. Twined, open-work baskets served as receptacles and leaching baskets for acorn meal. Seed beaters were roughly twined, except for the wickerwork of the Chumash. A close-twined, asphalted water jug was made by the Chumash and perhaps by the Gabrielino/Tongva (Kroeber 1925:700–701). Baskets also served other needs. A coiled-basket hat, the standard measure, was worn by women when carrying a net burden. A small, coiled trinket or "treasure basket" served as a gift or offering in the mourning ceremony (Kroeber 1925:698–700).

Basketry in southern California was "mission basketry" coiled on bundles of grass or *Juncus* that included sewing strands of *Juncus* or sumac (*Rhus trilobata*) with patterned bands of contrasting materials. Coiled basketry varied in details from group to group but not in the primary construction technique: noninterlocked stitches sewn in a rightward work direction. Basket forms were few: nearly flat plates; shallow basins/bowls; a larger, deeper bucket; a small, incurving "treasure basket"; and a truncated-cone hat (Kroeber 1925:698). With the exception of the Chumash close-twined and asphalted water bottles, the few twined baskets identified were mostly small, open-twined basins or bowls of whole *Juncus* stems in plain or twill twining (Kroeber 1925:700–701).

The uniformity of technique, material, pattern, and texture of coiled basketry, irrespective of the function of the basket or the ethnicity of the maker, was the hallmark of southern California basketry (Kroeber 1925:700). As discussed below and in the glossary, the subtle, specific features of the coiled construction technique (splices and rim finishes), the preferred material choice (*Juncus* or grass foundations), and the texture (fine or coarse) of sewing have become the criteria for suggesting probable uses of and assigning ethnicity to coiled basketry (Dawson and Deetz 1965:206–207).

Culturally Conditioned Features

In basketry studies, the details of conception and construction are evident in finished baskets and may be identified by post hoc analysis (Baumhoff 1957:2). When details are fairly consistent within a particular tradition but are not directly determined by function or materials, they are termed *culturally conditioned features* (L. E. Dawson, personal communication 1981). Each feature is analytically independent, although constellations of associated features may be observed. Features or constellations may be used to identify baskets of unknown provenience or to compare entire traditions (Weltfish 1930:493). By contrast to typological analysis, there is no a priori decision about what feature or features will be the most salient for comparison. Basketry of each historical period may be characterized by techniques, shapes, and designs that occur together (Morris and Burgh 1941).

Some of the details of conception and construction may be manifested in fragmentary remains of finished baskets and, through comparison to known traditions, may be used to identify the remains as a product of one or more of those traditions. Because not all features are available for analysis in fragmentary remains, choices are made by the analyst to determine those features most useful for inferring original technique, original functional form of a finished basket, and ethnicity of the maker. Those choices and the logic of their selection for this project are discussed below.

The carbonized textile fragments recovered from LAN-62 resulted from intentional behavior. The technical, functional, and stylistic decisions made by the weaver resulted in a textile whose technique can be known, whose function can be inferred, and whose ethnicity can be suggested through comparison of the constellation of culturally conditioned features to those of known traditions. When, as in the sample from LAN-62, the remains do not seem to include the totality of the local textile tradition, the sample is skewed. An apparent preference of behavioral possibilities can be a reflection of intentional selection from a wider corpus, a result of the deposition process, or an outcome of the specifics of the immediate habitat.

Definitions/Typologies

Culturally conditioned features are most usefully compared within the appropriate category: loomed textile, nonloom textile, or cordage. Basketry is defined as a handmade, nonloom textile differentiated from other nonloom textiles by its dimensionality and relative rigidity (Balfet 1957:3). It is three-dimensional rather than two-dimensional (e.g., mats or nets) and is sufficiently rigid to retain a stable form without distention by its contents (unlike bags) or any extraneous form of support (unlike nets) (Adovasio 1977:1; Driver 1969:159). Although the boundaries of classification are somewhat arbitrary, this definition fits all of the known Gabrielino/Tongva basketry. Basketry can be further divided into coiling, twining, and plaiting, each differing in the position and relation of passive (stationary) and active (manipulated) elements (Weltfish 1930:455). Carbonized textiles recovered from LAN-62 included twined and coiled basketry as well as cordage. Readers unfamiliar with the textile terminology used here should consult the glossary at the end of this document.

Coiling

Coiling is accomplished with an active, vertical element, the stitch, which moves around and/or through a passive, horizontal element, the foundation. With the aid of a needle or awl, a hole is punched into the previously completed work, and the sharpened end of the sewing strand is passed through the opening. Once the coiling is started, the same method is often used throughout basket construction to shape the basket wall, differing only in the angle of awl insertion, until the final course is reached. The activity of the stitching, whether inserted under, into, or between stitches in the foundation course below, and the composition of the passive foundation element(s) are the most frequently noted features of simple coiling and provide the basis of most typologies.

Twining

The term “twining” was first used by O. T. Mason (1885:292) to describe a method of manufacture “by means of twining two woof strands around a series of warp strands.” The term bears three connotations: “twin,” recalling the use of two strands; “twine,” or cordage, which is produced with the same twisting motion; and the “twining” activity of the active, horizontal strands themselves, twisting or “twining” about each other as they enclose the passive, vertical warp.

Two-strand twining produces a double helix identical to that of two-strand cordage; passive warp strands are caught in each weft twist and serve to join successive twined weft elements into a coherent fabric (Emery 1966:196). The horizontal weft pair is at right angles to the vertical warp elements but actually crosses them at the slightly oblique angle of the helix. The slant thus produced—up-to-the-right (///) when viewed from the weaver’s viewpoint, with the weft horizontal (or an S helix when viewed vertically, like dangling string), or down-to-the-right (\\\) in horizontal courses (or a Z helix when viewed vertically)—is the only visually distinctive characteristic of twining (Emery 1966:196).

Cordage

Cordage may be characterized by plant-fiber type and composition, the twist of the preliminary strand, the number of strands (or plies) combined into the final yarn (either “string” or "rope"), the twist of the finished yarn, and the size and degree of twist of all constituent elements (Osborne and Osborne 1954). Ordinary California and Great Basin cordage was two-ply, composed of two strands separately twisted to form either a z helix or an s helix (when viewed vertically in a dangling position) and then plied or twisted together to produce a yarn helix twisted in the opposite direction, "S" or "Z," to form a string or cord denoted "zzS" or "ssZ."

General Shapes of Baskets in Southern California

Coiled-basket function commonly varies with general shape and sewing texture. Dawson and Deetz (1965) provided a list of general basket shapes for Chumash coiled baskets that may apply to Gabrielino/Tongva basketry, as well. The general coiled-basket shapes include bucket shapes, basin shapes, flat baskets, and globular shapes. Bucket shapes include bucket-shaped baskets (for food preparation); large, bucket-shaped baskets (or burden baskets); and small, flat-topped, conical baskets (or hats). Basin shapes with the smoother work face on the interior were used in acorn-meal preparation. Flat, circular trays were used for winnowing/parching. Globular shapes included both large, globular baskets for storage and small, globular baskets for trinkets and other valuables. In general, the finer the sewing texture, the more decorated and less utilitarian the coiled basket. Twined-basket shapes include open-weave basins, flat baskets, and closely woven, asphalted, cylindrical bottles for water.

Interpreting Original Function from Fragments

Interpreting original function from coiled fragments depends on texture (the number of stitches per square inch) and possible shape (as compared to ethnographic and archaeological examples). Because original shape is difficult to ascertain from tiny fragments like those recovered from LAN-62, texture becomes the more important diagnostic feature. For comparative purposes, the LAN-62 fragments have been grouped into fine texture (98+ stitches), medium texture (51–97 stitches), and coarse texture (50 or less). In general, the coarser the weave, the more utilitarian and less decorated the basket.

Much less is known about the function of twined basketry than that of coiled, but simple twining of whole *Juncus* stems (usually two stems, "plain twining over two") was common throughout southern California and produced simple, undecorated baskets for utilitarian needs. Again, fragments make assigning function difficult. Because whole *Juncus* stems do not pack tightly when used as weft, the technique usually produced baskets somewhat open in texture. All else being equal, the tightest weave was produced by plain twining; so, it was often used for water bottles, which vary from less than 30 to more than 100 turns (or twists per square inch). Twill twining, with warp pairs alternately joined and separated in courses, tends to force the weave apart, and even when closely packed, it is permeable. More open effects could be had by intentionally leaving wider gaps between courses to produce a sieve. Truly tight weaving was impossible, and an impervious texture could be achieved only with the application of asphaltum.

Identification of functional forms in the LAN-62 cordage fragments must focus on the knots and netting, because the short lengths of cordage found separately were similar to that of nets and were otherwise not attributable to specific function.

Comparative Collections

We lack good, documented comparative Gabrielino/Tongva collections. Early travelers visiting the southern California coast sometimes brought home souvenirs of their trips, but these early baskets seldom retained documentation. Local basketry was treated casually, used up, and replaced by cast-off goods. A few baskets survived in the Los Angeles Basin, apparently saved as curiosities or as validation of "Californio" heritage. The "well-known" baskets of Hugo Reid's (1968:44) 1852 account are few. The arts and crafts movement of the early 1900s, with its collector's corners, brought about a new popularity for mission basketry and, in fact, created a new and simplified form of basketry to fill those corners. However, this new popularity came too late for Gabrielino/Tongva basket makers. The "last Indian woman basket maker of Mission San Gabriel" was probably a Serrano woman (Moser 1993:56).

Besides water bottles, so little was recorded and so few examples collected that the regional variation in twined basketry is poorly attested to. Water bottles drew admiration from early observers, but the humble twined working baskets apparently did not. Twined basketry was simple and easily replaced by European cast-offs, and even water bottles were rendered obsolete by mission pottery; thus, little twined basketry remained to be collected. Water bottles in museum collections are apparently all archaeological cave finds from early collectors.

Ethnographic

Museum and private collections include few ethnographic Gabrielino/Tongva baskets. Some are found in southern California museums, such as the Santa Barbara Museum of Natural History, the Southwest Museum, and the Los Angeles County Museum of Natural History (see Appendix E.1). One or two are on the East Coast. A few remain in private hands. Hudson and Blackburn estimated that fewer than 60 coiled Gabrielino/Tongva baskets remain, most identified by attribution and not documentation. In the early 1960s, Lawrence Dawson of the Lowie Museum and James Deetz, then at the University of

California, Santa Barbara, developed an interest in basketry of the Chumash area. They collaborated on a museum exhibition in Santa Barbara, producing a catalog and a scholarly article outlining the characteristics of "A Corpus of Chumash Basketry" (Dawson and Deetz 1964, 1965). Their analysis focused on the Chumash, with the Gabrielino/Tongva discussed in a residual category, but their studies have remained the foundation for Gabrielino/Tongva basket attribution.

Archaeological

Inland Chumash caves were an early focus of collectors and, later, archaeologists. Several sites contained important and well-known baskets (see Appendixes E.2 and E.3). Early collectors removed intact baskets from sites without recording exact locations. Later recoveries by archaeologists provided context for whole baskets as well as fragments. These inland sites, found in the Transverse Ranges, contained either cached basketry/regalia or scattered remains of inland Chumash and Tataviam activity areas that were functionally different from LAN-62 funerary remains. Their importance to the present study lies in the breadth they add to comparisons; several coarse baskets are best known from these caves. Sites throughout Ventura and Los Angeles Counties have added a scattering of additional materials. Several Chumash coastal sites apparently had basketry or basketry impressions, but reports of these have not been published.

Archaeological activity on the Channel Islands began early, but the few textiles were recovered or salvaged by early collectors. The basketry and cordage that can be attributed to the Gabrielino/Tongva are restricted to later work in island settings: San Clemente Island (Hale 1995; Rozaire 1959) and San Nicolas Island (Rozaire 1957). The San Clemente Island sites include Big Dog Cave, various unnamed locales, and the Lemon Tank site (see Appendix E.4). The San Clemente Island material was late, included the same array of textiles as LAN-62, and was burial related, making it valuable for comparison. Rozaire's (1957) San Nicolas Island study was restricted to sea-grass cordage and cordage twining of unknown date, but it included hypotheses about twining that are important to regional comparisons.

Basketry from LAN-62

Basketry and other textiles recovered from LAN-62 provide an unparalleled opportunity to define Gabrielino/Tongva textile traditions. The hundreds of fragments and impressions from LAN-62 will provide a new basis for future studies within the seeming uniformity of southern California basketry, relieving the reliance on attribution for Gabrielino/Tongva ethnographic coiled specimens and providing secure archaeological documentation for scarce twined and cordage traditions. A total of 438 textile items were analyzed and included unidentifiable fragments (n = 9) (Table 108), twined basketry (n = 80, or 19 percent), coiled basketry (n = 206, or 48 percent), and cordage (n = 143, or 33 percent) (Table 109). See Appendixes E.1, E.2, and E.3 for the raw-data tables for coiled basketry, twined basketry, and cordage and netting, respectively.

Table 108. Worked Textiles Recovered from LAN-62

Textile Condition	n	Percentage of Total
Carbonized textiles and identified impressions (including samples conserved in solid matrix)	429	97.95
Unidentified impressions of textiles	9	2.05
Total	438	100.00

Table 109. Types of Identifiable Carbonized Textiles Recovered from LAN-62

Type of Textile	n	Percentage of Total
Twined basketry	80	19
Coiled basketry	206	48
Subtotal	286	67
Cordage	143	33
Total	429	100

Context and Expectations

Given the context and location of LAN-62, two expectations should be met by the textile remains. First, the fragments were all carbonized, apparently the result of intentional firing and smothering, mostly in human cremations or ceremonial-offering pits. Some selection of types considered culturally appropriate for funerary functions should have been evidenced. Textiles originally present at the site but consumed by burning or deposited unburned should not have been found. Second, the site was securely identified as Gabrielino/Tongva, and Gabrielino/Tongva textiles should have been present, to be tested against those traits attributed to their arts (Dawson and Deetz 1964, 1965).

Southern California Basketry Attributes

Southern California basketry was centered on coiling. Baskets that were twined elsewhere in the state were lacking, crude, or replaced by coiled baskets, ceramics, or stone wares. This is in clear contrast to the rest of the state, where all culinary needs were served by basketry. In the far north, coiling was unknown, and plain twining (with an up-to-the-right slant of twist) using woody shoots and roots predominated. In central California, both coiling and twining were found and were made in a great variety of materials and techniques. In general, a leftward work direction and woody-rod foundations were used for central California coiling. Twining in plain or twill work with both up and down slants of twist was found, sometimes within the same ethnic group. On the eastern edge of California, up-to-the-right, diagonal (twill) twining was preferred for all but fancy baskets of fine coiling (Kroeber 1925:819–822).

Southern California coiling was uniformly rightward in work direction and was sewn over bundles of grass or *Juncus* foundation using noninterlocked stitches of *Juncus* or *Rhus* in a uniform manner over the whole region (Kroeber 1925:701). Preferences in combinations of material choice and construction detail in southern California can be used to separate Gabrielino/Tongva coiled basketry from that of the neighboring Chumash and Luiseño. The Chumash preferred to use *Juncus* three-rod, coiled foundations, and the Luiseño used grass bundles. The Gabrielino/Tongva used both. The Chumash trimmed the fag end of the sewing material close to the surface of a basket, and the Luiseño tucked it under the next stitch on the work face (the "mission splice"). The Gabrielino/Tongva preferred the close-trimmed fag end but sometimes used the mission splice in background areas. The Chumash placed blocks of "rim tics" (alternating color stitches) on the final rim row of coiling, but the Gabrielino/Tongva and Luiseño never did. The Luiseño ended the final stitching on a coiled basket with herringbone backstitching. The Chumash did not backstitch, but the Gabrielino/Tongva sometimes did. Plain and diagonal twining in both right and left slants of turn has been found among Chumash and Gabrielino/Tongva archaeological collections. Thus, a corpus of Chumash basketry fragments should contain three-rod *Juncus* foundations and rim tics but no grass-bundle foundations, mission splices, or backstitching. Gabrielino/Tongva coiled fragments would have both foundation types, both splice types, and some backstitched ends but no rim tics (Dawson and Deetz 1965:201–207).

Playa Vista Ethnographic Location: On the Cusp

Neighbors share; however, "for lack of data we cannot speak of directions of influence or origins of elements but only of sharing of features and the likelihood that shared elements have a common origin" (Dawson and Deetz 1965:207). There are three possibilities for the origins of shared features: environment, diffusion, and trade. Both the Chumash and the Gabrielino/Tongva at LAN-62 shared a coastal environment that might have had privileged materials close at hand, specifically *Juncus* foundations in coiled basketry. Diffusion of coiling and twining technologies through several learning processes may have made the LAN-62 basketry tradition more similar to that of the neighboring Chumash rather than the inland Gabrielino/Tongva or other Takic textile traditions. Finally, the Chumash and the Gabrielino/Tongva were known to trade finished products, possibly including the trade of baskets, such as water bottles.

Methodology and Typology Used for Analysis

As noted above, culturally conditioned features, or constellations thereof, may be used to identify baskets of unknown provenience or, as here, to compare entire traditions. The most useful features for determining function for both coiled and twined basketry are shape and texture. In determining cordage function, analogous features, knotting, and strand size may suggest use.

The most useful features for suggesting ethnicity are the details of tradition handed down through generations of related women. Several of these features of material choice and details of technique could be identified in PVAHP fragments and have been reported in the literature and tied to ethnic affiliations. Again, not all features could be identified in the carbonized fragments from LAN-62, nor are all features suitable for comparison between neighboring groups. Work direction, for example, is almost universally rightward in twining and is always rightward in southern California coiling, making it useless for comparison of the basketry of the Gabrielino/Tongva and that of their neighbors. Finally, comparison requires that features be identified and reported for baskets not available for personal examination, which is not always the case in published studies.

Coiled-Basketry-Texture Designation and Function

Most southern California baskets were coiled, as were the fragments from LAN-62. Coiled baskets served the Gabrielino/Tongva in gathering, preparing, and serving acorn and seed foods. It provided large storage vessels, fine baskets for valuables, and offerings at funerals and mourning ceremonies. Whatever their original functions, their last service as funerary and mourning-anniversary offerings provided the fragments extant at LAN-62. However, as noted above, determining original function in coiled-basketry fragments must rely heavily on the sewing texture of the basket. In general, fine texture indicates a fine use and coarse texture a more humble, utilitarian role. This truism is substantiated by two sources: analogous ethnographic Chumash texture/use correlations and my study of some 700 coiled baskets and their texture/use correlations among the Numic Western Mono (Polanich 1994).

Fine-Texture Coiled Basketry

Measured by the time invested in their making, coiled fragments with 98 or more stitches to the square inch were luxury goods; baskets with lower counts could hold water, coiled basketry's most restrictive requirement. The time required for gathering and preparing the materials increased with the need for more stitching material, finely trimmed. Many of the fine southern California ethnographic baskets have complex designs; so, additional material pattern would need to be gathered and prepared, possibly by dyeing. Time invested in actual manufacture increased exponentially in fine, decorated baskets. Thus, when measured over the entire basket wall, even a small increase in stitch count could mean many more hours of weaving time invested. Fine-texture-basket fragments may be from trinket baskets, basin-shaped baskets, or trays (see Appendix E.5). There are few fine Gabrielino/Tongva baskets in ethnographic collections.

Trinket baskets held small items, variously described as "trinkets"; money (including shell beads); and valuables (including thread and handkerchiefs). Chumash trinket baskets include three shapes: fine, globular; shouldered; and bottleneck. However, ethnographic collections of Gabrielino/Tongva baskets include only the small, globular trinket basket of coarser texture, and only one bottleneck is known (in a private collection not reported here). Although it is possible, even likely, that the Gabrielino/Tongva made fine trinket baskets, ethnographic collections offer no support for this conclusion.

Basin-shaped baskets, sometimes elaborately decorated, were apparently used throughout the region for meal preparation and serving food (Dawson and Deetz 1965:201). A "large, rather shallow coiled basket . . . in which large portions of food are served" was called a *komiime'* by the Gabrielino/Tongva; the smaller, individual basket dish was called either *komiime'* or *hokopitat* (Hudson and Blackburn 1987:221, 256).

Several tray forms were used in food preparation and even gambling. There is considerable confusion among the functions, and the deep tray form may be confounded with the shallow basin. The Gabrielino/Tongva word used is *tivao'*, for "the great platter basket" (Hudson and Blackburn 1983:280–281). Truly flat basket trays were apparently not made by the Gabrielino/Tongva (L. E. Dawson, personal communication 1994).

Functional form is not even exclusive to a single texture; trinket baskets, basins, and trays were also made in coarser-texture weave. However, utilitarian bucket bowls; large, globular storage baskets; and gap-stitched trays seem not to have been made in fine weaves but in the sturdier, plainer medium and coarse weaves suitable to their larger sizes and intended uses.

Medium-Texture Coiled Basketry

In the Western Mono case, baskets used by the North Fork Mono (n = 100) to boil acorn mush, the baskets renowned for "holding water," had a mean of 79.7 stitches per square inch, with a standard deviation of 25.6 (Polanich 1994:296). In the Western Mono case, as with the Gabrielino/Tongva, baskets within this range (approximately 55–95) were deemed "medium texture," sufficient to hold water with no excess effort in manufacture. Because the watertight function is the most restrictive, baskets with finer stitching texture are deemed "fine."

Medium-texture baskets were finer among the Chumash than among the Gabrielino/Tongva in every shape category. Chumash and Gabrielino/Tongva basins were made in medium weave, with the Chumash at the top half of the weave count and the Gabrielino/Tongva at the bottom. Chumash bottlenecks and footed bowls and somewhat coarser Gabrielino/Tongva globular treasure baskets represent fancy baskets; Chumash bucket-shaped baskets and trays were probably more utilitarian in nature (see Appendix E.6).

Just as most of the fragments recovered from LAN-62 were coiled, most of these coiled fragments were of medium texture and probably represent most of the Gabrielino/Tongva coiled functional forms. Trays were made in medium weave. Seeds and acorns both required winnowing for preparation, but their specific requirements differed. Both would necessitate a flat or shallow, basin-shaped winnowing basket. A small, nearly flat coiled basket (probably less than 35 cm in diameter) was used for winnowing and parching seeds (Hudson and Blackburn 1983:132). Both this and the larger tray may have, if decorated, been used as gambling trays. A large, nearly flat coiled basket more than 35 cm in diameter was used for winnowing seeds (Hudson and Blackburn 1983:15). A related third process, parching, may have been accomplished in a tray asphalted on the interior, on which seeds were toasted by tossing with hot coals (Hudson and Blackburn 1983:192). The presence of asphaltum was controversial among Harrington's consultants (Hudson and Blackburn 1983:192–193), but archaeological examples exist (Mason 1904:487, Plate 201).

Bucket-shaped baskets were often made in medium weave. Seeds may have been collected and acorns transported in a bucket-shaped carrying basket (*cumuka*), a large, coiled, truncated cone used in conjunction with a carrying net (Hudson and Blackburn 1982:259). Among the Chumash, some of these were undecorated. A large basket with no necessity for tight weave, the burden basket may have fallen at the lower end of the stitch count. A second bucket-shaped basket may have been used as a boiling basket, a large coiled basket (in the form of a truncated cone) in which food was cooked by means of heated stones (Hudson and Blackburn 1983:175). This was not the only Gabrielino/Tongva boiling technique; stone bowls were also used, but the Luiseño ceramic pot was not a Gabrielino/Tongva craft. Another bucket shape, a hopper mortar, was apparently made to purpose: a bottomless, coiled, decorated basket used on a flat stone mortar to which it was anchored with asphaltum (Hudson and Blackburn 1983:112). Two small, bucket-shaped baskets were used throughout the region: the carrying cap worn under the tump line by women and the individual serving bowl, possibly the same basket.

Coarse-Texture Coiled Basketry

Coarse-texture basketry was the workhorse of the southern California culinary practices. The buckets or deep basins discussed above and the coarse trays used to prepare seeds and acorns for cooking were often made in coarse coiling (see Appendix E.7). Used as burden baskets, they were simply decorated and woven on a bundle or three-rod foundation of *Juncus*. Barrel-shaped composite baskets used to store or cache food and other items have been frequently found in archaeological contexts and infrequently included in ethnographic collections.

The winnowing tray used for separating coarse acorn flour from the finely ground may have required gaps in the stitching. For acorns and finely pounded meals, the fine meal must be separated from the coarse, which requires further pounding. Two processes could have been used to accomplish this task. In one method, partly processed flour was spread across the winnowing tray and the coarse particles shaken off. This type of winnowing required a gap-stitched basket to hold the fine meal in the interstices of the surface. The other winnowing process required no gaps in stitching; the meal was separated by vibrating the fine and the coarse to different sides of the coiled tray (Hudson and Blackburn 1983:134–139).

One coarse-texture form is not found in ethnographic collections. Unlike the gap-stitched winnowing tray, the globular storage basket found in Sierra Madre cave collections is coarse, not because of function but efficiency of manufacture. Often patched, sometimes a composite of finer bucket- or basin-shaped baskets missing bottoms and remade with rough "in-coiling" to provide the base and shoulder, these useful baskets were fashioned for use, not beauty.

In reading these descriptions, it is important to remember that "open" and "close" are relative terms. A shallow, "roughly twined" leaching basket and a flat, "open-work" leaching tray were both used to leach acorn flour of tannin. In leaching, water is slowly trickled through a mound of fine meal, dissolving the tannin and carrying it away, but it is essential that the supporting structure not allow the flour to be carried away as well. Although both leaching baskets were described as "open-work," the description of the leaching basket was "open" by virtue of twill twining and was further described by one consultant as "very fine mesh," which would have kept the wet meal secure (Hudson and Blackburn 1982:157, 161). A second, smaller, "open-twined" gathering basket was also described as an open-twined or fine weave: "The mesh is not coarse but the basket is open weave" (Hudson and Blackburn 1982:274). The basket illustrated was, again, twill twined. The few LAN-62 open-twined fragments defied assignment to a specific function.

Close-twined *Juncus* baskets were often coated with asphalt to make them watertight. Water bottles with down-to-the-right slants of turn in the P. A. Hearst collections varied from 24.5 to 126 turns per square inch. The two up-to-the-right water bottles were coarser; the plain-twined bottle had 22.75 turns, and the twill-twined bottle had 30 turns per square inch (see Appendix E.3). In addition to the water bottle, both large and small, a water bailer or line basket for fishing use and a tarred basket bowl (evidently the base of an old water bottle) have been recorded (Hudson and Blackburn 1982:223, 361, 1983:244). Of these asphalted baskets, the water bottle is best known. Mohr and Sample (1955) provided a thorough discussion of the "Cuyama type" water bottles found in caves in the Transverse Ranges. These tall, somewhat tubular storage bottles were apparently meant for storing large quantities of water (Hudson and Blackburn 1983:51). A smaller, personal size is also known and is discussed below. In addition to whole *Juncus* baskets, a few other forms and materials were used in the region. Best known is the seed beater, incorporating wicker weave into a twined-woody-shoot body.

Twined-Basketry Texture and Function

Once again, Harrington's notes provided most of our information about the use of twined baskets in the region. Baskets described as open-twined baskets include a large gathering basket, single or double twined (plain or twill), made of *J. acutus* and sometimes supplied with a cord handle and/or a rim rod (Hudson and Blackburn 1982:269). Both deep and shallow baskets were described by Harrington's consultants, and undoubtedly the lightweight weave could accommodate a variety of needs. Other open baskets with more-specific uses include a berry basket, loosely woven for gathering berries, and a fish basket, used for transporting fish, which could be woven of *Juncus* or sturdier willow (Hudson and Blackburn 1982:276–277).

Cordage Knots and Function

Unfortunately, Harrington's descriptions of nets, detailed and valuable as they are, were blurred by passage of time (Blackburn 1963:16–17). Large-mesh netting, 6–9 mm between knots, would have produced netting with 1/2-inch openings. Probably too small for hunting or fishing, small-mesh netting might have been used for carrying and supporting baskets or other loads in transport. Harrington's information on the hammock-style carrying net seems to fit. Described as "big mesh," over 1/8 inch and made of milkweed (*Asclepias*) or Indian hemp (*Apocynum*), the net seems to have been rectangular and to have required a stick to close the long sides together when distended by a burden (Craig 1967:117).

Smaller cordage could have been used for bags. Hudson and Blackburn (1983:290) discussed the several types of net bags and concluded that the distinctions made by Harrington's consultants were based on mesh size, the presence of a drawstring or wooden ring at the bag's neck, and the relative size and intended function of the bag. Archaeological cordage is scarce but is still the best comparative resource (see Appendix E.8).

Manufacturing Markers for Ethnicity Assignment

Although the texture of a coiled fragment can suggest the original function of a coiled basket, the details of coiling manufacture technique are more important for determining ethnicity. One significant detail is the choice of coiling-foundation arrangement. A bundle arrangement (bunched stalks of *Muhlenbergia rigens*) was the universal foundation in southern California, except with the Chumash and the Gabrielino/Tongva. A foundation arrangement of three elements (*Juncus* arranged in a triangular fashion), the three-rod foundation, was found only among the Chumash and the Gabrielino/Tongva. It is possible to identify both foundation arrangements in coiled archaeological fragments or impressions on asphaltum and to identify the constituent *Juncus* or grass elements in deconstructed fragments.

The second important detail of manufacture is the splice of sewing elements. Because sewing strands are finite, the ends must be secured in coiling. In southern California, the mission splice was ubiquitous. However, the Chumash used this splice sparingly and never in a pattern, only in background areas. The Gabrielino/Tongva seem to have used the method more frequently, though, again, never in patterns. To the south and east, this was the preferred splice, and advantage was taken of its decorative possibilities.

Finally, the rim finish on the last row of a coiled basket is especially indicative of ethnicity. Rim tics, alternating stitches, or patches of color were ubiquitous on Chumash baskets but seldom found on Gabrielino/Tongva coiled baskets and never among the southern Takic people. Herringbone rim finish, a figure-eight effect, was used by the Luiseño and sometimes by the Gabrielino/Tongva but not by the Chumash.

In twined baskets, the weft slant of twining twist, discussed below, has been identified as an ethnic marker. In general, an up-to-the-right slant (////, viewed horizontally) is associated with Takic peoples, and a down-to-the-right slant (\\\\, viewed horizontally) with the Chumash. The choice of plain or twill twining does not seem to be ethnically marked, but the use of auxiliary weaves is restricted to Chumash water bottles, in which several complex, three-weft-strand techniques have been found. Twist of strand and ply in cordage fragments are also ethnically marked. As discussed below, an ssZ twist is ascribed to the Chumash and a zzS twist is ascribed to the Gabrielino/Tongva and other Takic peoples.

Raw-Material Choice

At least 78 different species of plants representing 36 plant families were found in one study of California ethnographic baskets (Merrill 1923). As Merrill concluded, the use of specific plants was not wholly dictated by availability or suitability for any particular technique but was determined, amid a combination of those factors as developed by each tribe or group of tribes within a specific environment, through cultural choices over time. Those choices, as reflected in the archaeological record, can document both the local environment and the cultural identities of the people living there.

Coiling Materials

Several varieties of *Juncus* were used in basketry throughout the region (Timbrook 2007:97–102). For coiling, *J. textilis* supplied the main sewing strand from Santa Barbara to San Diego and inland to Palm Springs, and the white strands of tough *R. trilobata* were used for highlights and long-wearing basket bottoms. A second *Juncus* species was used for foundations by the Chumash and the Gabrielino/Tongva, and the groups to the south and east relied on grass bundles. A third species of *Juncus,* or the base of *J. textilis,* was used for decoration.

Juncus

Sewing strands of *J. textilis* were used by the Chumash, the Gabrielino/Tongva, and all of missionized southern California (Moser 1993), and it can tolerate both seasonal drought and total inundation (U.S. Department of Agriculture Natural Resources Conservation Service [USDA-NRCS] 2007). Harrington's Chumash consultants described it as 6 or 7 feet long, growing in bunches, and found at the mouth of the Ventura River (Hudson and Blackburn 1987:214). The lower portion (usually belowground) was red and was used for patterning (Hudson and Blackburn 1987:214). The upper portion was sometimes white, but the ordinary stalk could be whitened by laying it on a bed of ashes (Hudson and Blackburn 1987:223). The shoots could be harvested year-round and were apparently cured for a time in the sun or quickly in ashes and then stored whole. The shoots were not split until needed. If they were to be used for light background color, they were scraped to remove the spongy pith and trimmed to the desired width. If they were to be dyed black, the pith was left on, and the split shoots were buried in a specially prepared mud bath (Hudson and Blackburn 1987:217–225). The Gabrielino/Tongva also used a dye bath of an unknown plant that produced a brownish black strand (Hudson and Blackburn 1987:225).

Rhus trilobata

Unlike *Juncus*, *R. trilobata* is intolerant of flooding or high water tables and grows in shrub and oak woodlands in the region. Found over much of California, it has several ecotypes that vary in character (USDA-NRCS 2007). One type found across southern California provided tough sewing strands for basket bottoms and some white pattern material for the Gabrielino/Tongva and their neighbors. Sometimes mistaken for willow by ethnographers, *Rhus* looks much like willow after the shoots are cut. For sewing strands, it was probably stripped of bark, split into four long strands, thinned of pith, and trimmed until even and pliable; sometimes the bark was removed last (Hudson and Blackburn 1987:225–226). Identified by a somewhat folded or "gathered" surface, the strand lies flat, not rounded, on the basket.

Other Materials

A few other sewing-strand materials are known to have been used by the better-documented Chumash, including sedge, bulrush, and possibly willow. These materials seem to have had limited use in Chumash territory and have not been attested to for the Gabrielino/Tongva (L. E. Dawson, personal communication 1981).

Regional Variation in Coiling-Foundation Materials

Juncus balticus

Both the Gabrielino/Tongva and the Chumash used another *Juncus*, *J. balticus*, for coiled foundations. Described by Harrington's consultants (Hudson and Blackburn 1987:215) as thinner (1/16 inch), tougher, and growing in individual shoots, not in bunches like *J. textilis*, it grew both in the sand at the mouth of the river and in the mountains. One subspecies was more slender but as long as *J. textilis,* and the second was both more slender and much shorter (Hudson and Blackburn 1987:229). The use of two closely related plants for specific basket parts was deliberate. A three-rod foundation of thicker *J. textilis* would have made a fatter basket foundation than did the slender *J. balticus*. *J. textilis* is woodier in texture than *J. balticus* and retains its rounded shape when split, which may account for its preferential use as a sewing strand (USDA-NRCS 2007). There may have been a restricted harvesting season for *J. balticus* (Hudson and Blackburn 1987:232), but plant stems could be stored for long periods.

Muhlenbergia rigens

The final plant commonly used in southern California coiling, *Muhlenbergia rigens*, was also widely distributed and used for coiled foundations almost universally throughout the region. Only the Chumash and the Gabrielino/Tongva used *Juncus* in addition. *Muhlenbergia* is plucked from its bunch in the fall and stored in bundles. Before use, the sharp seeds must be stripped from the stalk. In valleys, stream sides, and meadows, this perennial bunchgrass can withstand dry hillsides or flooding but not poorly drained soils. Periodic flooding from streams will not kill it, but once established, it is quite a drought-tolerant, good southern California native (USDA-NRCS 2007).

Twining Materials

Juncus

Twined basketry, like coiled, was made from *Juncus*, but a different species. *J. balticus* was used for coiled foundations, and *J. textilis* was used for sewing, but *J. acutus* was preferred for twining. Harrington's notes identified Chumash *'esmu* as *J. acutus*. It was thinner and smaller than *J. textilis,* had a needle-like point, and grew in Ventura, Mugu, and Hueneme but not Santa Barbara (Craig 1967:89). *J. acutus* was probably also used at LAN-62.

Woody Shoots

Although woody shoots were sometimes used for twined basketry, with the exception of the unique, unidentified "comb" fragment, none appeared in the LAN-62 fragments.

Tule

Sewn or twined tule mats were used for a wide variety of purposes, and a few fragments of tule were included in the LAN-62 textiles. These fragments were too damaged to identify either species or function.

Cordage Materials

Although the materials used to make LAN-62 cordage and netting could not be determined in the fragments because of carbonization, a short discussion of those used in the region is useful for assessing some of the comparative materials.

Bast Fibers

Early reports of Gabrielino/Tongva cordage have documented the use of bast fibers: "[Their] fiber [is the color of] coconut husk, with which they make their cords" (Vizcaino [Woodward 1959:151]). "Hemp was made from nettles, and manufactured into nets, fishing line, thread, etc." (Reid 1926:44).

In addition to human hair and the yucca, Harrington recorded the use of nettle (*Urtica*), Indian hemp, and milkweed among the Chumash, the last two called "red milkweed" and "white milkweed," respectively, by consultants. Although the LAN-62 cordage was carbonized, two tiny fragments of cordage, one red and one white, survived the flames. It is probable that much, if not all, of the fine cordage and netting found among the LAN-62 fragments was made of bast fiber, because yucca is a coarser fiber, and no human-hair cord was present.

Sea Grass and Grass

On San Nicolas Island, marine grass (*Phyllospadix torreyi* and *P. scouleri*) was used to make rope, skirts, capes, bags, and baskets. In ethnographic island Gabrielino/Tongva territory, the undated assemblage was 90 percent zzS cordage (Rozaire 1957:20–27). Sea-grass technology apparently has considerable time depth in the Chumash-held islands to the north. Early Holocene sea-grass cordage from San Miguel Island, at Daisy

Cave, dated to between 8600 and 9900 cal B.P. By contrast to the San Nicolas Island materials, the Daisy Cave sea-grass cordage was 88 percent ssZ twisted (Connolly et al. 1995:309, 313). This prehistoric dichotomy in sea-grass-cordage twist (ssZ for the Chumash and zzS for the Gabrielino/Tongva) has been applied to historical-period ethnographic groups and used to characterize their cordage industries as a whole. No ethnographic accounts of sea-grass-cordage manufacture are known.

Results of Analysis

The textile remains from LAN-62 included carbonized fragments, impressions on asphaltum, and carbonized basketry imbedded in solid matrix. These varied remains required differing analytical techniques and yielded differing levels of information. The fragments were all remains of intentional burning in a smothered atmosphere, either in graves or at ceremonial burn sites. Recovered from graves and artifact concentrations or from scattered fragments in archaeological excavation units, the fragments were differentially preserved for analysis by variations in recovery and curation. Both initial deposition and subsequent recovery and preservation affected the determination of typology and ethnicity.

Technological Analysis

The several specific techniques of textile manufacture found in the textile remains from LAN-62 provided the basis for assigning types for analysis. Then, through comparison to ethnohistoric reports, ethnographic collections, and archaeological remains from the region, functional forms were inferred, and probable ethnic origins were suggested.

In this study, textiles recovered from LAN-62 were analyzed and included twined and coiled basketry and cordage (see Table 109). The textile materials from the PVAHP were preserved by three distinct processes, which determined the level of analysis:

1. Carbonization of textiles preserved many of the technical features for analysis. Both fragments of completed material (basket walls and cordage netting) and fragments of weave elements (warp and weft, foundation and strand, and strand and knots) yielded information.

2. Impressions of textiles in and on asphaltum preserved the gross features of basketry-weave type.

3. Conservation of basketry in solid matrix (as specified and suggested by the Most Likely Descendant [MLD] for the PVAHP), consolidating the mass and protecting the surface with applied paper, rendered most of the technical features illegible.

Deposition

As discussed in detail below, the materials to be analyzed were recovered from excavation units, burn pits, human cremations, and artifact concentrations of carbonized materials identified as mourning features. Initial or primary deposition was probably in either a funerary or a mourning context, because excavation units recovered carbonized materials that could not be otherwise explained. Although the burned pit may reflect primary deposition, carbonization requires smothering; so, an open fire source is unlikely. Primary deposition in human cremations and artifact concentrations differed along two axes: choice of material deposited and treatment of the burning material. As discussed below, burials and mourning features differed in ratios of material types recovered. This may reflect original deposition or the outcome of the treatment of mourning features, which were subjected to a "stirring" process. Differential preservation favored sturdy construction, because stirring was intended to completely destroy the mourning offerings (Reid 1968:42).

Preservation

Archaeological recovery and curation techniques may also have affected the number and types of materials analyzed. Textiles are unexpected in California, and at LAN-62, the carbonized fragments, impressions on asphaltum, and materials imbedded in matrix were subjected to several recovery and curation techniques.

Carbonized fragments recovered from LAN-62 were stored in small specimen bottles, placed in plastic bags, packaged with granular matrix in folded aluminum foil, or sewn onto small pieces of ethafoam. Fragments in rigid bottles were best preserved, whereas bagging was variable in result, and blindfolding into aluminum with matrix often assured destruction. Those fragments sewn to ethafoam survived well but allowed only one surface to be examined.

As examination of the conservator's notes attested to, many of the impressions in asphaltum were initially thought to be basketry. Not all of those were available for analysis. Finally, the masking of materials imbedded in matrix with paper that could not be effectively removed left those materials out of the analysis. In short, the analysis presented below should be a more accurate indicator of the presence, not the absence, of any one technology.

Typological Assignment of LAN-62 Coiled-Basketry Remains

Not all of the culturally conditioned features found in whole coiled baskets were available among the LAN-62 fragments, because fragments could not be used to positively identify the original shape, functional form, design layout and placement on the design field, design units, slant of diagonals in patterns, method of adding fresh elements to the foundation, or work face of a basket. In addition, carbonized material could not reveal pattern color, and impressions on asphaltum could not identify foundation type or material and gave distorted measurements of stitch gap.

Features either universally present or absent in the region and in LAN-62 fragments were not used in creating types (Table 110). Three main observations were made:

- California coiling was simple coiling, usually employing one active strand to form a single helix.

- Work direction was rightward throughout southern California, creating a down-to-the-right slant of stitch along the horizontal foundation element and a counterclockwise spiral in the stitching strand, both of which were identified in fragments or separate elements.

- Stitch type was noninterlocked. No exceptions were found in the LAN-62 materials.

Plant identification in carbonized fragments indicated the following:

- Experiments with identified plant samples of *Juncus* and grass determined that carbonized *Juncus* materials exhibit distinctive "threads" protruding from the shoot ends, the remains of vascular conductive tissues. These "threads" identified *Juncus* used as coiled foundation. Grass is hollow, variable in diameter, and lacks these "threads."

- "Threads" were sometimes found in stitch strands that were too badly damaged for identification of characteristic *Juncus* surface texture (Figure 120).

Identification of three-rod foundations was done through the presence of a raised "belly" sometimes observed in individual stitches that was created by the three-rod, triangular foundation arrangement. Bundle arrangements lack this protrusion. Second, a single foundation element could be traced along the work, following the base edge of that triangular arrangement. Bundle foundations are usually twisted along their lengths to keep them compact.

LAN-62 Coiled Basketry

Interpreting original function from coiled fragments depends on texture, possible shape, and comparison to known types. Because original shape was often impossible to ascertain from the LAN-62 fragments, texture became a primary feature. Comparison to ethnographic Gabrielino/Tongva baskets was the necessary first step in interpreting function from the LAN-62 fragments.

Texture-Designation Determination for Coiled Basketry

Texture designations of coarse, medium, and fine were assigned to the coiled basketry recovered from LAN-62 using stitch count (stitches per inch of foundation coil multiplied by the number of foundation coils per inch) (Tables 111 and 112). Stitch count is a measure of both the work invested in making a basket and the intended use of the basket. Because most of the fragments with both counts available displayed

Table 110. Typological Assignment of LAN-62 Coiled-Basketry Remains

Culturally Conditioned Coiling Feature	Unit of Measurement	Identification in LAN-62 Intact Fragments	Identification in Individual Elements	Used for Subtype?
Coil width	mm	all complete fragments	no	no
Stitch width	mm	all complete fragments	strand width	no
Stitch gap	mm	all complete fragments	no	yes
Stitches per inch	count	all complete fragments	impressions on foundation	yes
Coils per inch	count	all complete fragments	no	yes
Foundation type	three-rod/bundle	most complete fragments	foundation	yes
Foundation material	*Juncus*/grass	most complete fragments	foundation	yes
Stitch expansion	all two-in-one	few complete fragments	no	no
Strand material	*Juncus*/*Rhus*	most complete fragments	strand	no
Stitch splices	mission/cut	few complete fragments	no	no
Coil termination	herringbone?	few complete fragments	no	no
Rim finish	rim tics?	few complete fragments	no	no
Decoration	new strand	few complete fragments	no	no
Start	bundle?	few complete fragments	no	no

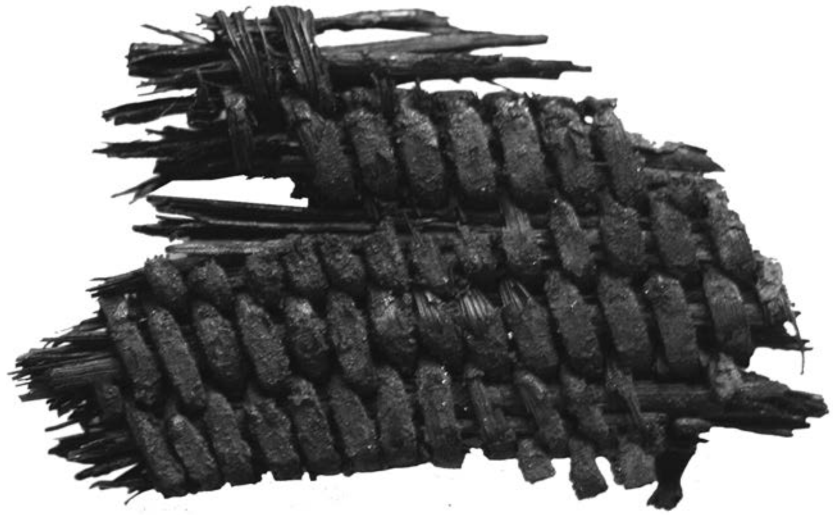

Figure 120. Coiled fragment with *Juncus* sewing strands, LAN-62.

Table 111. Texture Designations for Coiled Basketry

Texture	Stitches per Square Inch	Stitches per Inch	Coils per Inch
Coarse	50 or less	9 or less	less than 5
Medium	51–97	10–13	5–6
Fine	98 or more	14 or more	7 or more

Table 112. Texture Designations of Coiled Basketry from LAN-62

Texture	LAN-62	Percentage of Total
Coarse	28	14
Fine	58	28
Medium	79	38
Unknown	41	20
Total	206	100

a ratio of twice the number of stitches to coils, or 2:1, it was possible to estimate the number of coils per inch for cases in which only the stitch count was available.

For external comparison and discussion, it was useful to treat each combination of texture, foundation type, and material as a type. In the LAN-62 collection, fine *Juncus* three-rod fragments (n = 31) had from 98 to 264 stitches per square inch and a linear stitch-count high of 24. Fine grass-bundle fragments (n = 16) had from 98 to 240 stitches per inch and a linear stitch-count high of 24. However, one anomalous fine grass-bundle fragment (nonburial Feature 384 in FB 3) may have had as many as 384 stitches per square inch. Medium-texture *Juncus* three-rod fragments (n = 59) had from 54 to 96 stitches per square inch. Medium-texture grass-bundle-foundation fragments (n = 15) had from 60 to 96 stitches per square inch. Coarse-texture *Juncus* basketry (n = 16) had both three-rod and bundle foundation types. In addition to texture, two other methods were evidently used to achieve functional utility in these coiled baskets: coating the finished basket with asphaltum to protect the surface or to achieve a watertight vessel and leaving gaps between the stitches to achieve an open texture. Where gaps measured 1.5 mm or greater, they were deemed intentional and were noted in the designations.

Shape and texture govern the functional form of coiled baskets, but choices made in materials and specific construction techniques often indicate ethnicity. The foundation type, bundle or three-rod, and foundation materials, grass or *Juncus*, varied among fragments and were used in typing. Strand material was not used, as it was uniformly *Juncus*; *Rhus* was found in only two fragments. Details of construction, including rim finish and strand-splicing techniques, were noted where found.

Fine-Texture Coiled Basketry

Fine-texture coiled Gabrielino/Tongva ethnographic specimens are extremely rare, and their fragmentary presence at LAN-62 was among the most important findings. Fine *Juncus* three-rod fragments had from 98 to 264 stitches per square inch and a linear stitch-count high of 24. One fragment (nonburial Feature 433 in FB 3) had a coiled start worked on a bundle of shredded material. Another (nonburial Feature 45 in FB 3) was started on whole *Juncus* that was crimped, not shredded. One fragment (Burial Feature 615) had sewing material of *Rhus*, as evidenced by the "gathered" aspect of the surface. Two fragments (Burial Feature 59) had unidentified stitch material that was very round in aspect—possibly another species of *Juncus* rather than the ubiquitous *J. textilis*.

Fine grass-bundle fragments had from 98 to 240 stitches per inch and a linear stitch-count high of 24. One anomalous fragment (nonburial Feature 384 in FB 3) may have been even finer, because the stitch count of 32 per linear inch (strand width = 0.6 mm) and 12 coils per inch (coil width = 1.8 mm) resulted in 384 stitches per inch. One fragment (EU 817) included the termination of the coiling, which was secured with a herringbone stitch. Comparison to ethnographic collections from the region suggested several analogous Gabrielino/Tongva forms of these fine baskets: decorated basin, trinket basket, hat, or (possibly) tray. One fragment from LAN-62 (EU 187) may have been the remains of a hat, because the extreme wall curvature was visible. It was not possible to determine which forms were represented by the fine LAN-62 fragments, because the fragments were too small to distinguish between basin and tray forms.

Medium-Texture Coiled Basketry

Medium-texture *Juncus* three-rod fragments had from 54 to 96 stitches per square inch. Several of these fragments came from solid matrix or stacks of baskets (e.g., nonburial Features 45 and 458 in FB 3) (Figure 121). Two fragments (nonburial Feature 458 in FB 3) had the unidentified, rounded stitching material seen in finer examples. One fragment (nonburial Feature 458 in FB 3) with 60 stitches per square inch had an asphaltum coating. Another fragment (Burial Feature 134) included a mission splice, with the fag end of the new strand tucked under the first new stitch on the work surface of the basket.

Medium-texture grass-bundle-foundation fragments had from 60 to 96 stitches per square inch. One fragment (Burial Feature 59) included the very rounded, unidentified sewing material seen in a few three-rod fragments. Another fragment (EU 817) had *Rhus* sewing strands, and another (EU 144) had a herringbone termination on the final sewing course (Figure 122).

Again, given the size of the LAN-62 fragments, it was not possible to suggest specific uses for each, only the possible functional category. The ethnographic collections included basins, a bucket, and globular trinket baskets. As noted above, parching may have been accomplished in a tray asphalted on the interior, on which seeds were toasted by tossing with hot coals (Hudson and Blackburn 1983:192). One relatively large LAN-62 impression in asphaltum (Burial Feature 438) may have been the remains of an asphalted parching tray. The impression was convex in form and represented an asphaltum coating on the concave surface of a gently curved basket. The impression showed a three-rod *Juncus* foundation with 84 stitches per square inch. A second use known for the Chumash asphalted coiled basket is as a water or offering bowl for ritual use, but it was apparently bucket shaped (Hudson and Blackburn 1986:243–246).

Figure 121. Coiled and twined basketry, stacked, nonburial Feature 458, LAN-62.

Figure 122. Herringbone termination, EU 144, LAN-62.

Coarse-Texture Coiled Basketry

Coarse-texture *Juncus* basketry has both three-rod and bundle foundation types. The *Juncus* three-rod foundation has relatively more courses per inch than the bundle type, because there is a limit to the size that can be achieved with three relatively slender *Juncus* rods. Ethnographic comparisons suggested deep basins, buckets, storage baskets, or trays. One fragment (nonburial Feature 458 in FB 3) had a mission splice. A fragment (nonburial Feature 458 in FB 3) of *Juncus* foundation had perceptible gaps between the stitches. Coarse-texture grass-bundle-foundation fragments (n = 6) were the coarsest basketry found at LAN-62. One fragment (nonburial Feature 458 in FB 3) had only 12 stitches per square inch, and another had only 16 (Burial Feature 576). All of these fragments had gaps between the stitches. Finally, possible mends or repairs (nonburial Feature 458 in FB 3) of the type found on coarse-texture coiled utility baskets may have signaled the presence of storage baskets (Figure 123).

Typological Assignment of LAN-62 Twined-Basketry Remains

As with coiled fragments, not all culturally conditioned features were used in analysis or in creating types: (1) The lean of warp rows, the method of warp insertion and subtraction, and the method of weft additions could not be discerned. (2) Warp arrangement was assumed to be radial and ubiquitous locally, unless otherwise demonstrated. (3) All warp and weft material was whole *Juncus*, a shoot. (4) Preparation of *Juncus* was nil. (5) Because the *Juncus* whole shoot has no flat surface, warp-face distinctions were not germane. (6) Although auxiliary weaves are known in *Juncus* twining, none were observed. (7) There was no decoration apparent. (8) No auxiliary means of support, weaving starts, underselvedges, or selvedges were observed. (9) Only one weft selvedge was found (Burial Feature 273) (Table 113; Figure 124).

Again, the shape of the basket and the texture of the surface determine the functional form of twined weaving, as of coiled weaving. Some basket shapes could be determined, thanks to heavy applications of asphaltum. In other cases, only the holes left in asphaltum by vanished weft strands could be discerned and measured (Burial Features 136, 223, and 512). Close-twined fragments (as measured by turns per square inch) predominated in the collection, possibly because open twining is especially liable to disintegration under the twin impacts of fire and mechanical force. However, even weft fragments can reveal the weaving helix and sometimes exhibit impressions of warps. Similarly, warp fragments may have impressions of weft evidencing the slant of weft turn.

Texture and weaving mechanics were the best suited for comparative types. Texture was measured by the number of

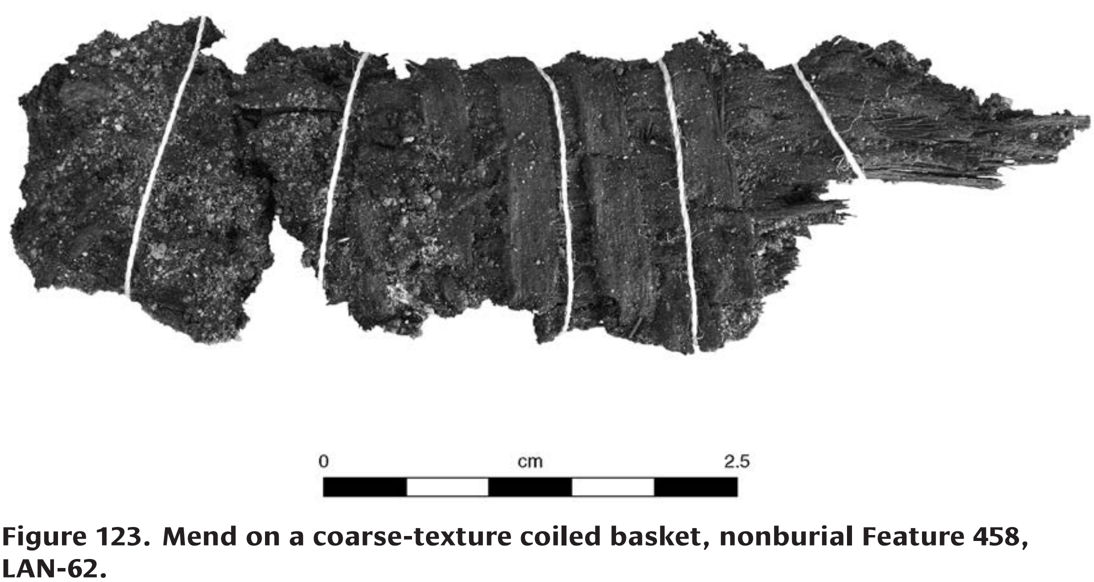

Figure 123. Mend on a coarse-texture coiled basket, nonburial Feature 458, LAN-62.

Table 113. Typological Assignment of LAN-62 Twined-Basketry Remains

Culturally Conditioned Twining Feature	Unit of Measurement	Identification in LAN-62 Intact Fragments	Identification in Individual Elements	Used for Subtype?
Warp width	mm	all complete fragments	yes	no
Weft width	mm	all complete fragments	yes	no
Weft-row gap	mm	all complete fragments	no	yes
Weft turns per inch	count	all complete fragments	no	yes
Warps per inch	count	all complete fragments	no	yes
Main weave	plain/twill	all complete fragments	no	yes
Slant of weft turn	up-/down-to-right	all complete fragments	yes	yes
Warp material	*Juncus*	all complete fragments	warp	no
Weft material	*Juncus*	all complete fragments	weft	no
Stitch splices	paired?	none observed	no	no
Weft termination	bound down?	one complete fragment	no	no
Warp selvedge	bound down?	no	no	no
Decoration	beads?	some associated	no	no
Start	crossed?	none observed	no	no

Figure 124. Selvedge on a twined basket, human-burial Feature 60, LAN-62.

turns per square inch (the number of weft turns multiplied by the number of weft courses); designations of open and close were assigned based on the presence of large gaps between weft rows. Intentional gaps of more than 1.5 mm, rather than warp width and weft width, were used, because gaps indicate work the basket was intended to do. Unlike the comparable situation in coiled fragments, there was no way to estimate the count per square inch in the absence of several successive courses, because spacing was variable.

Two mechanical features were essential to comparative typing: slant of turn and main weave. The slant of turn of the weft is the diagnostic feature of twining, as discussed above, and has assumed importance in regional comparisons. It was possible to determine the slant from individual elements, from impressions on the warp, and from the helix twist of weft elements, making it applicable to disarticulated fragments. The other essential feature was main weave, either plain twining or twill twining. In plain twining, the same warp or group of warps is engaged on every course. In twill twining (also known as diagonal, alternate-pair, or split-pair twining), a different or alternate pair of warps is engaged in each successive round (Figure 125). Both techniques were present at LAN-62, although many fragments (n = 25) were impossible to type for this feature.

LAN-62 Twined Basketry

A total of 80 twined-basketry fragments were analyzed from LAN-62. Plain, down-to-the-right twining (usually over a pair of warp shoots) was the most frequently found fragment (n = 26). As with fine coiling, this may have been an outcome of preservation, because tight weave holds together, especially when asphalted. Twill, down-to-the-right twining was also frequently found (n = 10) asphalted and/or embedded in solid matrix. Plain, up-to-the-right twining was found in fragments and in several disarticulated elements (n = 14). Twill, up-to-the-right twining was found in only 3 fragments. Open twining was represented by disarticulated fragments (n = 4), which were frequently impossible to type further.

Most of the LAN-62 twined basketry was relatively close twined, and some of it was asphalted. The slant of weft turn was predominantly down-to-the-right, and the main weave

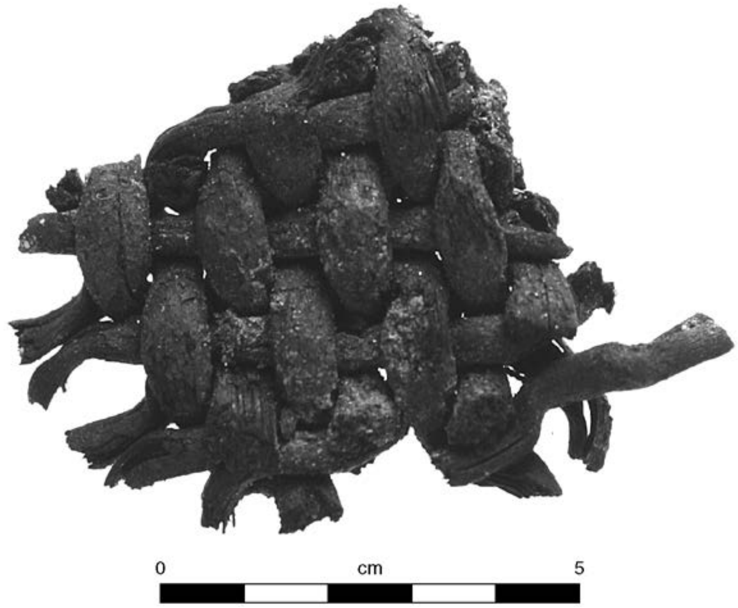

Figure 125. Twill-twined fragment, human-burial Feature 60, LAN-62.

was plain twining over paired warps. The prevalence of close twining over open twining may have been skewed by preservation or sacrificial intent, but it has been reported from other sites, as well. So little twined basketry exists in ethnographic collections that archaeological collections provide the primary material for comparisons.

It is possible that the LAN-62 asphalted fragments of plain, down-to-the-right, close twining came from water bottles. However, the weft courses of "reinforcing" weave found on all but one (Inventory No. 1-14503) by Mohr and Sample (1955:349) were completely absent from the LAN-62 fragments. Because these reinforcing weaves are sturdier than plain or simple twill twining, if used, they should be present. The water-storage basket that most resembled these fragments was one of unknown provenance in the collection of the Los Angeles County Museum of Natural History (Inventory No. A.2562.58-143). The basket was plain twined with a down-to-the-right weave; it was 46 cm high and 78 cm in circumference and had 58 twists per square inch.

It is also possible that the LAN-62 fragments of close twining were from the smaller individual water bottle, plain or twill twined and covered in asphaltum, with a narrow neck and round body. In comparison to museum examples, any fragment with more than 25 turns per square inch might be from a bottle. The remains of one such bottle were reported from LAN-62, but the artifact could not be located (Figure 126). It was reported to be 20 cm long and 10 cm wide. The Gabrielino/Tongva water bottle, *pahatath,* apparently had a round bottom, unlike the indented form of the large bottle (Hudson and Blackburn 1983:39). A lost example from the "Lone Woman" of San Nicolas Island had no reinforcing bands but was plain, up-to-the-right weave (Hudson and Blackburn 1983:46, Figure 97-6). It is noted that several examples of asphaltum recovered from LAN-62 were not examined for this chapter.

Only one twined fragment from LAN-62 was not whole *Juncus* twining. The fragment (nonburial Feature 458 in FB 3) of fine, peeled-shoot warp was twined with fine cordage into a comb-like form obscured with wrapping over the work (Figure 127). There was no clue in the literature to suggest the original use of this fragment.

One remarkable close-twined basket (Burial Feature 265) was part of a composite bundle surrounding a copper pot in three layers: loom-woven cloth, unworked tule, and the twined *Juncus* basket. The basket was twill twined with down-to-the-right slant of weft turns and 48 turns per square inch. Olivella beads (measuring 5.9 mm in diameter on average) were associated with the basket.

Typological Assignment of LAN-62 Cordage Remains

The cordage fragments were examined for evidence of a number of culturally conditioned features, some of which were included in the external comparisons (Table 114). The greatest loss of information was, again, due to the fragmentary and carbonized state of the materials.

No material identifications were possible, although one tiny fragment of unburned cord was reddish (possibly Indian hemp), and another was gray (possibly milkweed). Few knotted fragments with wide-spaced knots included knots at each

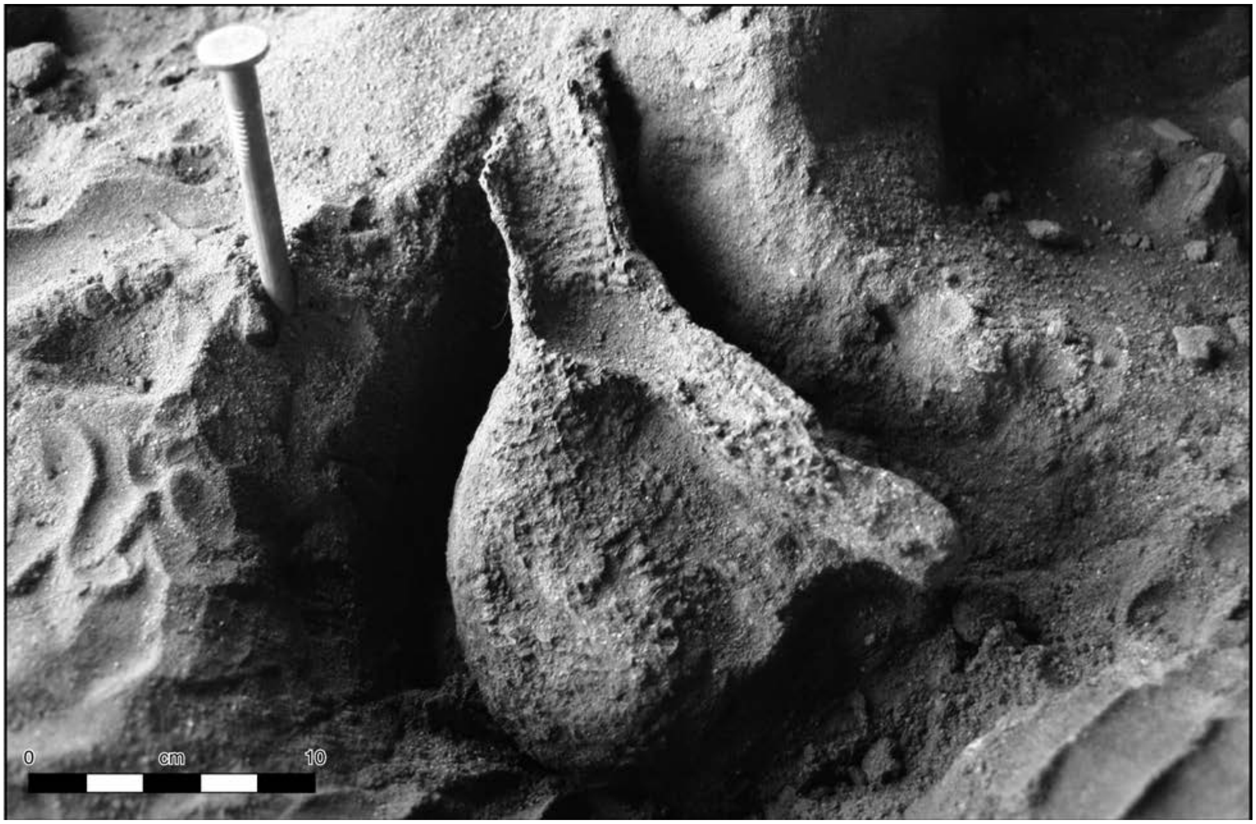

Figure 126. Twined water bottle, LAN-62.

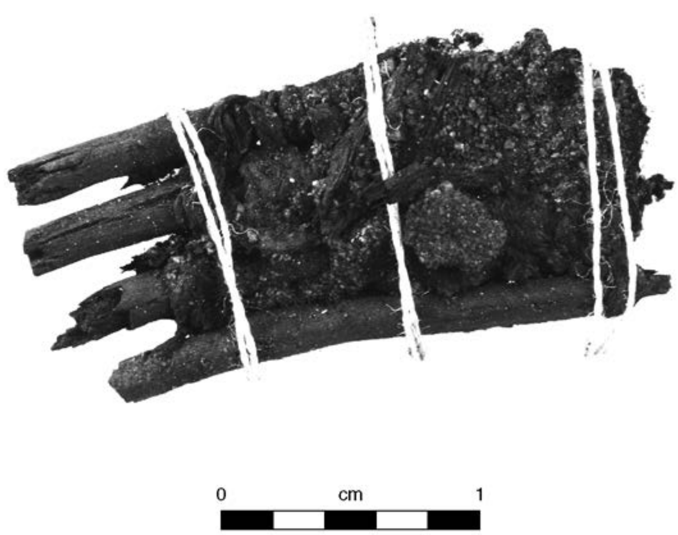

Figure 127. "Comb" fragment, nonburial Feature 458 LAN-62.

Table 114. Typological Assignment of LAN-62 Cordage Remains

Culturally Conditioned Cordage Feature	Unit of Measurement	Identification in LAN-62 Intact Fragments	Identification in Individual Elements	Used for Subtype?
Diameter of cable	mm	several examples	no	no
Diameter of cord	mm	all intact cords	no	yes
Diameter of strand	mm	most intact cords	yes	no
Strand helix	S or Z	most intact cords	yes	yes
Cord-ply helix	S or Z	all intact cords	no	yes
Number of strands	counted	all intact cords	no	no
Number of cords	counted	few cables present	no	no
Angle of ply helix	degrees off vertical	most intact examples	no	no

end of the strand; thus, netting mesh in open specimens was often impossible to measure accurately.

Knots were found both as parts of netted fabrics and as individual fragments without any measurable strands attached. When netting was indicated, the knots were counted and measured. When the knots survived without attached cordage, they were measured, and the total number was noted. The several types of knots included half-hitch (or knotless netting), netting knots, and square knots.

With the exception of sea-grass cordage from San Nicolas Island, little cordage from the area exists in ethnographic or archaeological collections. Thus, the characteristics chosen for external comparison were the few that have received attention in the past (see Table 114):

- zzS cordage of two z-twist strands combined into an S-twist string or cord,
- ssZ cordage of two s-twist strands combined into a Z-twist string or cord, and
- netting, which was described and compared to individual specimens.

LAN-62 Cordage

Cordage from LAN-62 was typical of California: it was two-strand, and the two-strand elements plied, or twisted around each other, at an angle of around 30° from vertical. Almost all cordage could be characterized as "string" rather than rope: hard-spun, z-twist and S-ply (zzS) string (Table 115). Many of the fragments included knots—both ordinary netting knots and fine, closely knotted fabric—and closely worked, knotless netting.

The LAN-62 cordage was fine, two-strand, zzS cordage with the two initial strands twisted to the left and the plying twist to the right. Fine cordage, like the majority of LAN-62 fragments, was undoubtedly made on the thigh, with the initial twist made by rolling the strands up the thigh and the plying twist made by rolling them together down the thigh, away from the worker. Cordage material could not be determined from the carbonized fragments, but a few scattered, noncarbonized bits were found, one gray-white (Burial Feature 653) and the other reddish (EU 165).

Some of the cordage may have been used in mat construction. Several fragments of cordage were found in association with rush or possibly tule materials (EU 136, Burial Features 556 and 601, nonburial Feature 458 in FB 3), although it could not be determined whether the rush was twined with or pierced by the cordage.

It is probable that most of the LAN-62 cordage was used for the netting found in larger fragments (Figure 128). Small fragments of three-ply and four-ply cables fashioned from zzS cordage were also present (Burial Feature 426). The net fragments from LAN-62 may compare to those from LAN-1031, with 1–2-mm-thick cords and knots from 6 to 10 mm apart (Dillon and Beroza 1989:88). However, there are no complete extant examples in either archaeological or ethnographic collections for comparison; so, the identification must remain tentative. The smallest mesh fragments from LAN-62, though possibly made by several different methods, fit the several descriptions of net bags, some of which had both very-close-mesh bottoms and wider-mesh sides (as observed on basketry remains from nonburial Feature 672 in FB 3).

Several sorts of nets and knots were observed in the LAN-62 fragments. For open netting, it was sometimes possible to estimate the length of one side of the mesh by measuring the distance between knots. A number of other fragments had knots so close together that it was difficult to determine how they were made. There were probably three methods, all leading to a fabric more knot than net (Figure 129).

With ordinary netting, which usually requires both mesh measure and shuttle, a netting needle could be used to make a more open fabric (Hudson and Blackburn 1983:295). The netting knot created would be firm, and it would be easy to increase the width of the bag using ordinary netting methods of two new meshes in one above. Hudson and Blackburn (1983:290) illustrated a bag made of two-ply cordage, the bottom tightly knotted to form a disk and the sides, "which appear to have been made with the same technique," having a

Table 115. Cordage Recovered from LAN-62, by Feature

Provenience	Inventory No.	Cord (mm)	Strand (mm)	Degree of Twist	Space between Knots (mm)	Knot Size (mm)	Knot Type
HB 426	30008272	1.6	1.0	35	6.2	4.1	netting
	30008289	1.6	1.0	35	8.8	4.4	netting
	03000828B	1.2	1.0	30	8.0	4.7	netting
	03000C5AE.a	1.5	1.0	32	9.3	5.3	netting
	03001898B.b	1.4	0.8	30	8.4	3.4–5.0	netting
NB Feature 672	0300084C7.b	1.8	1.4	30	8.7	5.1	netting

Key: HB = human burial; NB = nonburial.

Figure 128. Netting and netting knots, human-burial Feature 426, LAN-62.

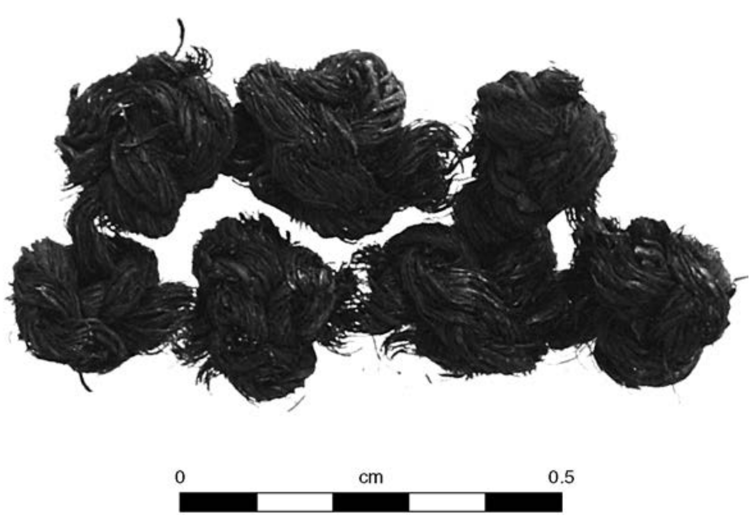

Figure 129. "Tennis net" close knotting, EU 147, LAN-62.

larger mesh. The obviously circular bottom, clearly knotted, and the change in mesh of the sides would argue for regular netting done with a netting needle. Lengths of cordage could have been easily spliced in as the work progressed.

A second method produces a well-defined knot, distinct from the cordage it is made from. This may be a "tennis net" type, a macramé-like technique in which separate, short strings depend vertically from a support and adjacent strings are knotted together, using the fingers, without mesh measure or shuttle (Shaw 1933:118). The next course knots an alternate pair, much like twill in basketry. Like tennis net, the fabric was probably square or rectangular in outline, and there was no easy way to add or decrease the width (EUs 147, 155, 339, Burial Feature 426). The length of the opening could be easily adjusted, and there were three different mesh sizes (nonburial Feature 672 in FB 3). It is so difficult to distinguish the result from the close-knotted-netting knot that both are designated as "tennis net" to distinguish them from ordinary-spaced netting.

The final method is "knotless" netting, a horizontal strand twisting around the one above it to form a loop but no real knot (Mathewson 1985:Figure 11). It would probably have been made with the aid of a netting needle, because the loops formed are very small (EU 155, Burial Features 85 and 426). The fabric width could be increased by making two twisting inserts into the same loop or decreased by twisting through two loops. It had the second advantage of transitioning into regular netting if a firmer fabric were wanted (EU 155).

The islay-gathering net bag was described by Hudson and Blackburn (1983:293) as very small mesh, 1/8 inch or less; soft; and permanently open at the mouth, with a wooden hoop. Hung around the neck and sometimes including a drawstring at the bottom to release the load, the bag was apparently made from the hoop down. Any one of the three methods may have been used. The Harrington sketch clearly showed knotless netting (Hudson and Blackburn 1983:293, Figure 70-1). Some of the knotless-netting fragments from LAN-62 may have been the remains of a similar bag (EU 155, Burial Features 85 and 426). The description from Fernando Librado, however, seemed to indicate regular netting done with a netting needle and mesh (Hudson and Blackburn 1983:295, Figure 70-5).

The "tennis net" technique described above could also have been used to make islay-gathering baskets, but this is speculative. Short lengths of cord descending from a hoop and gathered at the bottom with a drawstring could be worked from the hoop down to the bottom without the need to increase the width. The knotting mesh that results from the "tennis net" technique looks much like regular netting but can be made without tools and in an extremely fine gauge. The examples from LAN-1031, the fragment from the Bousquet collection from Simi Valley with mesh of 6 mm (Hudson and Blackburn 1983:283–284), and that from LAN-243 with mesh of 3 mm (Craig 1967:146) could have been made with this technique, as could some of the finest, most firmly knotted fragments from LAN-62 (EU 155, Burial Features 85 and 426).

Interpretation and Discussion

The textile collection from LAN-62 represents a wide range of coiled and twined baskets and several types of nets and bags. Most of the functional types of textiles represented in southern California textiles were also present in this collection. The discussion below is focused on the behavior of the people of LAN-62, both the culturally conditioned behavior that left ethnic markers in their textiles and the social behavior that guided the deposition of those textiles at the site.

Ethnicity Assignment

Culturally conditioned features—those details of conception and construction evident in finished baskets—may be manifested in fragmentary remains of finished baskets and, through comparison to known traditions, may be used to identify the remains as a product of one or more of those traditions. Those features that define the basketry tradition and set it apart from others in the region became the criteria for identification of ethnicity.

Coiled Basketry

From the start, Gabrielino/Tongva basketry has been defined by comparison to Chumash basketry. In 1776, Pedro Fages noted that "[i]n their manufacture, the [Chumash] Indians, men and women alike, are more finished and artistic than those of the mission of San Gabriel" (Heizer and Whipple 1951:257). For southern California, where the uniformity of technique, material, pattern, and texture of coiled basketry was the hallmark of coiled basketry, the smallest details of manufacture mark ethnic identities.

Details of Manufacture

The initial profile of Gabrielino/Tongva basketry was provided by Dawson and Deetz (1964, 1965) in their classic study of Chumash basketry. They defined Chumash basketry through a compilation of features from documented baskets attributed to the Chumash through comparison to documented baskets and a few archaeological specimens. Discarding those "documented" baskets that were erroneously attributed to the Chumash, they studied whole baskets and based their attributions on functional form, materials, manufacturing technique, and design. Of these, with whole specimens at hand, design layout became a deciding factor in attribution: "The design style of Chumash coiled baskets is distinctive not so much in its traditional elements, many of which are shared with neighboring tribes, but in the composition and sense of space division used" (Dawson and Deetz 1965:204). Gabrielino/Tongva basketry was defined in comparison to Chumash:

> The coiled baskets of the Fernandeno and Gabrielino are the most similar to Chumash work. They frequently used the foundation of three *Juncus* stems and in some pieces trimmed the fag ends of sewing strands close to the work face, as was the Chumash custom. Most of the decorated pieces have a design layout that is closely analogous to the customary one of the Chumash, but the principal band is usually spaced only two coils below the rim, and the body zone designs nearly always rest on a base line, a feature not encountered with the Chumash. Furthermore, they used another layout consisting of a broad band with blocky elements within it. The coil ending with about one inch of herringbone stitches at the tip was sometimes used in common with the Juaneno, Luiseno, and Cahuilla to the south but was not shared with the Chumash [Dawson and Deetz 1965:207].

In the 40+ years following this initial study, Gabrielino/Tongva coiled basketry has remained a residual category. If a basket of the proper material and technique has a design layout that is "not Chumash" (as defined by Dawson and Deetz [1965]), it is often attributed to the Gabrielino/Tongva. Very late baskets, "efforts of women exposed only to the remnants of a dying culture and ignorant of the subtleties of the once rich and vital tradition" (Dawson and Deetz 1965:208), have sometimes been mistaken for Gabrielino/Tongva baskets, because they lacked the complexities of classic Chumash design layout.

Ethnicity of LAN-62 Coiled Basketry

With this definition of Gabrielino/Tongva coiling and the handicap of fragmentary remains, the criteria for assigning ethnicity lay in materials and culturally conditioned features accepted for securely attributed Gabrielino/Tongva ethnographic baskets. By this definition, there was no coiled fragment from LAN-62 that could not be accepted as Gabrielino/Tongva. Both three-rod and bundle foundations were allowed. *Juncus* sewing strands were the norm, and a few *Rhus* stitches were identified. A few unknown-stitching strands appeared in otherwise routine fragments that could not be disqualified as Gabrielino/Tongva. Most of the splices were cut short (Figure 130), but at least one mission splice was present. Backstitching and herringbone terminal stitching were present. Two-in-one expansion stitches were also present.

The faint internal division within the LAN-62 coiled fragments seemed to be between *Juncus* and grass foundations. The foundation choice did not seem to reflect probable basket function as expressed in texture. Fine baskets were found with both foundations, as were coarse-texture baskets. It probably did not reflect ethnicity, because all coiled baskets could be identified as Gabrielino/Tongva, including those few fragments with the mission splice and herringbone rim finish, like those found among the southern and eastern neighbors. This foundation choice may reflect the primary location of the basket maker and the environmental preferences of two plants. *J. balticus* and *J. textilis* are both obligate wetland species, occurring almost always (>99 percent) in wetlands (Magney 2006). *Muhlenbergia rigens* occurs in seasonal streams, grasslands, and oak savannahs. *Muhlenbergia* is harvested in the fall, as are acorns in the oak savannahs. There may have also been a seasonal harvesting of *J. balticus*, but both plants can be used immediately and can also be stored for several years in dry conditions.

Reconstruction of the aboriginal environment, the ecological setting, and the seasonal round of the LAN-62 people

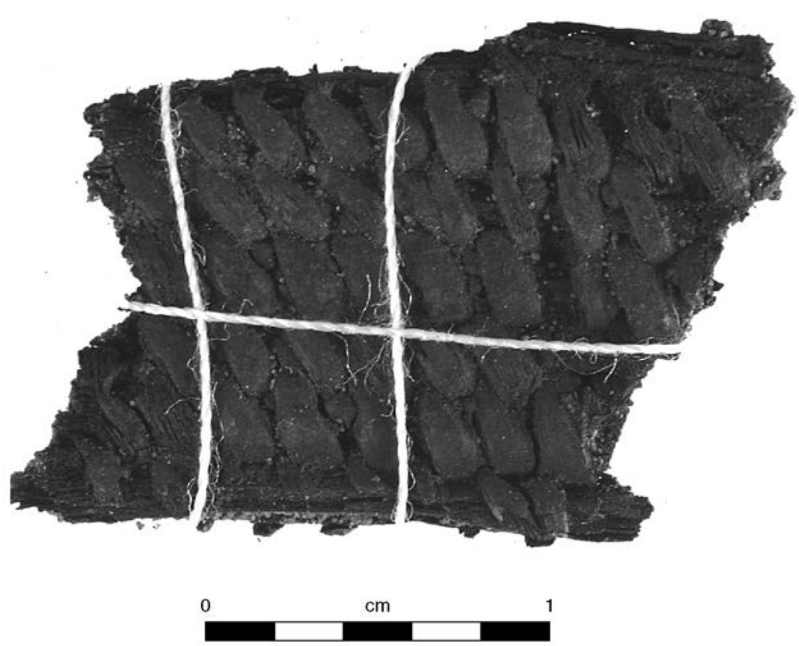

Figure 130. Coiled fragment with fag ends cut short, human-burial Feature 59, LAN-62.

might suggest reasons for such a possible division in material choice evidenced in the LAN-62 fragments. Rather than using a grass foundation, as recorded by Harrington and attested to by ethnographic collections, the Ballona Creek Gabrielino/Tongva, living among *Juncus* reeds, may have preferentially chosen the *Juncus* for their coiled basketry rather than the more labor-intensive *Muhlenbergia* grass bundle that required stripping the sharp seed heads from the stalk before use.

It is apparent from the descriptions above that Gabrielino/Tongva coiling, in a fragmentary state, is seemingly very close to what might be expected of Chumash coiling remains. The three-rod foundation and the fine texture of the work, relative to Gabrielino/Tongva ethnographic collections, might indicate Chumash ethnicity for at least the finer LAN-62 remains, but this is unlikely. First, fine work has been attested to by Gabrielino/Tongva archaeological remains. Second, the presence of two fragments with mission splices on *Juncus* foundations and two fragments with herringbone termination on grass bundles, neither found among the Chumash, indicates a more southerly origin. Third, the LAN-62 fragments did not include rim tics, the ubiquitous Chumash rim finish found in virtually all Chumash fine- and medium-texture coiled baskets. Finally, the ethnographic sample was very small, very late, and almost entirely based on attribution and was thus perhaps not a true representation of the Gabrielino/Tongva weaver's finer traditional work.

Twined Baskets

Slant of weft turn in southern California twining has been assigned ethnic significance since Rozaire's early work on the sea-grass twining from San Nicolas Island. Up-to-the-right slants of turn in San Nicolas Island sea-grass skirts, robes, and bags contrasted with down-to-the-right slants of turn in "Santa Barbara" collections at Berkeley and Santa Barbara museums (Rozaire 1957:90). Following Rozaire, a down-to-the-right slant of turn would indicate Chumash affiliation, and an up-to-the-right slant of turn would indicate greater Uto-Aztecan or local Takic (e.g., Gabrielino/Tongva) identity.

Details of Manufacture

All of the twined fragments found among the LAN-62 specimens were plain or twilled twined of *Juncus.* Almost all of the fragments were close twined, possibly because of depositional forces. A down-to-the-right slant of turn was found in most fragments; plain twining was more prevalent than twilled. No auxiliary weaves were noted.

Close, plain twining on paired warps and twill twining, in which the pairs are alternately separated and paired, were both found in the LAN-62 fragments. In both the LAN-62 fragments and the Sierra Madre water bottles, the slant of weft turn was down-to-the-right. The use of asphaltum on one or both water-bottle surfaces was attested to in the Sierra Madre sample, and the frequency with which close-twined fragments were found with or embedded in asphaltum in the LAN-62 collection led to the hypothesis that these fragments were from water bottles. It remains to be determined whether they were Chumash or Gabrielino/Tongva water bottles.

The only documented Gabrielino/Tongva water bottle was made by the "Lone Woman" of San Nicolas Island (The Indian Woman of San Nicholas 1857:347). It was destroyed in the San Francisco earthquake and fire of 1906 (Hudson and Blackburn 1983:45). Photographs indicated that it was plain twined and had an up-to-the-right slant of weft turn and a long neck but no auxiliary weave.

This simple sorting of ethnicity entirely by slant of weft turn encounters three problems:

1. There was variation within the original Sierra Madre collections attributed to the Chumash. Not all the water bottles had down-to-the-right turns.

2. There was variation in slant of weft turn within other basketry traditions. The Pomo weft slant in close twining on weft shoots with split weft materials was down-to-the-right, and the slant of turn for whole-shoot warp and weft was up-to-the-right. The two different techniques have been attributed to a gender difference in makers (Barrett 1908:147). By contrast, the Washo made whole-shoot baskets with a down-to-the-right slant, and close twine with split weft materials was done with an up-to-the-right slant. This has been explained as wholesale adoption of close twining from Uto-Aztecan Numic neighbors (Fowler and Dawson 1986:705; L. E. Dawson, personal communication 1981).

3. There was variation in San Clemente Island archaeological collections attributed to the Gabrielino/Tongva; close, plain twining had a down-to-the-right slant of turn, and open twining had an up-to-the-right slant of turn (Rozaire 1957).

It is possible that some unconfirmed technical reason required the use of a down-to-the-right slant of turn in the close twining used for water bottles. Discussions of Catlow twining, close twining on Z-ply-cordage warp with a similar down-to-the-right slant of turn, have included the possibility that warp strand twist and weft twist combined to produce a firmer fabric (Cressman 1942:34), a suggestion entertained by Mohr and Sample (1955:348) in their discussion of Cuyama water bottles, despite the S ply of the Cuyama examples.

Another sort of difficulty with attributing the LAN-62 down-to-the-right fragments to Chumash water bottles is the total lack of auxiliary weaves in the LAN-62 fragments. The Cuyama-type water bottles included bands of three-strand twining; three-strand, braided twining; and three-strand, parallel twining (Mohr and Sample 1955:348). However, 1 basket of the 17 described (Inventory No. 1-14503) was plain twined over paired warps and had down-to-the-right slants of turn and no auxiliary weave. Another basket without provenience in the Los Angeles County Museum (Inventory No. A.2562.58-143) was of the same weave. Were these Chumash baskets?

Ethnicity of LAN-62 Twining

Gamble and Russell (2002:117) have suggested that the Chumash at Pitas Point (Gamble 1983) manufactured water bottles in surplus of local need and used them in trade. If this was the case and accounted for the down-to-the right turn in the tightly woven and asphalted fragments at LAN-62, it is still necessary to explain the lack of auxiliary weaves in close twining and the down-to-the right turn found in open weaves. The simplified technique, lacking auxiliary weaves, might be explained in two ways: the small, long-necked bottle shape might not require the reinforcement of auxiliary weaves, or a "made-for-trade" water bottle might have been simplified for economy of manufacture. The variability in open weaves might be due to their casual manufacture.

It was difficult to attribute all of the down-to-the-right, close-twined fragments found at LAN-62 to remains of imported Chumash water bottles for several reasons. Living among rushes and reeds, the weavers of LAN-62 probably had ample *Juncus* materials at hand for water-bottle construction. The main twining technique may owe its weft turn to unknown mechanical factors rather than foreign manufacture. The total lack of ancillary weave bands may argue for a local, simplified tradition learned from Chumash exemplars. Although the plain and twilled, close-twined fragments may have been Chumash, it is as likely, indeed more likely, that they represented a simplified Gabrielino/Tongva technique lacking auxiliary bands (much like Inventory No. A.2562.58-143). At this point, there is not enough comparative evidence to decide the case.

Cordage and Netting

Cordage and netting in the region is best known from the few fragments found in archaeological contexts (see Appendix E.8). Much of the cordage from the Los Angeles Basin was zzS, as was all the cordage from LAN-62.

Details of Manufacture

Because the materials used to make bast cordage were used throughout the region, indeed throughout California, the details of manufacture take on additional significance. The twist of the two strands, s or z, and the twist of ply, S or Z, were determined by the manufacturing process. With the initial twist made by rolling the strands up the thigh, producing two z-twisted strands, then rolling them together down the thigh, away from the worker, producing an S ply, the process produced zzS, two-ply cordage. Cordage made in the opposite sequence, first down the thigh then up, was ssZ.

Ethnicity of LAN-62 Cordage and Netting

Based on twist of strand and ply helix, there is every reason to suppose that the cordage and netting from LAN-62 were Gabrielino/Tongva. The twist, zzS, was identical to the San Nicolas Island sea-grass specimens and the fine cordage from San Clemente Island. Although netting knots were reported from San Nicolas Island, none of the fine, small-knotted fabrics were reported from there. The few examples from Los Angeles County sites seemed to be similar in both knotting and, at LAN-1031, in cordage twist, as well.

Contextual Association

Summaries of perishable fragments must be undertaken with extreme caution, because all fragmentary remains are but pieces of a whole artifact, whether there is 1 fragment or 100 and whether the fragments are ceramic or cloth. Perishable artifacts are subject to additional problems, because preservation is a critical issue. In the case of carbonized fragments, complex burning in a reduced-oxygen atmosphere is necessary, and 1 carbonized fragment may remain where many others were consumed by the flames. A number of human activities may affect the process at several points. Finally, intrasite and intersite comparisons should remain tentative. With that in mind, the contextual associations at LAN-62 revealed several interesting points.

The 429 carbonized textiles and impressions from LAN-62 that were analyzed in this study were recovered from five distinct contexts: 46 human burials (n = 181), 10 artifact concentrations (n = 173), 1 pit (n = 25), 1 thermal feature (n = 6), and 24 excavation units (n = 44) (Table 116). The majority of the carbonized textiles were recovered from the 46 human burials (42.2 percent) and the 10 artifact concentrations (40.3 percent). Only 1 pit and 1 thermal feature yielded textiles, which is not surprising, because preservation

Table 116. Contexts of Identifiable Carbonized Textiles from LAN-62

Type of Worked Botanical	Human Burial	Artifact Concentration	Pit	Thermal Feature	Excavation Units	Total (n)	Percentage of Total
Twined basketry	39	31	7	1	2	80	19
Coiled basketry	36	127	11	4	28	206	48
Subtotal	75	158	18	?	30	286	67
Cordage	106	15	7	1	14	143	33
Total	181	173	25	6	44	429	
Percentage of total	42.2	40.3	5.8	1.4	10.3	100.0	

of the majority of artifacts in these two contexts (noncarbonization in the pit and complete reduction in the thermal feature) was a determining factor.

Table 117 summarizes the carbonized textiles recovered from the 46 human burials. There was marked variation in distribution among the human burials (see Table 117): very low frequencies (less than 3 textile samples) in 34 burials (73.9 percent of the burials), low frequencies (between 3 and 10 textiles) in 11 burials (23.9 percent), and high frequencies (more than 10 textiles) in 1 burial (2.1 percent). The textiles recovered from burial contexts were composed of coiled basketry (n = 36, or 20 percent), twined basketry (n = 39, or 21.7 percent), and cordage (n = 106, or 58.9 percent). Cordage alone was recovered from 13 of the 46 burials (28.3 percent), compared to 27 burials (58.7 percent) that had basketry (coiled and twined), and only 6 burials (13 percent) had both basketry and cordage (see Table 117). The majority of the cordage (n = 76, or 71.7 percent) was recovered from 1 burial, the single high-frequency burial. That burial accounted for 52.2 percent of all textiles in burials. If that burial is removed from the total, 87 fragments remain and are more evenly divided among coiling (n = 32, or 36.7 percent), twining (n = 25, or 28.7 percent), basketry (n = 57, or 65.5 percent), and cordage (n = 30, or 34.5 percent).

A total of 173 carbonized textiles were recovered from 10 artifact concentrations (Table 118). The majority of the textiles (n = 148, or 85.7 percent) were recovered from Features 384 and 458 (both dating to the Mission period). The textile collection from the 10 artifact concentrations was primarily composed of coiled basketry (n = 127, or 73.4 percent), most of which was recovered from the convex hull. As noted above, the relative absence of twined basketry from the artifact concentrations may have been a result of "stirring" of the burning remains, which would have differentially affected the looser-twined basketry, or of recovery and curation processes that privileged carbonized fragments over asphaltum impressions and basketry imbedded in matrix.

The carbonized-textile collection was recovered from 24 test units and included 30 basketry fragments (68.2 percent) and 14 cordage fragments (31.8 percent) (Table 119). The distribution among the 24 units was relatively similar; 21 units had less than 3 fragments each (87.5 percent), and 6 units had between 3 and 5 fragments (25 percent). This distribution is characteristic of a midden, which represents an amalgam of activities rather than a singular activity. However, these fragments must have had primary deposition in an environment similar to that of the burials and mourning features, or else noncarbonized fragments would not have survived.

Possible Ritual Significance

Ethnohistoric accounts of Gabrielino/Tongva funerary and mourning rites have included mention of the items used and burned in the rituals (Blackburn 1963:33–36). Baskets have been mentioned along with other artifacts, but we do not know the order in which the chosen artifacts were thrown into fires and the burning mass covered with earth before the textiles were totally consumed by the flames. Smothered contexts resulted in preservation by carbonization. The surviving portion reflects those textiles chosen for intentional sacrifice, but it is, in reality, only that portion of the textiles that was consigned to the flames but not consumed by them. All things being equal, the surviving fragments may be a true reflection of textiles appropriate for ritual sacrifice selected from the total corpus of textiles or may have been just the first (or last) to be thrown into the fire and smothered sooner or later.

Other baskets, supplied by the master of ceremonies, were used to decorate the *Ko-too-mut* pole that served as a grave marker and were not burned in the ceremony; still others were distributed as gifts to mourners at the ceremony (Merriam 1955:78–82). Only the first two instances, carbonized with the burial or in the mourning ceremony, were evidenced at LAN-62.

Human Burials

Several accounts mention items belonging to the deceased as grave goods; other valuables included in human burials did not necessarily belong to the deceased (Boscana 1947; Engelhardt 1927a; Kroeber 1908b; Reid 1968).

At LAN-62, there was striking variability among the grave lots in both richness and composition (see Table 117). Because there was no record of "stirring" in burials, the deposition itself may have been less compromised and may have allowed for the preservation and recovery of more-fragile twined basketry and cordage. This variation in richness has been attested to for Chumash cemeteries at Malibu (Gamble et al. 2001, 2002), although no textiles were recorded there.

Artifact Concentrations

As one account showed, at the mourning ceremony,

> a deep hole was dug, and a fire kindled in it, when the articles reserved at the death of relatives were committed to the flames; at the same time, baskets, money, and seeds were thrown to the spectators. . . . During the burning process, one of the seers, reciting mystical words, kept stirring up the fire to ensure the total destruction of the things. The hole was then filled up with earth and well trodden down [Reid 1968:42].

Another account, collected by Merriam (1955) from a Gabrielino/Tongva woman living at Tejon, detailed all the baskets involved in the mourning ceremony, only some of which were consigned to the flames: those offerings brought by the mourners. These two accounts differ in the origins of the goods sacrificed in mourning; the first included those belonging to the deceased; the second, those "all given freely to be sacrifices as a burnt offering to the dead" (Merriam 1955:82–83).

Table 117. Distribution of Textiles in Human Burials at LAN-62

Feature No.	Coiled Basketry	Twined Basketry	Total Basketry	Cordage	Total	Percentage of Total
5	—	1	1	—	1	0.6
50	1	—	1	—	1	0.6
58	1	—	1	—	1	0.6
59	5	2	7	—	7	3.9
60	1	1	2	—	2	1.1
85	—	—	—	1	1	0.6
126	1	—	1	—	1	0.6
134	1	—	1	—	1	0.6
136	1	3	4	—	4	2.2
149	1	—	1	—	1	0.6
180	1	—	1	—	1	0.6
223	—	1	1	—	1	0.6
255	—	—	—	1	1	0.6
265	—	1	1	2	3	1.7
271	—	—	—	1	1	0.6
273	—	1	1	—	1	0.6
280	1	1	2	1	3	1.7
285	1	—	1	—	1	0.6
286	2	1	3	—	3	1.7
312	—	1	1	7	8	4.4
316	—	—	—	1	1	0.6
326	—	2	2	2	4	2.2
344	3	—	3	—	3	1.7
358	—	—	—	3	3	1.7
363	1	1	2	—	2	1.1
376	—	—	—	1	1	0.6
408	1	1	2	—	2	1.1
426	4	14	18	76	94	51.9
428	1	—	1	—	1	0.6
438	2	1	3	1	4	2.2
451	—	—	—	2	2	1.1
461	—	1	1	1	2	1.1
482	—	—	—	1	1	0.6
499	1	—	1	—	1	0.6
501	—	—	—	1	1	0.6
511	1	—	1	—	1	0.6
512	2	1	3	—	3	1.7
539	—	—	—	2	2	1.1
552	—	—	—	1	1	0.6
556	—	2	2	—	2	1.1
576	1	—	1	—	1	0.6
601	—	1	1	—	1	0.6
610	1	1	2	—	2	1.1
615	1	—	1	—	1	0.6
616	—	1	1	—	1	0.6
653	—	—	—	1	1	0.6
Total	36	39	75	106	181	
Percentage of total	19.9	21.5	41.4	58.6	100.0	

Table 118. Distribution of Textiles in Artifact Concentrations at LAN-62

Feature No.	Cultural Period	Coiled Basketry	Twined Basketry	Total Basketry	Cordage	Total	Percentage of Total
35	Mission	—	1	1	—	1	0.6
45	?	2	—	2	—	2	1.2
119	?	—	1	1	—	1	0.6
252	?	—	—	—	1	1	0.6
384	Mission	36	9	45	3	48	27.7
433	Mission	3	1	4	2	6	3.5
454	Mission	1	1	2	3	5	2.9
456	Mission	5	—	5	3	8	4.6
458	Mission	80	18	98	2	100	57.8
475	Mission	—	—	—	1	1	0.6
Total		127	31	158	15	173	
Percentage of total		73.4	17.9	91.3	8.7	100.0	

Table 119. Distribution of Textiles in Excavation Units at LAN-62

Control Unit No.	Coiled Basketry	Twined Basketry	Total Basketry	Cordage	Total	Percentage of Total
136	—	1	1	2	3	6.8
138	—	—	—	1	1	2.3
143	2	—	2	—	2	4.5
144	1	—	1	—	1	2.3
145	3	—	3	1	4	9.1
146	—	—	—	1	1	2.3
147	—	—	—	2	2	4.5
151	1	—	1	—	1	2.3
154	—	—	—	1	1	2.3
155	2	—	2	3	5	11.4
163	1	—	1	—	1	2.3
165	1	—	1	1	2	4.5
175	1	—	1	—	1	2.3
296	1	—	1	—	1	2.3
310	3	—	3	—	3	6.8
313	1	—	1	—	1	2.3
339	—	—	—	1	1	2.3
375	4	—	4	—	4	9.1
376	1	—	1	—	1	2.3
774	2	—	2	—	2	4.5
809	1	—	1	—	1	2.3
817	3	—	3	—	3	6.8
822	—	—	—	1	1	2.3
826	—	1	1	—	1	2.3
Total	28	2	30	14	44	
Percentage of total	63.6	4.5	68.2	31.8	100.0	

At LAN-62, almost 75 percent of the textiles recovered from the artifact concentrations identified as mourning features were coiled basketry (see Table 118). Although this percentage may have been skewed by depositional circumstances or "stirring," it is much higher than the less than 20 percent found in burials. This might suggest that if the mourning goods were only from the personal belongings of the deceased, their coiled baskets were withheld from burial cremation and saved for the mourning ceremony. If the mourning goods were "freely given" by others, then fine-quality, labor-intensive coiled baskets were a favored sacrificial gift.

Comparison to Expected Results

Overall, the type and ethnicity of the coiled basketry and cordage recovered from LAN-62 were close to the expected results. The twined-basketry result was unexpected.

Coiling

Given the initial reports of Pedro Fages (Heizer and Whipple 1951:257) and John Harrington (1942:22), the large quantity of relatively fine-texture-basket fragments found at LAN-62 was unexpected. Given the attribution criteria of Dawson and Deetz (1965:203, 207), the high ratio of three-rod *Juncus* fragments to grass-bundle foundations and the scarcity of mission splices were not anticipated. However, as discussed above, it is unnecessary to suggest a Chumash origin for the LAN-62 coiled fragments.

Cordage

Fine cordage of two-ply, zzS twist and a few pieces of three-ply and four-ply cord matched expectations of Gabrielino/Tongva cordage based on Rozaire's (1957) San Nicolas Island archaeological sea-grass cordage and Rozaire's (1959) thin cordage of shredded material from San Clemente Island used for netting. Although finely knotted fabrics have not been reported from the ethnographic Gabrielino/Tongva, these possible bags or nets, demonstrably of Gabrielino/Tongva cordage, represent an addition to our knowledge of Gabrielino/Tongva material culture. Archaeologically, they were similar to fine-knotted fragments from LAN-0131, LAN-243, and a dry cave in Simi Valley (Dillon and Beroza 1989:89).

Coarse cordage and heavy netting, though reported from the region, were not represented among the fragments from LAN-62. Because these would probably have survived in carbonized form, their absence was probably due to initial intent.

Twining

The minor role of twining in the region was reflected in the LAN-62 fragments; there were many more coiled remains than twined. The further lack of open-twined fragments may have been due to its modest place in the repertoire or to depositional forces that favored the sturdy construction of close twining.

Twined-textile remains were the most puzzling of all the LAN-62 fragments and did not meet the expectations for the slant of weft turn associated with Takic peoples.

Slant of Weft Turn for Twined Basketry

Slant of weft turn in southern California twining has been assigned ethnic significance since Rozaire's (1957) early work on the sea-grass twining from San Nicolas Island. Up-to-the-right slants of turn in San Nicolas Island sea-grass skirts, robes, and bags contrasted with down-to-the-right slants of turn in "Santa Barbara" collections at Berkeley and Santa Barbara museums (Rozaire 1957:90). Following Rozaire, a down-to-the-right slant of turn would indicate Chumash affiliation, and an up-to-the-right slant of turn would indicate greater Uto-Aztecan or local Takic (e.g., Gabrielino/Tongva) identity. However, Rozaire (1957:92) specifically warned against this "highly tenuous" inference, a fact often overlooked by contemporary researchers.

In light of Rozaire's findings and the water bottle collected from the "Lone Woman," the LAN-62 close-twined fragments should have had a weft slant of up-to-the-right, but they did not. If they had been imported from the Chumash as a specialty item and been identical to the Cuyama water bottles, they should have had bands of reinforcing weave. The LAN-62 fragments included no reinforcing weaves. The tentative explanation is that these fragments—if they were from water bottles, as seemed likely, given the frequency of asphaltum coatings—represent a Gabrielino/Tongva water-bottle technique learned and copied in a simplified manner from the Chumash exemplar.

Comparison to Regional Comparative Collections

Comparison of the LAN-62 textile remains to the range of functional forms in ethnographic southern California suggested that the LAN-62 remains may have encompassed many, if not all, of them. Fine-texture coiled basketry, possibly representing the coiled-basket hat or (ethnographically rare) a small, coiled trinket or "treasure basket," was present. Medium-texture coiled plates and bowls that served culinary needs throughout southern California for gathering, preparing, serving, and storing food may have been represented. Coarse-texture coiled basketry for gathering, carrying, and storing food and gap-stitched basketry for winnowing were represented. Even the large storage basket may have been present, as suggested by the possible "repairs."

Twined, open-work baskets that served as receptacles and leaching baskets for acorn meal may have been represented by a few fragile, open-work fragments. Even the close-twined, asphalted water jug documented for the Chumash may have been made by the Playa Vista Gabrielino/Tongva, as suggested above. Only the seed beater of woody shoots was missing. Importantly, the textile remains included many fragments of cordage, which has been poorly represented in regional collections, as well as knotted textiles, the scarcest of remains.

Coiled basketry from LAN-62 was "mission basketry" coiled on bundles of grass or *Juncus* with sewing strands of *Juncus* or *R. trilobata* and patterned bands of contrasting materials. Coiled basketry reflected the uniform southern California template: noninterlocked stitches sewn in a rightward work direction. Ethnicity was reflected in the subtle, specific features of coiled-basketry-construction techniques (splices and rim finishes), preferred-material choices (*Juncus* or grass foundations), and foundation constructions (bundle or three-rod). Comparison to regional collections secured the Gabrielino/Tongva ethnic assignment of the LAN-62 textiles.

Comparison of LAN-62 remains to regional archaeological sites was most fruitful when those sites were either funerary or mourning sites. Gamble and Russell (2002:119–122) provided a table of funerary remains from Chumash and Tongva coastal sites. Few sites included basketry. Gamble et al. (2001) analyzed the grave goods at Malibu and presented an argument for a Middle period rise of Chumash chiefdoms based on their analysis. However, no textile remains at that site were preserved, because they did not burn. It was difficult to compare the remains from those sites to the LAN-62 textile remains, given the problems inherent in the preservation of those perishable remains.

From the islands, the Lemon Tank site (Hale 1995) provided a useful contextual and temporal comparison (see Appendix E.9). San Clemente Island was identified as Gabrielino/Tongva (Johnson 1988a; Kroeber 1925:620), and the Lemon Tank site was occupied for roughly the last 1,000 years. The site included both burials and mourning features, and the textile remains, only 40 (in comparison to the more than 400 from LAN-62), were listed in enough detail to provide a reasonable comparison to remains from LAN-62. However, it should be noted that the Lemon Tank site remains also included animal burials and "ideological" remains that Hale identified as related to nonfunerary rituals. The total textile remains included 17 coiled remains, 8 lots of cordage fragments, and 14 twined remains, many asphalted. Of the funerary remains, the two grave lots included only the recognizable remains of twined water bottles and no other textiles. At LAN-62, there were also coiled fragments and cordage in graves.

The Lemon Tank site mourning features included six coiled-basket remains on both *Juncus* and grass-bundle foundations, four remains of Z-twist surf grass and S-twist "hemp" cordage, and nine twined fragments, many of which were asphalted and appeared to be water bottles.

Given the problems of deposition and preservation of carbonized remains, only a few conclusions may be reached. First, in both cases, the numbers of textiles in the burials were low, suggesting that these remains might have been only those belonging to the deceased. Second, the mix of textile types in the identified mourning features, though variable, suggested that no single type was set aside at death or "freely given" by mourners.

Islanders, Mainlanders, and Inlanders

Finally, it is useful to view the textiles from LAN-62 from the several perspectives offered by Altschul and Grenda (2002). Comparing the Gabrielino/Tongva island, mainland, and inland textiles directly was difficult because of the lack of ethnographic collections from the islands and the dearth of archaeological remains from the Gabrielino/Tongva inlands. What little evidence there was suggested that the mainland and inland areas lacked the sea-grass cordage and twined skirts found at island archaeological sites. Fine cordage from LAN-62 was similar in twist (zzS) to that from island sites and inland Los Angeles County sites. Coiled remains from the island and inland Los Angeles sites were also similar to those from LAN-62. With limited evidence, it was difficult to demark internal textile "territories," because seasonal travel, exchange, and ritual relationships may mask the distinctiveness of the three areas (McCawley 2002:55–65).

From a geographic standpoint, the unexpected reliance on *J. balticus* for coiled foundations by the weavers of LAN-62 can be compared to the almost universal reliance on that material by Chumash weavers and its almost absolute neglect by Takic weavers to the east and south. *J. balticus* is an estuary plant, and its use in ethnographic coiled basketry can be correlated with the historical-period estuary habitats of the several groups: the Chumash, pinned to estuaries by the mountain ranges behind them; the Gabrielino/Tongva, free to exploit inland areas to the northeast; the Luiseño, inhabiting the cliffs and lowlands of the southern coast; and the desert groups to the east (Grenda and Altschul 2002:176; Vellanoweth and Grenda 2002:71).

In a regional perspective, the similarities between Chumash twining and the down-to-the-right slant of weft turn at LAN-62 have been noted and ascribed to simplified Gabrielino/Tongva copying of Chumash exemplars, water bottles in particular. This copying of specific technologies by prehistoric desert incomers who probably had their own water bottles might have been due to Gabrielino/Tongva wholesale copying of the successful Chumash island-mainland exchange strategies. It is worth noting that only the Chumash and Gabrielino/Tongva used the *Juncus* twined water bottle, and only they controlled island-mainland trade. On sea voyages, freshwater is essential. Successful Chumash exploitation of island resources required water bottles, and in adopting *tomol* solutions to expansion pressures, the Gabrielino/Tongva might have copied the entire complex, not just its canoe.

Conclusion

The textile remains from LAN-62 have provided the best documentation of Mission period Gabrielino/Tongva basketry and cordage extant. Unlike ethnographic collections almost entirely identified by attribution, these remains were securely Gabrielino/Tongva, as attested to by site location and the ethnohistoric record.

- LAN-62 coiled basketry had both grass-bundle and *Juncus* three-rod foundations; both *Juncus* and *Rhus* stitches; both flush-cut and mission splices; and backstitched and herringbone coil terminations but no rim tics. It could be unexpectedly fine textured in execution.

- LAN-62 twined basketry had both open and close weaves, with an unexpected dominance of the down-to-the-right slant of turn heretofore ascribed to Chumash rather than Takic twining. Asphalted water bottles were probably made at LAN-62 in a simplified weave, as discussed above.

- LAN-62 cordage was hard-spun, zzS string similar to cordage otherwise ascribed to Takic peoples. The close-knotted-cordage textiles present were similar to those known from Chumash and Los Angeles County archaeological collections and have added important data to our understanding of those bag textiles.

Suggestions for Further Research

A need for further research regarding Gabrielino/Tongva twining would seem to be indicated by this study. First, Gabrielino/Tongva archaeological collections should be examined and reported in full detail. Then, the twining and water bottles of neighboring Takic peoples should be studied for suggestions of shared heritage. Finally, all the twined Chumash collections should be examined to better define Chumash twining and distinguish between Gabrielino/Tongva and Chumash artifacts. With more complete technical evidence at hand, it might be possible to determine the ethnicity of the anomalous twined fragments found at LAN-62.

Glossary

Auxiliary weaves. Weaves covering a minor part of the wall surface for structural or decorative reasons are termed auxiliary weaves and vary in the same ways as the main construction weaves.

Degree of fineness of weave (twists per square inch). To calculate the fineness of a weave, the number of courses per inch is multiplied by the number of twists per inch. This provides a rough estimate of weaving time as, *ceteris paribus*, it will take three times as long to weave 36 turns per square inch as to weave 12 per square inch. Although all other measurements are metric, this measure is most useful in inches as all old (ca. 1900) comparative data are in inches.

Diagonal twining. In diagonal twining (twill, alternate pair, split-pair twining), a different or alternate pair of warps is engaged in each successive round or course of weaving.

Helix, s. See slant of twist.

Helix, z. See slant of twist.

Main construction weave. The primary construction weave, or wall type, is the usual basis of typologies. The weave varies along two dimensions: the grouping of warp elements and the number of components in the weft. The warp elements vary by the number, arrangement, and sequence of warps engaged at each weft crossing. In plain or simple twining, a single warp is engaged. In plain twining over two or more warps, the same group of warps is engaged in every round. In twill twining (diagonal, alternate pair, split-pair twining), a different or alternate pair is engaged in each successive round. The number of wefts varies from two to three or more. If two wefts are employed, the weave will be the same on both surfaces. If three wefts are used, the faces will be different (3-strand twining). If two active wefts and a passive element are used (lattice twine), the lattice will cause the surfaces to appear different, although they are structurally the same.

Open weave. If the weft courses are separated, one from the next, by an intentional gap, the weave texture may be characterized as open.

Plain twining. In plain or simple twining, a single warp is engaged in every turn of twining. In plain twining over two or more warps, the same group of warps is engaged in every round.

Plaiting. Plaiting is a class of weaves in which all elements are active. Single elements or sets of elements pass over and under each other at a fixed angle.

Slant of twist in the weft helix (up-to-the-right, down-to-the-right). The slightly oblique angle at which the wefts cross the warp is a product of the helix turn of the wefts. The angle may be characterized as S-twist or Z-twist when analyzed, as is a cord—that is, in a vertical position. However, the horizontal position of basket weft and the rightward progress of work result in a slants of twist best characterized as up-to-the-right and down-to-the-right slants of turn.

Spacing of weft rows. Spacing of weft rows may be described as "close" or "open" twine or "compact" or "spaced" twine. The description depends on the size of the gap between weft rows, which may be measured.

Splice of fag ends. Wefts are seldom of infinite length. There is recurrent need to splice in new elements without weakening the basket. The end of the new material (the fag end) will be apparent in the wall, revealing the splice technique.

Splice of moving ends. The weft element, which runs out during weaving (moving end), must also be secured.

Start. Twining is initiated with a "start," which serves to align the warps with one another; thus, the general type of start is dependent on the warp arrangement planned: radial, fan, or parallel. Within these constraints, the variation is so great as to yield only to description, not classification.

Superstructural supports (for manufacture or use). Supports may be permanent or used during the manufacturing process only. The most common support in Mono twining is the rim rod, bound or coiled onto the work, which provides the volumetric capacity of a conical or elliptical basket.

Termination of weft row. The final weft course may be terminated with a feature designed to keep the moving ends in place and prevent unraveling, such as three-strand twining.

Twill twining. In twill twining (diagonal, alternate pair, split-pair twining), a different or alternate pair is engaged in each successive round.

Twining. The term "twining" describes a method of twining two weft (woof) strands around a series of warp strands. Twining produces a double helix identical to that of two-strand cordage or twine; warp strands are caught in each turn of the wefts and serve to join successive groups or cords of the twined elements in a coherent fabric. The weft pair is at right angles to the warp elements but actually crosses them at the slightly oblique angle of the helix. The slant thus produced is the only visually distinctive characteristic of twining (Emery 1966:196). The weft strands are usually manipulated with the right hand while the left hand holds the completed or nearly completed work. Thus, from the weaver's viewpoint, the work proceeds from left to right.

Warp. The passive (usually vertical) element in twining.

Warp arrangement (circular, fan, or parallel). In twining, the passive or warp elements are arranged in a stable position relative to one another, either circular (radial), parallel, or roughly fan shaped.

Warp insertions and subtractions. Method of warp insertion depends on warp class. Shoot warps may be sharpened and jammed into place in the completed weave, paired with an existing warp for a course or two, or added to the weave as a singleton, its butt projecting over the courses woven below.

Warp material class, composition, and preparation. The choice of material class is more fundamental than the composition, or exact species, of that material. Thus, shoot warps of all species may be grouped together as a class, distinct from the classes of cordage warp or spilt-root warp. Shoot preparation is usually simple: the shoot may be used as cut or peeled and/or scraped.

Warp selvage. The method by which the warps are finished off is the basket selvage. Sometimes there is a course or two of alternate weave before the selvage, and this is known as the underselvege.

Weft (woof). The active (usually horizontal) elements in twining.

Weft material class, composition, and preparation. Classes of weft material include shoots, roots, rushes, and bark. Shoots may be used whole, either peeled or unpeeled, but split shoots and split roots are normally peeled and shaved to a uniform diameter.

Coiling Glossary

Coil. Coiling is accomplished with an active vertical element, the stitch, which moves around or through a passive horizontal element, the foundation. With the aid of a needle or awl, a hole is punched into the completed work, and the sharpened end of the sewing strand is passed through the opening. California coiling is simple, usually employing one active strand to form a single helix.

Coil ending. The coiled end may be tapered smoothly to join with the course below, and the last few stitches may be secured in several ways.

Coils. A single circuit (of sewing over the foundation) around the basket.

Degree of fineness of stitch (stitches per square inch). As with twining, the relative construction time may be estimated by multiplying the number of courses per inch by the number of stitches per inch.

Foundation arrangement: bundle. A foundation arrangement of loose fibers, stems, or twigs.

Foundation arrangement: three-rod. A foundation arrangement of three elements arranged in a triangular fashion.

Foundation ending (blunt or tapered). The final circuit of foundation may be modified to form a smooth finish to the sewing.

Foundation material class, composition, and preparation. The class of foundation materials (rod or grass) is often easier to discover through analysis than are the exact species and preparation method of the foundation materials; these may be hidden by stitching.

Incoiling. A repair to a coiled basket that has lost its base. New coiling is added starting from the torn edge and is coiled inward to form a new base. The "start" position of the resulting basket is actually the last stitching rather than the first.

Mission splice. Another splice, ubiquitous on grass-bundle foundation, was not described by Harrington: the "mission" splice. Instead of making a "knot" in the fag end, the end is bound under the first stitch made with the new strand. As the stitches in rightward work slant down-to-the-right (\\\\), this splice is easy to see (\\\/\\\) in the finished work and is usually accompanied by a similar treatment of the moving end on the back of the work. The Chumash used this splice sparingly and never in a pattern, only in background areas. The Gabrielino seem to have used the method more frequently—again, never in patterns. To the south and east, this is the preferred splice, and decorative advantage is taken of its possibilities.

Proportion of sewing strand to foundation thickness. The ratio of width of sewing strand to thickness of foundation (actually measured as length of stitch) results in a characteristic "look" to the basket fabric.

Rim finish. Although there is little variation in stitch between the start and the rim of a coiled basket, the last row of coiling, or rim row, may be finished in a variety of ways.

Rim finish: rim ticking. The Chumash finished their baskets with "rim ticking," alternating patches of plain sewing with checkerboards of two black strands alternated with two light strands on the last round of sewing (Hudson and Blackburn 1982–1987 V:233). Rim ticking could also be patches of two sewing strands, alternating stitches of black and white (Dawson and Deetz 1965:204). This is one of the hallmarks of Chumash coiling, and although it is shared with northern neighbors, it is not often found to the south or east of them. The Gabrielino very seldom used this rim finish.

Sewing strand material class, composition, and preparation. Like twining weft, sewing strands must be flexible and strong.

The material class may be roots, shoots, leaves, or rushes. Preparation may include peeling, splitting, and trimming to size.

Spacing of stitches. Stitches may be tightly packed together or may be spaced far apart so that the foundation shows between them. The resulting gap may be measured for comparison to other work.

Splice of fag ends. Like twining weft, sewing strands are not infinitely long and must be periodically replaced, but the treatment of the resulting ends is an aesthetic problem rather than a structural one. Compression between courses will keep the coiled basket from unraveling, but the smooth surface will be spoiled by lumpy or ragged ends.

Splices. Once coiling is begun, each subsequent course requires more stitches than the one below it as the foundation spirals outward. This is achieved by the two-in-one method, wherein the second stitch is placed in the same hole as the first. Virtually the same method was used by the Chumash and Gabrielino. When the sewing strand is played out, a new strand is begun. The old, or moving, end is left protruding to the back of the work, and the new strand is pulled through the same hole, leaving the fag end protruding on the front near the worker. This end is split with the thumbnail to make a "knot" in the work and to prevent its pulling loose at this splice (Hudson and Blackburn 1982–1987 V:231–232). Evidently, the pressure of the two strands in a hole meant for one and the compression of the foundation is sufficient to keep the strands in place.

Splice of moving ends. Splice of moving ends presents the same problem as the fag ends. Most fag ends are cut flush on the work face, and the moving ends are tucked under the next stitch on the nonwork surface.

Start. Coiled starts are less varied than twined ones, in part because coiling produces only one foundation arrangement: the spiral. The need to produce a tiny spiral and the rigid nature of many foundation materials may dictate that a different material and technique be used to start the basket.

The *Juncus* three-rod-foundation basket starts with a constricted coil. Lengths of sewing strands are bundled, a short length of the bundle is wrapped with a single strand and bent into a circle, and sewing proper is begun. This bound-length start was used throughout southern California for grass-bundle-foundation coiling. However, two other methods for basket starts observed in attributed Gabrielino baskets were not recorded by Harrington. The first is a single rod of *Juncus* bent into a circle, which results in a larger-diameter circle at the start. The other method bends the rod into an oval, and the basket assumes a circle shape by the time the edge of the base is reached.

Stitch type (interlocked or split). In California, stitch type varied principally by whether the stitch formed a fabric with the stitching on the course below. If it does so (and removing the foundation would leave a net-like structure), the stitch is "interlocked." If it does not (and removing the foundation would result in complete disintegration), then it is "noninterlocked." If the awl and the stitch pass through the stitch in the course below, the stitch is split, either on the work or nonwork face, or both.

Stitch count. The number of stitches to a linear measurement, "stitches per inch," may be multiplied by the number of courses, "courses per inch," to arrive at the number of "stitches per square inch." The resulting number is used to denote fineness of the work and as a comparative estimate of time invested in manufacture.

Termination of stitching. When the end of the basket is reached, the weaver tapers the foundation by cutting the core "slantingly," first one, then another, and then the last.

Two methods sometimes used by the neighboring Luiseño to end the work were also used by the Gabrielino: the backstitch and the herringbone. When the end of the work was reached, the weaver turned the work so that the normal work surface was facing away from her and made one or two stitches back over the previously completed work, thus the backstitch. The Chumash sometimes used this ending. The herringbone was a more elaborate version done with two stitches and producing a characteristic XXX on the top edge of the work. It was not found among the Chumash (Dawson and Deetz 1965).

Texture. The fineness of weave, or stitch texture, is an estimate of the time invested in sewing the basket.

Texture: coarse. Less than 50 stitches per square inch.

Texture: fine. More than 98 stitches per square inch.

Texture: medium. Between 50 and 98 stitches per square inch.

Work direction (rightward or leftward). Although the hole may be punched and the sewing strand inserted by right-handed weavers, the stitch may be placed either to the right or left of the previous stitch. Unlike twining, then, the work may progress to the right or the left of the weaver.

Work face. The surface, or face, of the basket into which the hole is punched is the face turned toward the weaver. This may be either the concave or the convex face of the finished basket.

Cordage Glossary

Degree of twist. The number of twists per inch, or the helix angle. A 30° twist is "hard" twisted or plied.

Ply. Twisting together two or more single strands or yarns. Characterized by the number of strands (two-ply or three-ply) and the direction of twist (Z twist or S twist).

Spin. Twisting together and drawing out massed short fibers into a continuous strand.

S twist. When the yarn or cord is held in vertical position, the spiral slopes the same direction as the central portion of the letter "S."

Twist. The spiral of the yarn or cord. The spin of the initial strand or yarn is usually opposite the twist of the plied strands, and the opposing mechanical forces create a stable finished "string" or "rope." The finished product—for example, two-strand, Z-plied string—may be designated (e.g., "ssZ") to denote the number and succession of twisted elements.

Z twist. When the yarn or cord is held in vertical position, the spiral slopes the same direction as the central portion of the letter "Z."

Knot and Netting Glossary

Knotless netting. The "knot" produced is also known as "half hitch." A single element, simple looping technique in which the free end of the cord is passed through the loop above, brought through and over the active loop, and then the motion is repeated in the next loop. A netting needle is often used.

Looping. A fabric structure built up of repeated interworking of a single continuous element with itself. The free end of the cord is drawn through the appropriate opening, or loop, of the fabric.

Netting knot. Also known as a sheet bend or weaver's knot. A knotted looping technique with fixed knots in which the free element moves over, around, and through the loop above to form another loop, the size of which is secured by the knotting action of the pendant loop and the active element. Netting in California was usually accomplished with a spacing bar to standardize the mesh-loop size and a shuttle on which the active element was wound.

Square knot. A fixed knot in which two overhand knots are joined in a symmetrical knot.

Tennis net. An interknotting technique in which multiple free-hanging elements are worked into a single fabric by knotting elements around the adjacent elements, first to one side and then the other, as in macramé.

Glass and Ceramic Beads

Lester A. Ross, Scott H. Kremkau, Amanda C. Cannon, and John G. Douglass

Introduction

Between 1999 and 2006, excavations at four sites recovered thousands of glass and ceramic beads dating from the late eighteenth century to the mid- to late nineteenth century. The following study explores where these beads originated, how and when they arrived at these sites, and what functions they may have served for the people who used them. In total, 58,118 glass and ceramic beads, 53 glass-bead strands, and 5 patterned groups of glass beads were recovered from LAN-62, LAN-193, LAN-211, and LAN-2768 (Table 120). In addition, LAN-1932 and LAN-2676 each contained a single glass bead, but because these two sites were composed of redeposited material from other sites in the Ballona, they are excluded from the following discussion. For additional information regarding the information presented in this chapter, please see Appendixes F.1–F.55 on the accompanying disk.

Glass beads represent a material-cultural class associated with specific individuals or groups of individuals, such as a family or kinship group. Glass beads possessed some cultural values that followed individuals to their graves. Generally, such cultural values were indicative of wealth, status, profession, and/or religious affiliation, but not always. Therefore, it is essential to establish whether a specific material-cultural class was a symbol of wealth and/or rank. Determining all cultural values that existed within a society using a single material-cultural class is impossible, but examining the comparative relationships between a specific material-cultural class and other factors can provide inferences that then can be otherwise evaluated.

The 155 burial features with glass beads at LAN-62 contained quantities ranging from 1 to nearly 3,000 beads per burial feature. Burials with limited quantities and relatively few varieties and colors may indicate relatively early burials, whereas those with numerous varieties and colors may indicate relatively late burials. Variations in quantities, varieties, and colors also may be indicative of the age, sex, and/or status of individuals. Until these attributes can be identified, compared, and evaluated, a relative temporal seriation must be considered to be tentative and preliminary. A four-phased temporal sequence based on combinations of different glass-bead colors has been hypothesized for LAN-62 and evaluated through comparisons with glass-bead collections from other Chumash and Gabrielino/Tongva sites and from various Spanish colonial sites in Alta California. This sequence does appear to have temporal significance, with green, blue, and purple glass beads dominating earlier contexts (Phase 1) and additional sequences of glass beads ranging in color from white and red (Phase 2) to black (Phase 3), to yellow (Phase 4).

This chapter explores the people and cultures involved in the manufacture, distribution, acquisition, and use of imported glass and ceramic beads; how and when beads arrived at the PVAHP sites; and what functions they may have served. The chapter first presents analysis methods, including an examination of the technologies required to produce the beads and how an understanding of these technological attributes can be used to identify beads and address temporal issues properly. The results of bead analysis are summarized for each of the four PVAHP sites. The chapter also presents relevant ethnohistoric and archaeological site-comparison information regarding how regional indigenous populations used imported beads. A detailed examination of ethnohistoric, historical, and archaeological contexts is provided in Appendixes F.1–F.4. Archaeological inferences are evaluated in a final section on ethnic, spatial, and temporal comparisons. In general, this study reflects a material culturalist's view of the past. Other project-specific studies have focused on broader issues of ethnohistoric, historical, archaeological, and anthropological significance, but this study focuses on the material-cultural universe into which European glass beads were imported.

Methods

Sorting Beads into Varieties

A detailed review of glass- and ceramic-bead classification systems is found in Appendixes F.5 and F.6. Beads from individual sites were sorted into varieties and placed into labeled resealable polyethylene bags along with a catalog label containing provenience information, bead-variety numbers,

Table 120. Analyzed Glass and Ceramic Beads and Historical Contexts from Four PVAHP Sites

Site	Historical Context	Count
LAN-62	Early Spanish colonial period, ca. late eighteenth century to the 1810s.	57,985
LAN-211	Early Spanish colonial period, ca. late eighteenth century to the 1810s.	99
LAN-2768	Possibly Mexican rancho period, mid-1830s–1850s, and/or American period, 1850s to the late nineteenth century.	20
LAN-193	Some possibly associated with the Mexican rancho period, 1830s–1850s, but most probably associated with the American period, 1850s to the late nineteenth century.	14
Total		58,118

and bead quantities. This procedure was accomplished by opening the bag for one provenience and separating beads with similar attributes into groups. The process required the use of incandescent lighting, a dish with water (to wet beads to eliminate the appearance of surface patina and to remove loose dirt), magnifying loupes and lenses, and a binocular microscope. Patina and mineral encrustations were removed using one or more cleaning techniques (see below).

Twelve typological attributes were considered during the sorting process when determining bead classes, types, and varieties (Tables 121 and 122). These 12 attributes are considered to be *technological* (t-transforms), created during the manufacturing process; *natural* (n-transforms), resulting from the alteration of the beads by chemical processes in the soil; and *cultural* (c-transforms), created during use (see below). As beads were sorted, the effects of natural and cultural processes were considered and were ignored as typological criteria for defining bead varieties.

The creation of bead sizes during manufacture and distribution is a technological process (t-transform), but bead size is not considered a typological criterion for defining bead varieties. Rather, bead size is regarded as a dependent variable of individual varieties and was disregarded during initial sorting (see below). For beads from the PVAHP project, sizes were documented after final varieties were established. A review of small-bead varieties that could be underrepresented because of recovery-screen size is provided in Appendix F.7.

To provide a uniform method for recognizing beads belonging to a previously identified variety from each site, one set of specimens was selected for each variety (if more than one provenience bag per variety was available). This set was stored separately as a variety collection at the workstation used for cataloging. As with all archaeological collections of beads, the separation of beads into discrete varieties relies upon the variability of the attributes present and the ability of the analyst to distinguish groups of attributes consistently. Even though multiple varieties may have been deposited by the historical occupants of a site, once these varieties are mixed, it may or may not be able to separate them. As groups of attributes were segregated consistently, individual varieties were defined.

Variety descriptions were prepared by the lead author, initially using variety specimens, and were later refined, after examining the entire collection. Descriptions were entered by attribute class into a database that allowed queries to be made using one or multiple attributes (e.g., quantities of blue beads, wound beads, and faceted beads). Beads were tallied by variety and provenience, and quantities were entered into a master database. Queries of this database allowed tables to be constructed for the distributions of varieties and their attributes by provenience, temporal and/or cultural provenience, and stratigraphy or depth.

Bead Typologies

The following section highlights some of the important elements of bead typologies that are mentioned in the text. For a more complete discussion on bead typologies, see Appendixes F.5 and F.6.

Method of Manufacture

Methods for manufacturing glass and ceramic beads vary by country and temporal period. Common methods for the

Table 121. Glass- and Ceramic-Bead Attributes Resulting from Technological Processes (t-transforms), by Typological Categories

Typological Categories	Attributes
Class	material
	method of manufacture
	method of finishing
Type	layering
	shape
	decoration
Variety	diaphaneity
	color chroma, value, and hue
	luster (original, if it can be determined)
	perforation type, shape, and orientation
	mold seam shape (if present)
	mold seam orientation (if present)

Table 122. Nontypological Glass and Ceramic Bead Attributes and Uses

Attribute/Use	Description	Nontechnological Process
	Natural Processes	
Corrosion	erosion of bead surfaces through contact with alkalic and acidic solutions in soil	n-transforms
Staining and mineral encrustations	discoloration of bead material and layering of mineral salts on bead surfaces	n-transforms
Patina and crazing or crizzling	effects of "glass disease"	n-transforms
Fire effects	postdepositional burning (e.g., forest fire)	n-transforms
	Cultural Processes	
Beading	creation of multicolored and multisized strands and patterns on wearing apparel or other material cultural items	c-transforms
Mortuary practices	cremation and mourning-ceremony activities	c-transforms

late-eighteenth- and nineteenth-century periods of occupation for these sites were drawn, wound, and mold-pressed bead making for glass beads and Prosser-molded bead making for ceramic beads. Prior to the nineteenth century, most beads were manufactured by hand using very simple tools, such as a metal tube for drawing, wires for winding, and flat or curved paddles or hemispherical molds for shaping and finishing. During the late eighteenth century, more-complex hand tools for shaping and finishing beads began to appear, such as tong molds for shaping. During the nineteenth and early twentieth centuries, the mechanization of bead making began to appear for drawing and shaping glass tubing and Prosser molding.

Drawn Beads

Drawn beads are the most common glass beads recovered from late-eighteenth- and nineteenth-century western North American sites and generally compose 86–100 percent of the bead collections from major colonial distribution sites and 68–100 percent from Native American sites (see Appendix F.8). Not unexpectedly, the percentage of drawn beads from the Protohistoric and early Historical periods was highest. A decrease in the percentage of drawn beads first occurred at Euroamerican distribution sites, and the percentage stayed relatively high at Native American sites during that same time. By the late nineteenth century, the range of bead classes and types increased, and the percentage of drawn beads declined. The decline of drawn beads remained most noticeable at Euroamerican sites. The percentage of drawn beads at sites occupied by Native Americans remained relatively high even into the late nineteenth century.

Drawn beads were manufactured from tubing drawn from a molten gather of glass. The tubing was chopped or cut into bead-length segments for subsequent finishing, sorting, and packaging. The tubing was probably sized by hand prior to the bead segments being chopped, cut, or snapped. Before the mechanization of drawn-bead manufacture in the twentieth century, there were three major techniques for the rounding of cut edges: the Italian *a speo* process, used generally for medium-sized (>4 mm) drawn beads before the mid-eighteenth century; the Italian pan, or *ferraccia,* process, used generally for smaller drawn beads before the second quarter of the nineteenth century; and the Italian hot-tumbling process, which was invented in 1817 and was commonly used for all drawn beads after the first quarter of the nineteenth century.

Wound Beads

Wound beads make up the second-most-common group at western archaeological sites dating to the eighteenth and nineteenth centuries. Because of the lack of comparative terminology for wound-bead shapes, it is difficult to compare wound-bead descriptions among the archaeological reports for the region.

Wound beads were manufactured by a variety of techniques, of which two winding techniques were recognized for beads from the PVAHP sites. The first is free winding or lamp winding, including the *suppialume* process of the Venetians. Generally, this technique consists of wrapping or winding molten glass around a rotating mandrel, such as a wire or rod, occasionally coated with a releasing agent, such as a clay slip. Beads were produced individually or conjoined (probably accidentally) and then were removed from the winding rod, annealed, cleaned, sorted, and packaged. The second technique noted at the PVAHP sites was furnace winding, which generally consisted of free winding or shaping a glob of molten glass onto a wire or rod. Such beads often were shaped or impressed, and there is no visible evidence for spiral winding of the glass. Beads were produced individually and then removed from their shafts, annealed, cleaned, sorted, and packaged.

Molded Beads

Beads of this type from the PVAHP sites included mold-pressed beads and Prosser-molded beads. Mold-pressed beads were manufactured by pinching or pressing molten glass in a two-part mold. The perforations were produced by pushing a pin into the mold and through the glass. Mold-pressed beads appear to have been produced in Bohemia by the eighteenth century, but at present, the earliest mold-pressed beads from a western North American archaeological context is ca. the 1820s. Prosser-molded beads were manufactured variously by pressing a dry or moist mixture of powdered clay, flint, feldspar, metallic oxides, and "other earthy materials" into a mold. Upon removal from the mold, the bead would then have been bisque fired. Historical accounts of "Prosser" techniques have indicated that after bisque firing, the molded objects could be decorated, fired again, glazed, and fired for a final time. The technique was invented in the 1830s and was first used for mass production during the 1840s.

Bead Attributes

In addition to the method of manufacture, beads were sorted based on several attributes relating to their shapes and styles.

Layering

Beads were manufactured from one or more layers of glass (i.e., monochrome or polychrome). Multicolored layers were produced by at least two methods: (1) one or more layers of glass applied to a central core and (2) fortuitously created layers. Beads with applied layers were drawn from a gather of glass of one color and then covered with one or more layers of different-colored glass. Beads with fortuitous layers appear to have been produced from a gather of one color that, upon cooling, created multicolored layers (generally of the same color hue, but with a different chroma, color value, and/or diaphaneity). It is speculated that this phenomenon results as glass cools from its surface to its interior, causing different chemical elements to migrate slower or faster. It is further speculated that as coalescing elements "freeze," concentric layers are created that are brighter or duller, lighter or darker, or more opaque, translucent, or transparent than adjacent layers. Whether bead makers consciously created polychrome beads to exhibit these traits remains unknown. Polychrome layering can consist of multiple individual layers (e.g., two layers, three layers, or more layers, perhaps as many as ten), marbleized layers, or zoned layers.

Shape

Shape is a highly variable attribute and is often difficult to describe. Shapes include biconical, conical, cuboidal, cylindrical, ellipsoidal, multisided, ovoidal, spheroidal, and toroidal. Other less common shapes included pyramidal (three or four sided) and bipyramidal (three or four sided). Shapes are further categorized as irregular (generally an attribute associated with hand-shaping) or uniform (generally indicative of molding or shaping) and long or short. A single variety may include a range of shape attributes.

Decoration

Beads are either decorated or undecorated. Decorations are highly variable, and attributes used for identification included the type of decoration (e.g., appliqués, inlays, facets, molded surfaces, and shaped surfaces), the color of the decoration, and the style, placement, and orientation of repetitive elements (e.g., rows, sides, facets, stripes, ridges, and bands). Generally, the number of elements was not used in defining varieties except to identify a subtype or to describe the range of repetitive elements.

Diaphaneity

The clarity of glass is identified as opaque, translucent, or transparent. Beads composing a single variety may exhibit a range of diaphaneity (e.g., translucent to opaque) or may have multiple layers of glass of differing diaphaneity (e.g., opaque on transparent). All three variations of diaphaneity were present at the PVAHP sites.

Color Hue, Chroma, and Value

Color is one of the principal attributes used to sort beads into varieties. During examination, beads of a single possible variety with a similar color were grouped and then sorted into discrete color clusters. Often, subtle shades cannot be identified consistently, and a single bead variety might exhibit a broad range of color. When describing color, the hue, chroma, and value are recognized by a simplified set of color terms used individually or in various combinations when applied to monochrome or polychrome beads or to a range of attributes for a single variety.

The PVAHP Glass- and Ceramic-Bead-Variety Numbering System

The 58,118 beads recovered from the PVAHP sites comprise classes consisting of four primary and two secondary methods of manufacture and four methods of finishing. They are sorted into nine classes based on material, method of manufacture, and method of finishing; 46 types based on layering, shape, and decoration; and 132 varieties based on diaphaneity, color, luster, and perforation (Figure 131; Table 123; Figure 132, Table 124; Figure 133, Table 125; Figure 134, Table 126; Figure 135, Table 127; Figure 136, Table 128; Figure 137, Table 129). See Appendixes F.9–F.12 for detailed descriptions of bead varieties and frequencies recovered from the PVAHP sites. The PVAHP glass- and ceramic-bead-variety numbering system covers the entire combined collection for the four sites. These arbitrary numbers have no direct connection to numbers used for sites outside the project area. For comparative purposes, a reference notation from Karklins's (1985) glass- and ceramic-bead typological system is provided, when applicable, for each variety (i.e., IIa, WIb, MPIIa, PM, etc.) (Table 130). Karklins's typology focused on major bead attributes, including structure, shape, decoration, color, diaphaneity, luster, and size. The collections for the four PVAHP sites are spatially and temporally separated. For this reason, each site collection is described individually in the following four sections, arranged chronologically by the age of the collection.

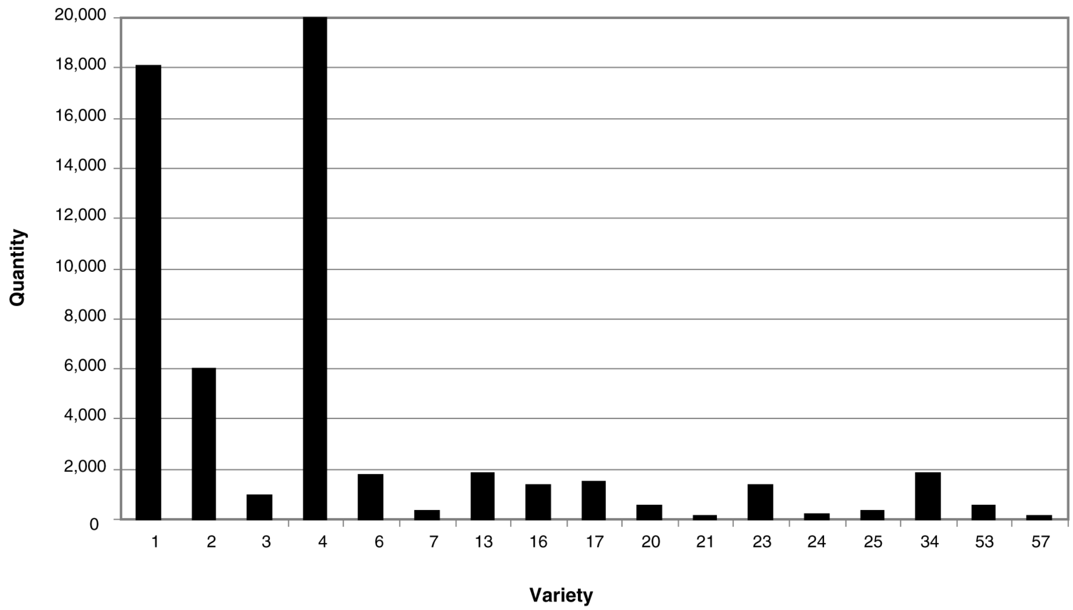

Figure 131. Frequencies of glass- and ceramic-bead varieties with more than 100 specimens, all PVAHP sites.

Table 123. Classes, Varieties, and Quantities of Glass and Ceramic Beads from the Four PVAHP Sites, by Inferred Temporal Period

Site	Class Attributes				Quantity		
	Material	Manufacture		Finishing			
		Primary	Secondary		Varieties	Count	Percent
	Early Spanish Colonial Period, ca. the Late Eighteenth Century to the 1810s						
LAN-62	glass	drawn		cut	14	983	1.70
				rounded, including *a speo*, *ferraccia*, and hot tumbled	33	55,974	96.53
		wound	free wound	unshaped	19	230	0.40
				shaped	38	769	1.30
			furnace wound	shaped	9	18	0.03
		unidentifiable				11	0.03
Subtotal					113	57,985	100.00
LAN-211	glass	drawn		cut	2	2	2.02
				rounded	11	97	97.98
Subtotal					13	99	100.00
	Mexican Rancho Period, ca. 1830s–1850s						
LAN-2768	glass	drawn		cut	4	5	25.00
				rounded	1	2	10.00
		wound	free wound	shaped	2	10	50.00
		mold pressed			2	3	15.00
Subtotal					9	20	100.00
	Early American Settlement Period, ca. 1850 to the Late Nineteenth Century						
LAN-193	glass	wound	free wound	unshaped	1	1	7.14
				shaped	2	3	21.43
			furnace wound	shaped	4	5	35.71
		mold pressed			1	1	7.14
	ceramic	Prosser molded			4	4	28.57
Subtotal					12	14	100.00
Total						58,118	

Figure 132. PVAHP glass- and ceramic-bead Varieties 1–13 (see Table 124; see Appendix F.5 for size categories).

Table 124. Playa Vista Glass-Bead Varieties 1–13 (see Figure 132)

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
1	IIa	drawn	pan and *a speo* rounded	transparent	light to dark bluish purple to purple	Many beads have flattened areas with an orange-peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified.	LAN-62, LAN-211, LAN-2676	18,074	
2	IIa	drawn	pan and *a speo* rounded	transparent	light bluish green to very light purplish blue	The glass for beads in this variety generally lack air bubbles, but many have few to numerous bubbles. Contrast with Variety 34 beads. Many beads have flattened areas with an orange peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified. Many beads have encrusted dirt, wear, and a dull finish, which made it difficult to see transparency unless the beads were wet. Multiple colors are included within this variety, but it was not possible to distinguish separate varieties on the basis of color since they graded into one another.	LAN-62, LAN-211	6,036	
3	IIa	drawn	pan and *a speo* rounded	transparent	clear (white)	Many beads have flattened areas with an orange-peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified.	LAN-62, LAN-211	978	

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Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
4	IIa	drawn	pan and *a speo* rounded	transparent to opaque	yellowish green to green	Many beads have flattened areas with an orange-peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified. Many have a blackened surface, suggesting that they had been inset in asphaltum. This variety is composed of a mixture of transparent to opaque beads, but it was not possible to divide beads in multiple varieties since most, it not all, beads are transparent to translucent when backlit by a bright light.	LAN-62, LAN-211, LAN-1932	19,966	
5	IIa	drawn	rounded, possibly hot tumbled	opaque	light yellowish green		LAN-62	2	
6	IVa	drawn	pan rounded and hot tumbled	opaque on opaque	white on white	Some beads have flattened areas with an orange-peel surface characteristic of pan rounding, but most are relatively uniform in shape suggestive of hot tumbling.	LAN-62, LAN-211	1,783	1771–1860
7	IIa	drawn	rounded, possibly hot tumbled	opaque to translucent	light purplish blue	Many beads have flattened areas with an orange-peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified. Contrast with Variety 10 and 93 beads.	LAN-62, LAN-211	332	
8	WIIm	shaped free wound	triangular	opaque	black	Three pressed sides. Probably a variation of Variety 56 beads. One side of one bead has 2 pressed facets.	LAN-62	14	1782–present

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
9	WIb	free wound	spheroidal	transparent	dark purple	Monochrome, spheroidal, undecorated, wound beads.	LAN-62	31	1771–1900
10	IIa	drawn	pan rounded	opaque	purplish blue	One bead has a flattened area with an orange-peel surface characteristic of pan rounding. Probably a variation of Variety 7 beads.	LAN-62	2	
11	IIa	drawn	rounded, possibly hot tumbled	transparent	purplish red to brownish red	Beads lack flattened orange-peel surfaces and asymmetrical shapes, suggesting they may have been hot tumbled. Contrasting these beads with Variety 57 and 75 beads, there is a distinction between beads with light and dark color values.	LAN-62	94	
12	Ia	drawn	cut	transparent	light purple	Commonly knows as "cornaline d'Aleppo" beads. See Variety 96 beads for a possibly variation of this bead variety.	LAN-62,	4	1782–1905
13	IVa	drawn	rounded, possibly hot tumbled	opaque on transparent	brownish red on light green	Undecorated, polychrome, cylindrical, rounded, drawn beads.	LAN-62, LAN-211	1,847	1771–1860

Figure 133. PVAHP glass- and ceramic-bead Varieties 14–41 (see Table 125; see Appendix F.5 for size categories).

Table 125. Playa Vista Glass-Bead Varieties 14–41 (see Figure 133)

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Site	Quantity	Estimated Date Range (A.D.)
14	WIIId	free wound	cylindrical, irregular	transparent	purple	Overlaid, simple, opaque white horizontal stripes.	LAN-62	1	
15	Ia - IIa	drawn	cut	translucent	very light purplish white	Some beads have slightly rounded ends which may be due to fire polishing and/or use wear.	LAN-62	68	1782–1905
16	IIa	drawn	pan and *a speo* rounded	opaque to transparent	black to very dark brownish red	Many beads have flattened areas with an orange-peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified. Contrast with Variety 57 beads.	LAN-62, LAN-211	1,396	
17	IIa	drawn	rounded, possibly hot tumbled	opaque to transparent	reddish purple	Very fragile.	LAN-62	1,532	
18	IIa	drawn	rounded, possibly hot tumbled	opaque to slightly translucent	white	Possibly a variation of Variety 6 beads.	LAN-62	6	
19	IIa	drawn	pan rounded	transparent	very light purple		LAN-62	1	
20	Ia	drawn	cut	transparent	purple	Undecorated, monochrome, cylindrical, cut, drawn beads. Some beads have slightly rounded ends which may be due to fire polishing and/or use wear.	LAN-62, LAN-211	544	1782–1905
	WIb					Monochrome, spheroidal, undecorated, wound beads.	LAN-62		1771–1900
21	Ia	drawn	cut	transparent	light bluish green to blue		LAN-62, LAN-211	162	
22	WIc	free wound	ellipsoidal	transparent	dark purple	Monochrome, toroidal, undecorated, wound beads.	LAN-62	30	1797–present

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Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Site	Quantity	Estimated Date Range (A.D.)
23	IIa	drawn	rounded, possibly hot tumbled	transparent to translucent	light to dark brownish yellow	Many have blackened surface, suggesting perhaps with were inset in asphaltum	LAN-62, LAN-211	1,387	
24	WIIm	shaped free wound	cuboidal	transparent	red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Four pressed sides. Contrast with Variety 39, 78, and 79 beads.	LAN-62	196	1782–present
25	WIIp	shaped free wound	bipyramidal	transparent	red	Four pressed sides with 2 rows or pressed concave facets. Contrast with Varieties 73 and 91 beads. Very fragile.	LAN-62	308	
26	IIIa	drawn	cut	opaque on transparent	brownish red on light green	Possibly the unrounded variation of Variety 13 beads.	LAN-62	87	1829–1860
27	WIIp	shaped furnace wound	multisided	translucent and opaque	red and black	Monochrome, bipyramidal, wound beads with pressed sides. Four pressed sides with 3 rows ground edge and corner facets, 4 facets for each row. Very fragile.	LAN-62	1	1797–1840
28	Ia	drawn	cut	opaque	black	Color: under bright light, some appear to be very dark brownish red. Compare to Variety 92 beads.	LAN-62	75	1782–1905
29	WIb	free wound	spheroidal	transparent	red	Some spheroidal beads are slightly flattened, but not toroidal. Contrast with Variety 69 beads.	LAN-62	60	
30	WIII	shaped free wound	biconical	opaque	white	Monochrome, biconical, undecorated, wound beads.	LAN-62	1	1782–present
31	WIIId	shaped free wound	spheroidal	transparent	red	Overlaid, simple, opaque brownish yellow combed horizontal loops.	LAN-62	1	1782–1905
32	WId	free wound	toroidal	transparent	dark red		LAN-62	2	
33	WIIp	shaped free wound	bipyramidal	opaque to slightly translucent	black to dark reddish purple	Four pressed sides with 2 rows or pressed concave facets. Possibly a variation of Variety 85 beads.	LAN-62	4	

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Site	Quantity	Estimated Date Range (A.D.)
34	IIa	drawn	pan and *a speo* rounded	translucent to transparent	greenish blue to blue	The glass for beads in this variety have very numerous air bubbles. Contrast with Variety 4 beads. There are two variations of this variety, one transparent variation with very numerous bubbles and one translucent version with micro-bubbles. These two variations could not be divided into two distinct varieties. Many beads have flattened areas with an orange-peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified.	LAN-62, LAN-211	1,827	
35	WIc	free wound	ovoidal	transparent	dark red	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads. Some are very fragile.	LAN-62	28	1781–1860
36	WIb-WIc	free wound	spheroidal to ovoidal, irregular	opaque	black	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads. Crudely manufactured.	LAN-62	11	1781–1860
37		shaped free wound	conjoined cuboidal	transparent	red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Conjoined Variety 24 beads.	LAN-62	1	1782–present
38	IIb	drawn	*a speo* rounded	transparent	purple	Twenty-three simple, vertical, opaque white stripes. Commonly know as "gooseberry" beads.	LAN-62	2	1812–1860
39	WIIm	shaped free wound	triangular	transparent	red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Three pressed sides. Probably a variation of Variety 24. Very fragile.	LAN-62	50	1782–present
40	WIe	free wound	conical	opaque	white	Monochrome, conical, undecorated, wound beads.	LAN-62	1	1804–present
41	WIc	shaped free wound	ellipsoidal	transparent	dark red	Monochrome, toroidal, undecorated, wound beads.	LAN-62	32	1797–present

Figure 134. PVAHP glass- and ceramic-bead Varieties 42–69 (see Table 126; see Appendix F.5 for size categories).

Table 126. Playa Vista Glass-Bead Varieties 42–69 (see Figure 134)

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diephaneity	Color	Decoration and Comments	Site	Quantity	Estimated Date Range (A.D.)
42	WIb	free wound	spheroidal	transparent	light blue	Monochrome, spheroidal, undecorated, wound beads. Very fragile.	LAN-62	14	1771–1900
	WIb					Undecorated, monochrome, spheroidal, unshaped, free-wound beads and undecorated, monochrome, spheroidal, shaped, free-wound beads.	LAN-193		1771–1851
43	WIe	free wound	conical	transparent	red	Monochrome, conical, undecorated, wound beads. Fragile. Contrast with Variety 113 beads.	LAN-62	2	1804–present
44	WIc	free wound	ovoidal	opaque	light yellowish green	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads. Originally the color may have been darker. This lightening may be due in part to leaching of the colorant (possibly copper). May be a variation of Variety 59 beads.	LAN-62	1	1781–1860
45	WIc	free wound	ovoidal	transparent	dark purple	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads.	LAN-62	5	1781–1860
46	WIIIb	shaped free wound	spheroidal	transparent	very dark reddish black	Inlaid, complex, opaque-on-opaque greenish blue on brownish yellow, combed horizontal loops with simple, opaque white dots.	LAN-62	2	
47	IIf	drawn	rounded, multi-sided	transparent	dark red	Monochrome, cylindrical, rounded, drawn beads with random ground facets. Two-to-5-sided with 1–2 rows of ground facets.	LAN-62	4	1781–1860
48	Ia	drawn	cut	opaque	red	Undecorated, monochrome, cylindrical, cut, drawn beads. Heavily oxidized and crumbles easily.	LAN-62	1	1782–1905
49	If	drawn	cut	transparent	dark purplish red	Cylindrical (not multisided) 2 rows of facets, one row at each end. Each end has 4 facets.	LAN-62	23	

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Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diephaneity	Color	Decoration and Comments	Site	Quantity	Estimated Date Range (A.D.)
50	IIa	drawn	rounded, short to long, possibly hot tumbled	translucent	dark purplish red to red	Very fragile and easily broken.	LAN-62	7	
51	WIIIb	shaped furnace wound	ovoidal	transparent	red	Inlaid, simple, opaque bluish green and brownish yellow dots.	LAN-62	1	
52	Ia	drawn	cut	transparent	dark green	Undecorated, monochrome, cylindrical, cut, drawn beads.	LAN-62	7	1782–1905
53	IIa	drawn	rounded, possibly hot tumbled	translucent	light yellow	Undecorated, monochrome, rounded, drawn beads.	LAN-62, LAN-2768	517	1781–present
54	IIa	drawn	rounded, short; possibly hot tumbled	translucent	red to dark red	Very fragile and easily broken.	LAN-62	21	
55		shaped free wound	conjoined triangular	opaque	black	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Conjoined Variety 8 beads.	LAN-62	1	1782–present
56	WIIm	shaped free wound	cuboidal	opaque	black	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Four pressed sides. Contrast with Varieties 8, 60, 104, and 106 beads.	LAN-62	30	1782–present
57	IIa	drawn	rounded, possibly hot tumbled	transparent	dark to very dark purplish red to brownish red	Beads lack flattened orange-peel surfaces and asymmetrical shapes, suggesting they may have been hot tumbled. Contrasting these beads with Variety 11 beads, there is a distinction between beads with light and dark color values. Some of these beads may be a variation of Variety 16 beads.	LAN-62, LAN-211	108	
58		drawn	pan rounded	transparent	light grayish blue	Conjoined Variety 2 beads which were fused during manufacture suggesting they were pan rounded.	LAN-62	1	

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diephaneity	Color	Decoration and Comments	Site	Quantity	Estimated Date Range (A.D.)
59	WIc	free wound	ovoidal	opaque	greenish blue to blue	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads. Contrast with Variety 44 beads.	LAN-62	25	1781–1860
60	WIIm	shaped free wound	cuboidal	transparent	very dark brownish red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Four pressed sides. May be a variation of Variety 56 beads.	LAN-62	1	1782–present
61	WIc	shaped furnace wound	ovoidal	transparent	very dark purple	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads. Beads of this size were known as "pigeon egg" beads.	LAN-62	2	1781–1860
62	IIa	drawn	pan rounded	translucent	very light greenish blue	Beads have flattened areas with an orange-peel surface characteristic of pan rounding.	LAN-62	2	
63	WIIIb	shaped furnace wound	spheroidal	opaque	very dark reddish black	Inlaid, simple , opaque, brownish yellow dots and complex opaque bluish green on opaque white and transparent red on opaque white dots.	LAN-62	1	
64	IIf	drawn	rounded, multisided	transparent	brownish red	Monochrome, cylindrical, rounded, drawn beads with random ground facets. Five sided with 2 rows of ground facets.	LAN-62	2	1781–1860
65	WIIIb	shaped free wound	cylindrical	transparent	red	Inlaid, simple, opaque, brownish yellow loops.	LAN-62	2	
66	WIb	shaped free wound	spheroidal	opaque	greenish blue to blue	Monochrome, spheroidal, undecorated, wound beads.	LAN-62	20	1771–1900
67	Ia	drawn	cut	transparent	dark purplish red	Undecorated, monochrome, cylindrical, cut, drawn beads.	LAN-62	5	1782–1905
68	WIIIb	shaped furnace wound	spheroidal	transparent	blue	Inlaid, complex, transparent red on opaque white on opaque brownish yellow combed vertical florals.	LAN-62	1	
69	WId	free wound	toroidal	transparent	red	May be a variation of Variety 29 beads.	LAN-62	14	

Figure 135. PVAHP glass- and ceramic-bead Varieties 70–88 (see Table 127; see Appendix F.5 for size categories).

Table 127. Playa Vista Glass-Bead Varieties 70–88 (see Figure 135)

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
70	WIII	shaped free wound	biconical	transparent	purple	Monochrome, biconical, undecorated, wound beads.	LAN-62	1	1782–present
71	WIa	free wound	cylindrical	transparent	bluish green		LAN-62	1	
72	IIf	drawn	rounded, multisided	transparent	dark purplish red to brownish red	Monochrome, cylindrical, rounded, drawn beads with random ground facets. One to four sided with 1–2 rows of ground facets.	LAN-62	3	1781–1860
	WIa					Monochrome, cylindrical, undecorated, wound beads.	LAN-62		1782–present
73	WIIp	shaped free wound	bipyramidal	transparent	red	Five pressed sides with 2 rows or pressed concave facets. Probably a variation of Variety 25 beads. Very fragile.	LAN-62	3	
74	WIIp	shaped free wound	bipyramidal	transparent	dark purplish red	3 pressed sides with 2 rows or pressed concave facets. Probably a variation of Variety 85 beads.	LAN-62	1	
75	IIa	drawn	rounded, possibly hot tumbled	transparent	light purplish red	Contrasting these beads with Variety 11 beads, there is a distinction between beads with light and dark color values.	LAN-62, LAN-211	8	
76		drawn	pan rounded	transparent	purple	Conjoined Variety 1 beads which were fused during manufacture suggesting they were pan rounded.	LAN-62	2	
77	IIIa	drawn	cut	transparent on opaque	clear on white	Undecorated, polychrome, cylindrical, cut, drawn beads. Material: The inner layer of white glass has numerous air bubbles indicating that it is an inexpensive white glass. The outer transparent casing masks the air bubbles of the white glass, giving the bead a smooth appearance.	LAN-62	1	1829–1860

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Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
78		shaped free wound	spheroidal to cuboidal	transparent	red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Five pressed sides. Probably a variation of Variety 24 beads. Very fragile.	LAN-62	4	1782–present
79		shaped free wound	flattened spheroidal	transparent	red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Two pressed sides. Contrast with Variety 105 beads, probably a variation of Variety 24 beads. Very fragile.	LAN-62	3	1782–present
80	IIa	drawn	pan rounded	translucent	purplish blue	Beads have flattened areas with an orange peel surface characteristic of pan rounding. Possibly a variation of Variety 7 beads. The surface of one bead is blackened, suggesting it may have been inset in asphaltum.	LAN-62	2	
81	WIIIa	shaped free wound	spheroidal	transparent on translucent	dark red on white	Polychrome, spheroidal, undecorated, wound beads. The inner white layer is extremely thin.	LAN-62	8	1781–1856
82	WIb	free wound	spheroidal	transparent	dark green	Monochrome, spheroidal, undecorated, wound beads.	LAN-62	1	1771–1900
83	WIIIb	shaped furnace wound	ovoidal	transparent	red	Inlaid, simple, opaque brownish yellow, combed loops. Fragile.	LAN-62	3	
84	WIIm	shaped free wound	triangular	transparent	dark purplish red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Three pressed sides.	LAN-62	2	1782–present
85	WIIp	shaped free wound	bipyramidal	transparent	dark purplish red	Four pressed sides with 2 rows or pressed concave facets. Contrast with Variety 33 and 74 beads.	LAN-62	22	
86	WIIIb	shaped furnace wound	spheroidal to ovoidal	transparent	red	Inlaid, simple, opaque white, combed loops. Fragile.	LAN-62	4	

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
87	WIIIb	shaped furnace wound	ellipsoidal	transparent	red	Inlaid, simple, opaque brownish yellow, combed horizontal loops.	LAN-62	3	
88	IIIm	drawn	cut	polychrome, opaque	dark purple on white on red on dark purple on white	Two rows with 6 ground facets.	LAN-62	1	

Figure 136. PVAHP glass- and ceramic-bead Varieties 89–113 (see Table 128; see Appendix F.5 for size categories).

Table 128. Playa Vista Glass Bead Varieties 89–113 (see Figure 136)

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
89	IIa	drawn	pan and *a speo* rounded	translucent	bluish green to greenish blue	Many beads have flattened areas with an orange-peel surface characteristic of pan rounding. However, a few have an asymmetrical shape characteristic of *a speo* fire polishing. Some may have been hot tumbled, but characteristics for this method have yet to be identified. Contrast with Variety 4 and 34 beads.	LAN-62	62	
90	WIIm	shaped free wound	ovoidal	opaque	greenish blue	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Two pressed sides. Probably a variation of Variety 112 beads.	LAN-62	1	1782–present
91	WIIp	shaped free wound	bipyramidal	transparent	red	Three pressed sides with 2 rows or pressed concave facets. Probably a variation of Variety 25 beads. Very fragile.	LAN-62	3	
92	WIa	shaped free wound	cylindrical	opaque	black		LAN-62	21	
93	IIa	drawn	rounded, possibly hot tumbled	opaque	very light bluish green	Possibly a variation of Variety 7 beads.	LAN-62	57	
94	IIa	drawn	pan rounded	opaque	purple	Some beads have flattened areas with an orange peel surface characteristic of pan rounding.	LAN-62	11	
95	WIc	free wound	ellipsoidal	transparent	light greenish blue	Monochrome, toroidal, undecorated, wound beads.	LAN-62	1	1797–present
96		drawn	rounded, possibly hot tumbled	opaque on transparent	brownish red on light green	Five pressed sides. Possibly a variation of Variety 13 beads.	LAN-62	1	

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Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
97	IIIm	drawn	cut	polychrome, opaque	dark purple on white on red on white	Complex, inlaid horizontal stripes with ground facets on both ends. Two rows of facets, one row at each end. Each end has 6 facets. Six red-on-yellow and very light green stripes.	LAN-62	1	
98	Ia	drawn	cut	translucent	greenish blue	Undecorated, monochrome, cylindrical, cut, drawn beads. Probably a variation of Variety 34 beads.	LAN-62	6	1782–1905
99		shaped free wound	truncated ellipsoidal	transparent	light reddish purple		LAN-62	1	
100	WIb	shaped furnace wound	spheroidal	transparent	light reddish purple	Monochrome, spheroidal, undecorated, wound beads. The small bead has concave ends.	LAN-62	2	1771–1900
101	WIIp	shaped free wound	bipyramidal	transparent	purple	Four pressed sides with 2 rows or pressed concave facets. Contrast with Variety 74 and 85 beads.	LAN-62	1	
102	WIa	shaped free wound	cylindrical	transparent	light reddish purple	Monochrome, cylindrical, undecorated, wound beads.	LAN-62	1	1782–present
103	WIa	free wound	cylindrical	transparent	red	Monochrome, cylindrical, undecorated, wound beads.	LAN-62	2	1782–present
104	WIIm	shaped free wound	cuboidal	opaque	black	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Five pressed sides. Probably a variation of Varieties 56 beads.	LAN-62	2	1782–present
105	WIIm	shaped free wound	ovoidal	transparent	red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Two pressed sides. Contrast with Variety 79 beads, probably a variation of Variety 24 beads. Fragile.	LAN-62	1	1782–present
106	WIIm	shaped free wound	cuboidal	translucent	dark purplish red	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Four pressed sides. Possibly a variation of Variety 56 beads.	LAN-62	6	1782–present

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
107	WIb	shaped free wound	spheroidal	opaque	black	Monochrome, spheroidal, undecorated, wound beads. Flattened ends. Small perforation.	LAN-62	1	1771–1900
108	WIIIb	shaped free wound	cylindrical	transparent	red	Inlaid, simple, opaque, white spiral stripe. Fragile.	LAN-62	2	
109	WIc	free wound	ovoidal	opaque	green	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads.	LAN-62	1	1781–1860
110	WIIm	shaped free wound	triangular	opaque	greenish blue	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Three pressed sides. Probably a variation of Variety 112 beads.	LAN-62	9	1782–present
111		shaped free wound	conjoined triangular	opaque	greenish blue	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Three pressed sides. Conjoined Variety 110 beads.	LAN-62	1	1782–present
112	WIIm	shaped free wound	cuboidal	opaque	greenish blue	Monochrome, spheroidal to cuboidal, wound beads with pressed sides. Four pressed sides. Contrast with Varieties 90 and 110 beads.	LAN-62	10	1782–present
113	WIe	shaped free wound	conical	transparent	dark red	Monochrome, conical, undecorated, wound beads. Fragile. Contrast with Variety 43 beads.	LAN-62	2	1804–present

Figure 137. PVAHP glass- and ceramic-bead Varieties 114–132 (see Table 129; see Appendix F.5 for size categories).

Table 129. Playa Vista Glass-Bead Varieties 114–132 (see Figure 137)

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
114	WIb	shaped furnace wound	spheroidal	transparent	light yellowish green	Undecorated, monochrome, spheroidal, unshaped, free-wound beads and undecorated, monochrome, spheroidal, shaped, free-wound beads. Very fragile.	LAN-193	1	1771–1851
115	WIb	shaped furnace wound	spheroidal	opaque	black	Undecorated, monochrome, spheroidal, unshaped, free-wound beads and undecorated, monochrome, spheroidal, shaped, free-wound beads. Small perforation.	LAN-193	2	1771–1851
116	WIb	shaped free wound	spheroidal	transparent	purple	Undecorated, monochrome, spheroidal, unshaped, free-wound beads and undecorated, monochrome, spheroidal, shaped, free-wound beads. Very fragile.	LAN-193	1	1771–1851
117	WIb	shaped free wound	spheroidal	opaque	white (bluish)	Undecorated, monochrome, spheroidal, unshaped, free-wound beads and undecorated, monochrome, spheroidal, shaped, free-wound beads. Small perforation. Selective dark staining of fibers of glass giving an appearance of a spiral decoration. Fragile.	LAN-193	2	1771–1851
118	none	prosser molded	spheroidal	transparent	light yellow	Monochrome, spheroidal, undecorated, Prosser-molded beads. Wide horizontal band around circumference. Prosser-molded technique not patented until 1840.	LAN-193	1	1782–present
119	none	mold pressed	cuboidal	transparent	clear (white)	Fire polished. Four molded, flat sides and two molded flat ends. Vertical, straight, mold seam, diagonally across each end and along opposite edges. Vertical, pierced, cylindrical perforation.	LAN-193	1	
120	WIc	shaped furnace wound	ellipsoidal	transparent	dark purple	Very fragile.	LAN-193	1	

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Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
121	none	prosser molded	spheroidal	opaque	yellowish green	Monochrome, spheroidal, undecorated, Prosser-molded beads. Wide horizontal band around circumference. Prosser-molded technique not patented until 1840.	LAN-193	1	1782–present
122	none	prosser molded	tapered cylindrical	opaque	white	Monochrome, spheroidal, undecorated, Prosser-molded beads. Prosser-molded technique not patented until 1840.	LAN-193	1	1782–present
123	none	prosser molded	spheroidal	opaque	white	Monochrome, spheroidal, undecorated, Prosser-molded beads. Wide horizontal band around circumference. Prosser-molded technique not patented until 1840.	LAN-193	1	1782–present
124	WIb	shaped furnace wound	spheroidal	transparent	clear (white)	Undecorated, monochrome, spheroidal, unshaped, free-wound beads and undecorated, monochrome, spheroidal, shaped, free-wound beads.	LAN-193	1	1771–1851
125	WIb	shaped free wound	spheroidal	opaque	bright white	Undecorated, monochrome, spheroidal, shaped, free-wound beads. Glass has no air bubbles, suggesting that it is relatively modern. Large perforation.	LAN-2768	2	1781–1856
126	Ia	drawn	cut	transparent	clear (white)	Undecorated, monochrome, cylindrical, cut, drawn beads. Thin-walled. Beads of this style often had an applied colored or metallic coating on the inside of the perforation which is easily eroded and lost.	LAN-2768	1	1782–1905
127	none	mold pressed	spheroidal, multisided	transparent	very light bluish purple	Monochrome, multisided spheroidal, mold-pressed beads with facets. Fire polished. 5 sides, 3 rows of molded and ground facets. 17 molded and ground side facets, 5 per row; and one top and bottom facets. Horizontal, straight mold seam. Vertical, pierced, cylindrical perforation. Probable mid- to late 19th-century manufacture (Ross 2006:50).	LAN-2768	2	1860–1880?

Variety No.	Karklins's No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Sites	Quantity	Estimated Date Range (A.D.)
128	WIc	drawn	cut	opaque	iridescent black	Undecorated, monochrome, multisided, cut, drawn beads.	LAN-2768	2	1782–present
129	none	mold pressed	spheroidal, multi-sided	opaque	black	Monochrome, multisided spheroidal, mold-pressed beads with facets. Acid polished. Seven sides, 5 rows of pattern molded facets. 35 molded facets, 7 per row. Zig-zag, horizontal mold seam. Vertical, pierced, cylindrical perforation. Probable mid- to late 19th-century manufacture (Ross 2006:50).	LAN-2768	1	1860–1880?
130	Ic	drawn	cut	opaque	black	Undecorated, monochrome, multisided, cut, drawn beads. Five sided.	LAN-2768	1	1782–present
131	Ia	drawn	cut	transparent	purple	Undecorated, monochrome, cylindrical, cut, drawn beads. Thin-walled.	LAN-2768	1	1782–1905
132	WIb	shaped free wound	spheroidal	opaque	black	Undecorated, monochrome, spheroidal, shaped, free-wound beads. Glass has no air bubbles, suggesting that it is relatively modern. Large perforation.	LAN-2768	8	1781–1856

Table 130. Playa and Karklins Variety Designations, Bead Descriptions, and Estimated Date Ranges for Glass Beads from PVAHP Sites

Estimated Date Range (A.D.)	Playa Bead Variety	Karklins's Variety	Description	Sites
1771–1851	42, 114, 115, 116, 117, 124, 130	WIb	Undecorated, monochrome, spheroidal, unshaped, free-wound beads and undecorated, monochrome, spheroidal, shaped, free-wound beads.	LAN-193
1771–1860	6, 13	IVa	Undecorated, polychrome, cylindrical, rounded, drawn beads.	LAN-62
1771–1900	9, 20, 42, 66, 82, 100, 107	WIb	Monochrome, spheroidal, undecorated, wound beads.	LAN-62
1781–1856	81	WIIIa	Polychrome, spheroidal, undecorated, wound beads.	LAN-62
1781–1856	125, 132	WIb	Undecorated, monochrome, spheroidal, shaped, free-wound beads.	LAN-2768
1781–1860	47, 64, 72	IIf	Monochrome, cylindrical, rounded, drawn beads with random ground facets.	LAN-62
1781–1860	35, 36, 44, 45, 59, 61, 109	WIc	Monochrome, ovoidal, truncated ovoidal, and ellipsoidal, undecorated, wound beads.	LAN-62
1781–present	1, 2, 3, 4, 5, 7, 10, 11, 53	IIa	Undecorated, monochrome, rounded, drawn beads.	LAN-2768
1782–1905	12, 15, 20 28, 31, 48, 52, 67, 98, 126, 131	Ia	Undecorated, monochrome, cylindrical, cut, drawn beads.	LAN-62, LAN-2768
1782–present	8, 24, 37, 39, 55, 56, 60, 78, 79, 84, 90, 104 105, 106, 110, 111, 112	WIIm	Monochrome, spheroidal to cuboidal, wound beads with pressed sides.	LAN-62
1782–present	30, 70	WIII	Monochrome, biconical, undecorated, wound beads.	LAN-62
1782–present	72, 102, 103	WIa	Monochrome, cylindrical, undecorated, wound beads.	LAN-62
1782–present	118, 121, 122, 123		Monochrome, spheroidal, undecorated, Prosser-molded beads.	LAN-193
1782–present	128	WIc	Undecorated, monochrome, ellipsoidal, shaped, furnace-wound beads.	LAN-193
1782–present	128, 130	Ic	Undecorated, monochrome, multisided, cut, drawn beads.	LAN-2768
1797–1840	27	WIIp	Monochrome, bipyramidal, wound beads with pressed sides.	LAN-62
1797–present	22, 41, 95	WId	Monochrome, toroidal, undecorated, wound beads.	LAN-62
1804–present	40, 43, 113	WIe	Monochrome, conical, undecorated, wound beads.	LAN-62
1812–1860	38	IIb	Monochrome, cylindrical, rounded, drawn beads with inlaid simple, straight stripes.	LAN-62
1829–1860	26, 77	IIIa	Undecorated, polychrome, cylindrical, cut, drawn beads.	LAN-62
1860–1880?	127, 129	MPIIa	Monochrome, multisided spheroidal, mold-pressed beads with facets.	LAN-2768

Table 131. Glass-Bead Collection from LAN-62

Categories		Number of Varieties	Total (Excluding 11 Unidentifiable Beads)			
			Tertiary Total		Secondary Total	
Secondary	Tertiary		Quantity	Percentage	Quantity	Percentage
Manufacturing Types						
Drawn beads					56,957	98.20
	cut, drawn beads	14	983	1.7		
	rounded, drawn beads, including *a speo*, *ferraccia*, and hot tumbled	33	55,974	96.6		
Wound beads					1,017	1.80
	unshaped, free wound	19	230	0.4		
	shaped, free wound	38	769	1.3		

Categories		Number of Varieties	Total (Excluding 11 Unidentifiable Beads)			
			Tertiary Total		Secondary Total	
Secondary	Tertiary		Quantity	Percentage	Quantity	Percentage
	shaped, furnace wound	9	18	<0.1		
Unidentifiable			11	0.03	11	0.03
Total (manufacturing types)		113	57,985	100.0	57,985	100.00
Decoration						
Undecorated		69	57,241	98.7		
Decorated		44	733	1.3		
Unidentifiable			11	0.03		
Total (decoration)		113	57,985	100.0		
Color						
Clear/white		7	2,835	4.9		
Black		10	1,552	2.7		
Red		51	4,510	7.8		
Yellow		2	1,900	3.3		
Green		8	20,011	34.5		
Blue		19	8,493	14.6		
Purple		14	18,671	32.2		
Multicolored		2	2	<0.1		
Unidentifiable			11	0.03		
Total (color)		113	57,985	100.0		
Color Layering						
Monochrome		105	54,249	93.6		
Polychrome		8	3,725	6.4		
Unidentifiable			11	0.03		
Total (color layering)		113	57,985	100.0		

Glass-Bead Collection from LAN-62

Almost all the glass beads from PVAHP sites were recovered from LAN-62. In total, 57,985 glass beads (99.76 percent of the total project collection), 53 glass-bead strands, and 5 patterned groups of glass beads were recovered from LAN-62 and comprised classes consisting of two primary and two secondary methods of manufacture and four methods of finishing (Table 131; Figures 138–151). These glass beads were sorted into five classes based on material, method of manufacture, and method of finishing; 41 types based on layering, shape, and decoration; and 113 varieties based on diaphaneity, color, luster, and perforation (see Figures 131–137 and 139–144). Whenever possible, these bead varieties were detailed so that they are comparable to Karklins's (1985) numbering system. The concordance of PVAHP glass-bead varieties and those used in Karklins's numbering system is presented in the appendixes. Generally, beads from LAN-62 and other sites in the PVAHP were from four types of manufacture: drawn; shaped, free wound; free wound; and shaped, furnace wound. The 113 glass-bead varieties were manufactured in one of seven colors: white, black, red, yellow, green, blue, and purple. See Appendixes F.13–F.21a for detailed discussions of bead types from LAN-62. Appendix F.15 details the entire glass-bead collection, describes in detail each variety in the PVAHP collection, and offers comparable data for glass-bead varieties identified at other archaeological sites in western North America. Glass beads were recovered from human-burial features (n = 29,198, or 50.4 percent), an animal-burial feature (n = 2), nonburial features (n = 4,192, or 7.2 percent), and excavation units throughout LAN-62 A (n = 24,592, or 42.4 percent) and LAN-62 B (n = 1). (See Appendix F.21a for a summary of the approximately 25,000 glass beads from nonburial features and excavation units across the site).

For the LAN-62 glass-bead collection, drawn beads were attributed to four classes, 10 types, and 47 varieties defined on the basis of the 12 typological criteria (see Table 131). Drawn beads were the most common, comprising 98.2 percent of the bead collection. Wound beads were attributed to three classes, 31 types, and 66 varieties defined on the basis of the 12 typological criteria. Although a high frequency of varieties was evident among the wound beads, only 1.8 percent of the beads from LAN-62 were of this form.

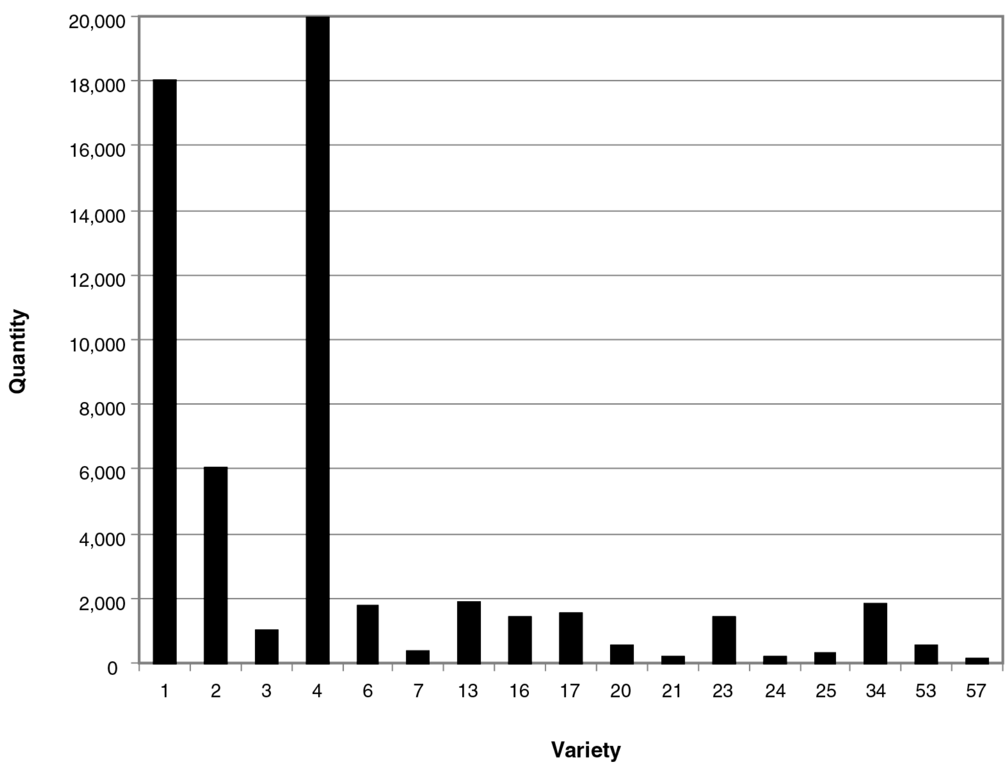

Figure 138. Glass- and ceramic-bead varieties with more than 100 specimens, LAN-62.

Figure 139. Cut, drawn glass-bead types and varieties from LAN-62.

Figure 140. Undecorated, rounded, drawn glass-bead types and varieties from LAN-62.

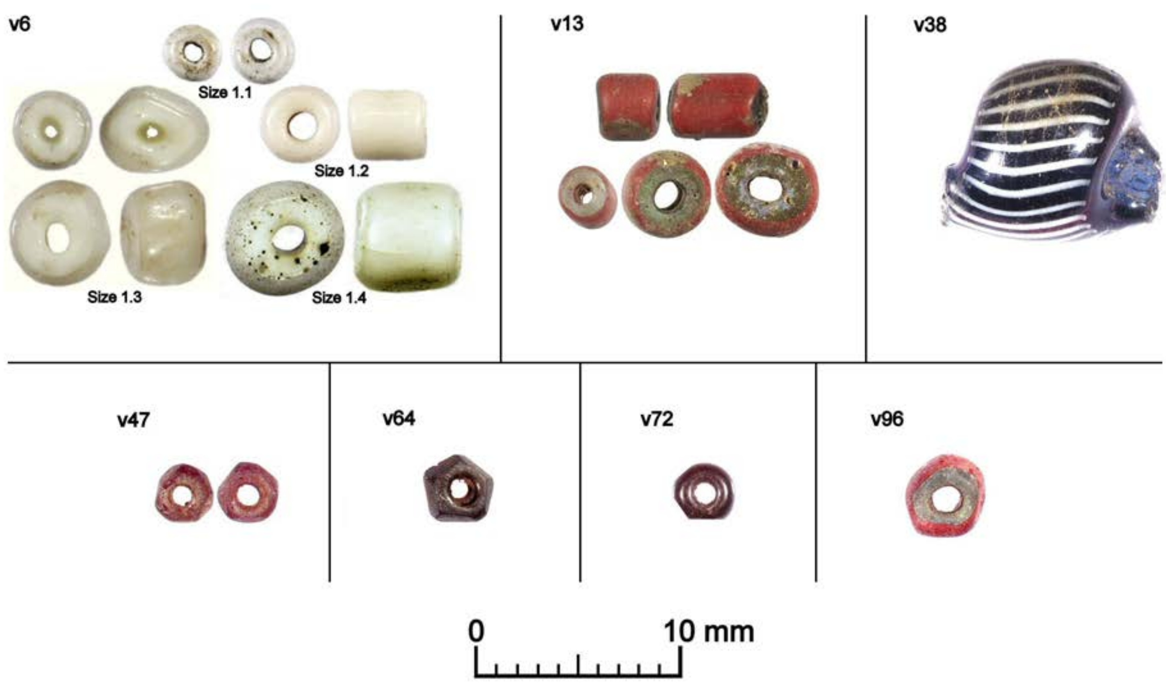

Figure 141. Decorated, rounded, drawn glass-bead types and varieties from LAN-62.

Figure 142. Undecorated, wound glass-bead types and varieties from LAN-62.

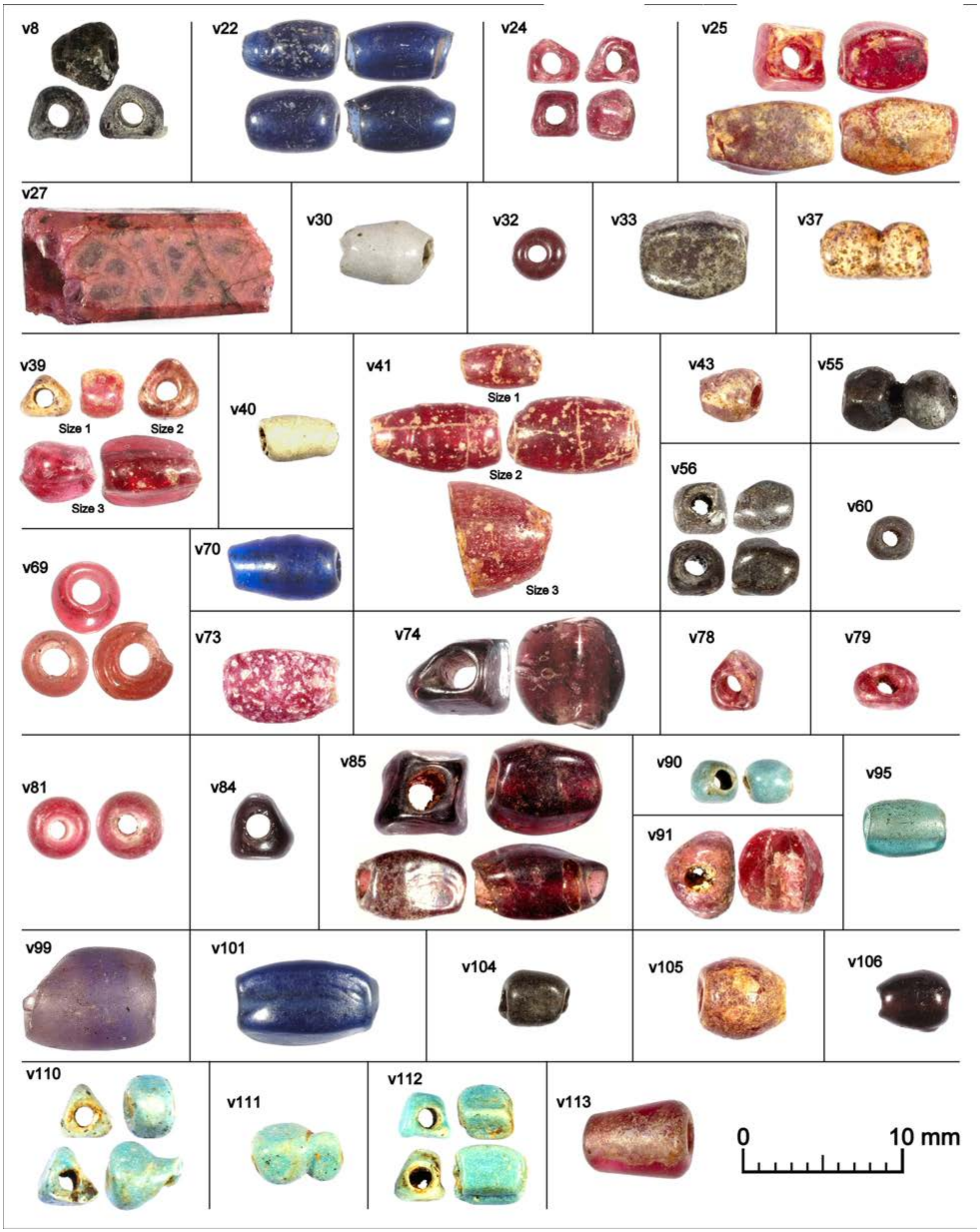

Figure 143. Undecorated and multisided, wound glass-bead types and varieties from LAN-62.

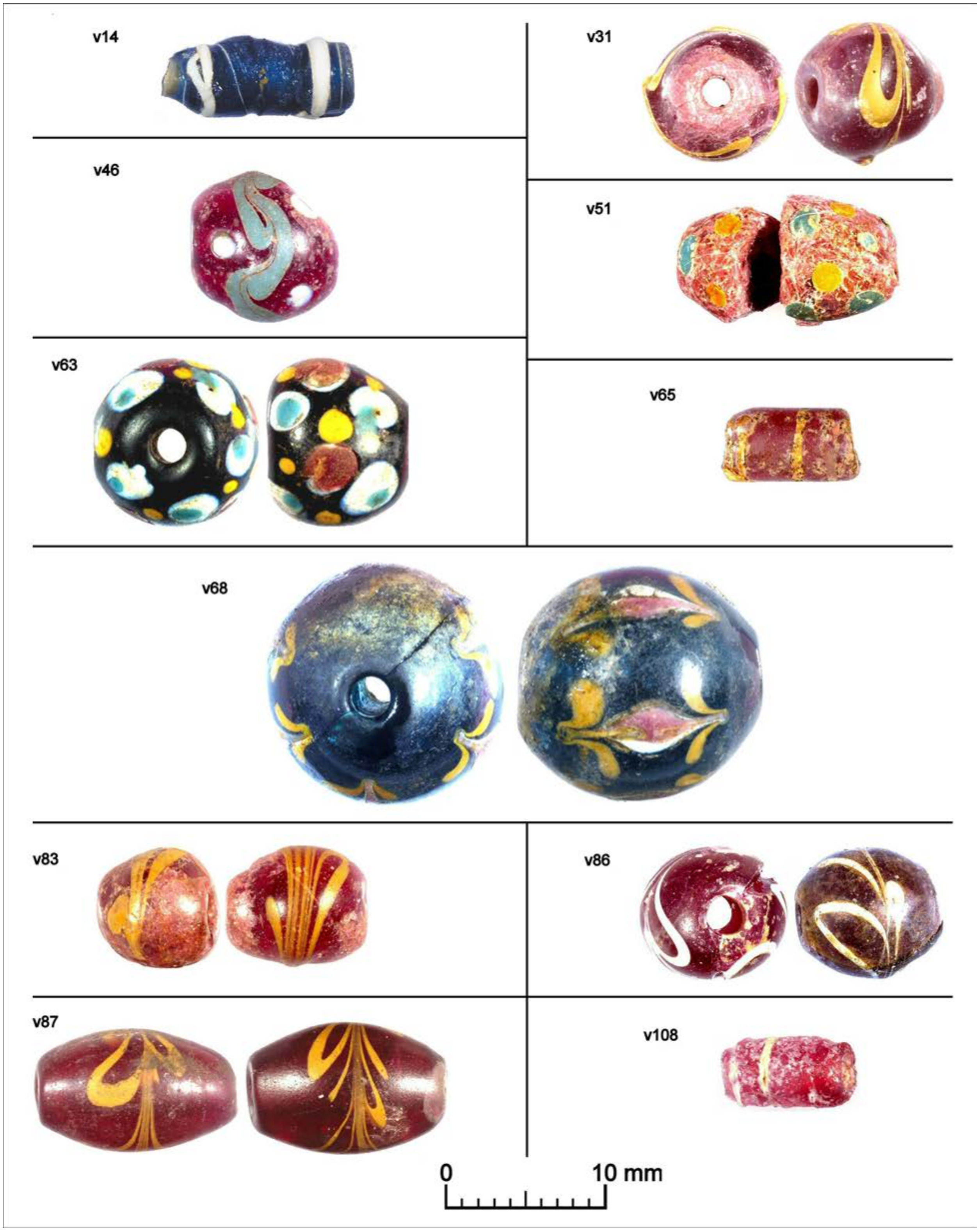

Figure 144. Decorated, wound glass-bead types and varieties from LAN-62.

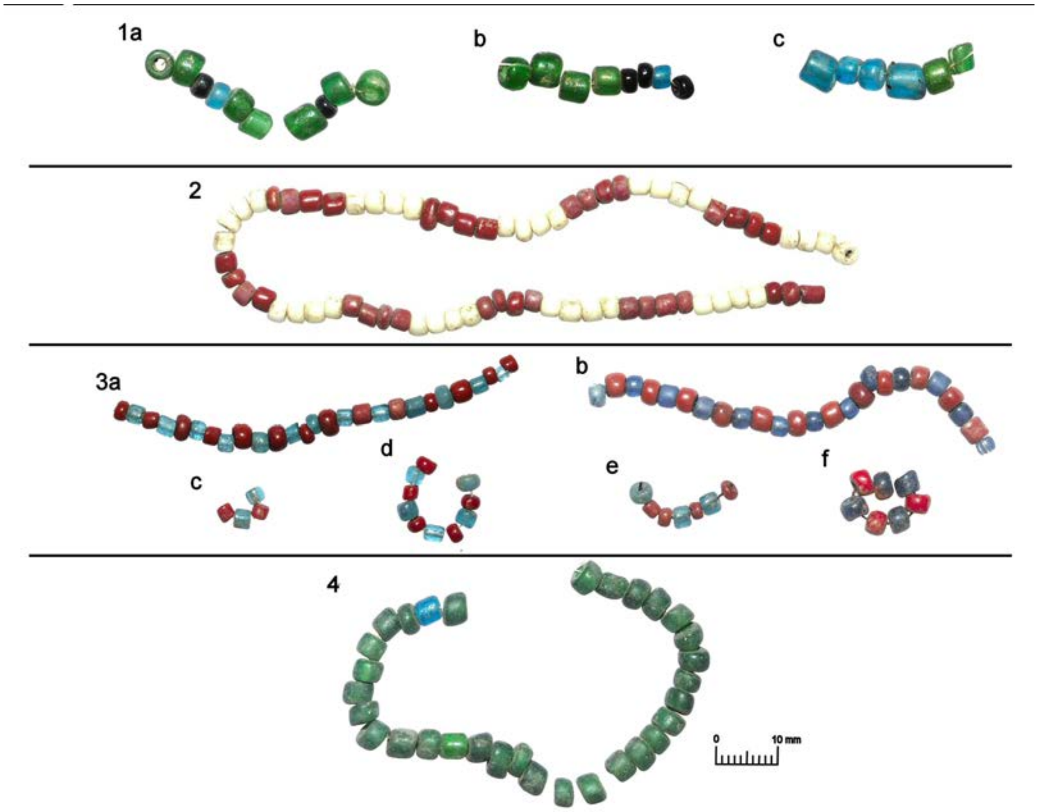

Figure 145. Glass-bead strands from LAN-62, human-burial Features 9, 96, 155, and 223.

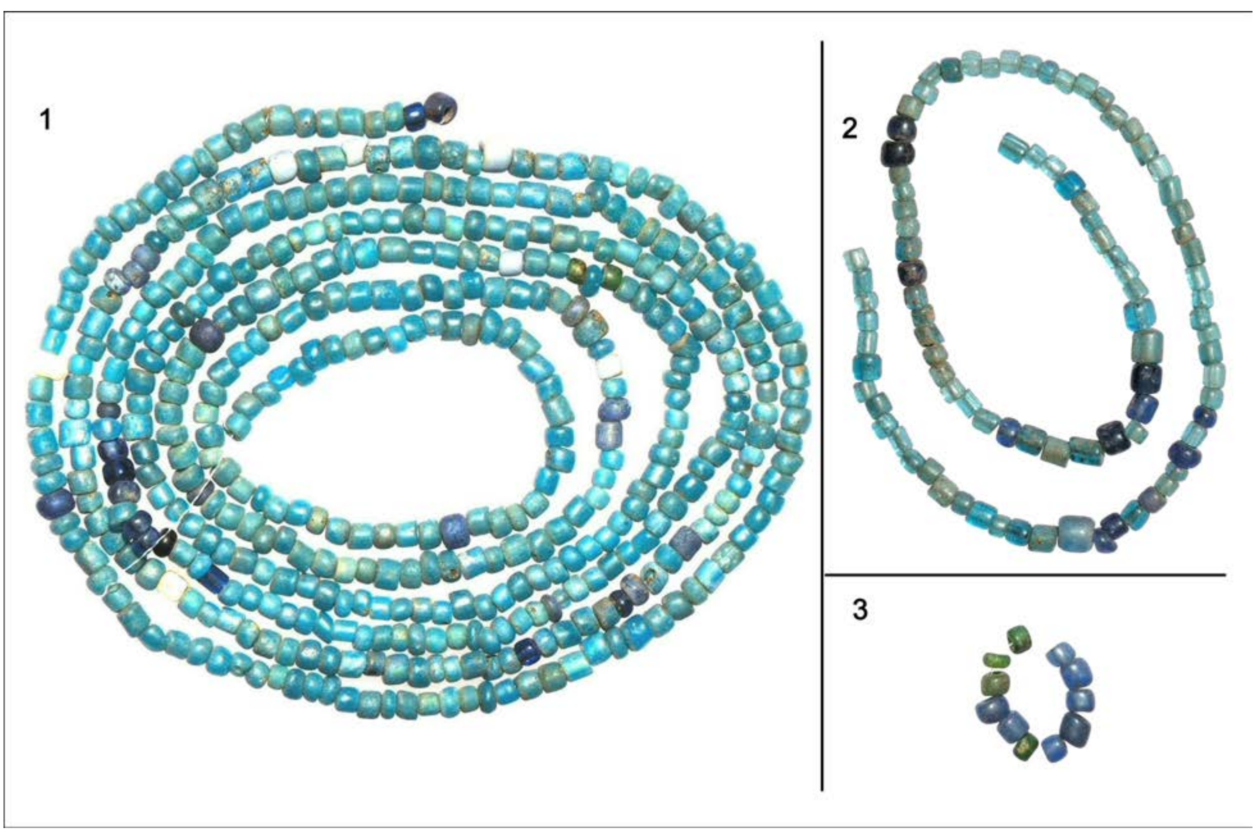

Figure 146. Glass-bead strands from LAN-62, human-burial Features 90, 112, and 244.

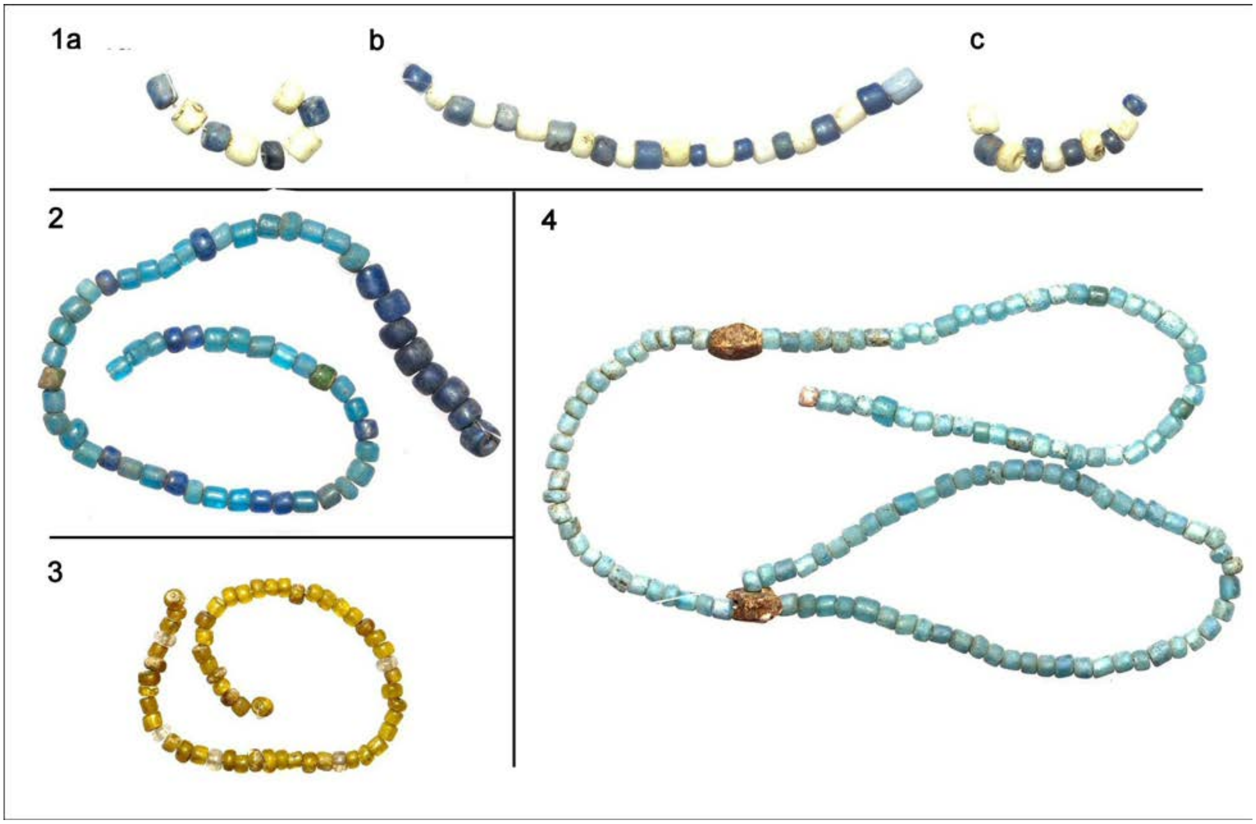

Figure 147. Glass-bead strands from artifact-concentration Features 75 and 78, LAN-62, and from nonfeature areas.

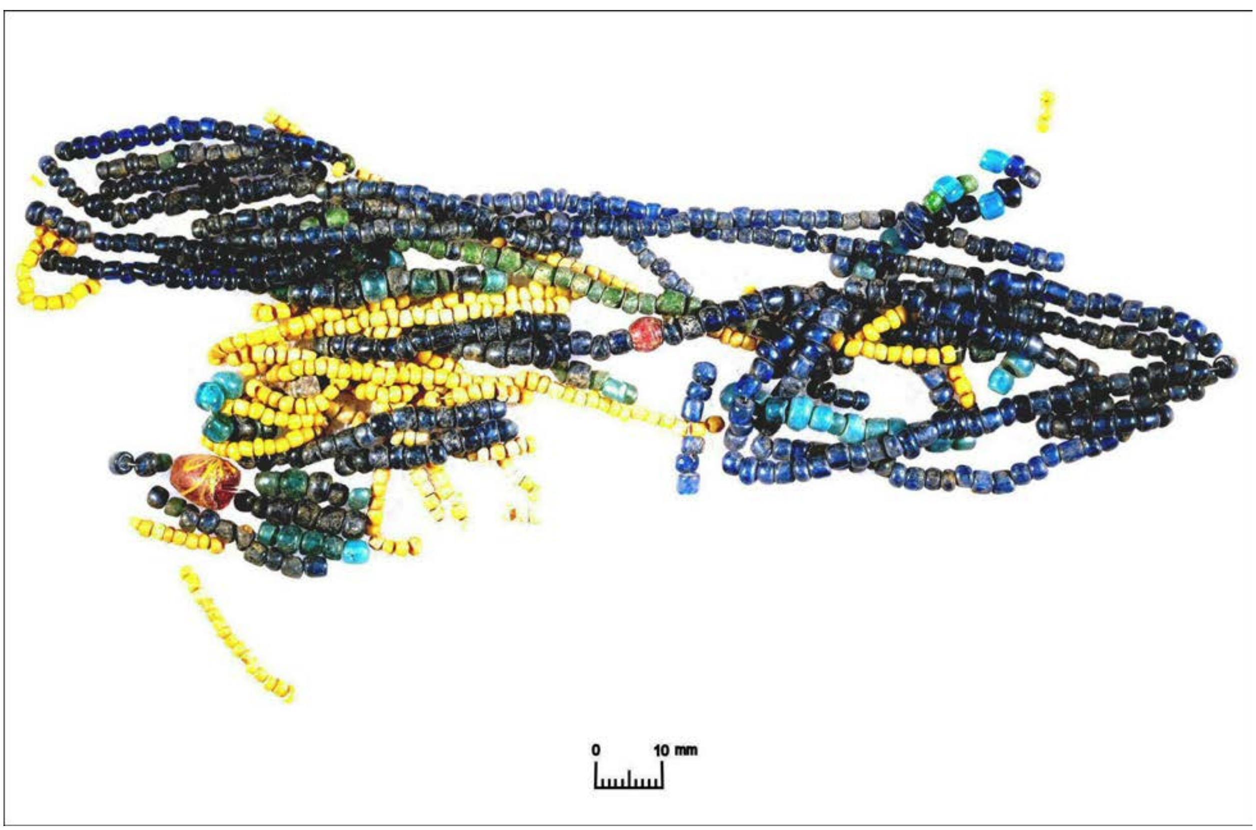

Figure 148. Glass-bead pattern from LAN-62, human-burial Feature 280.

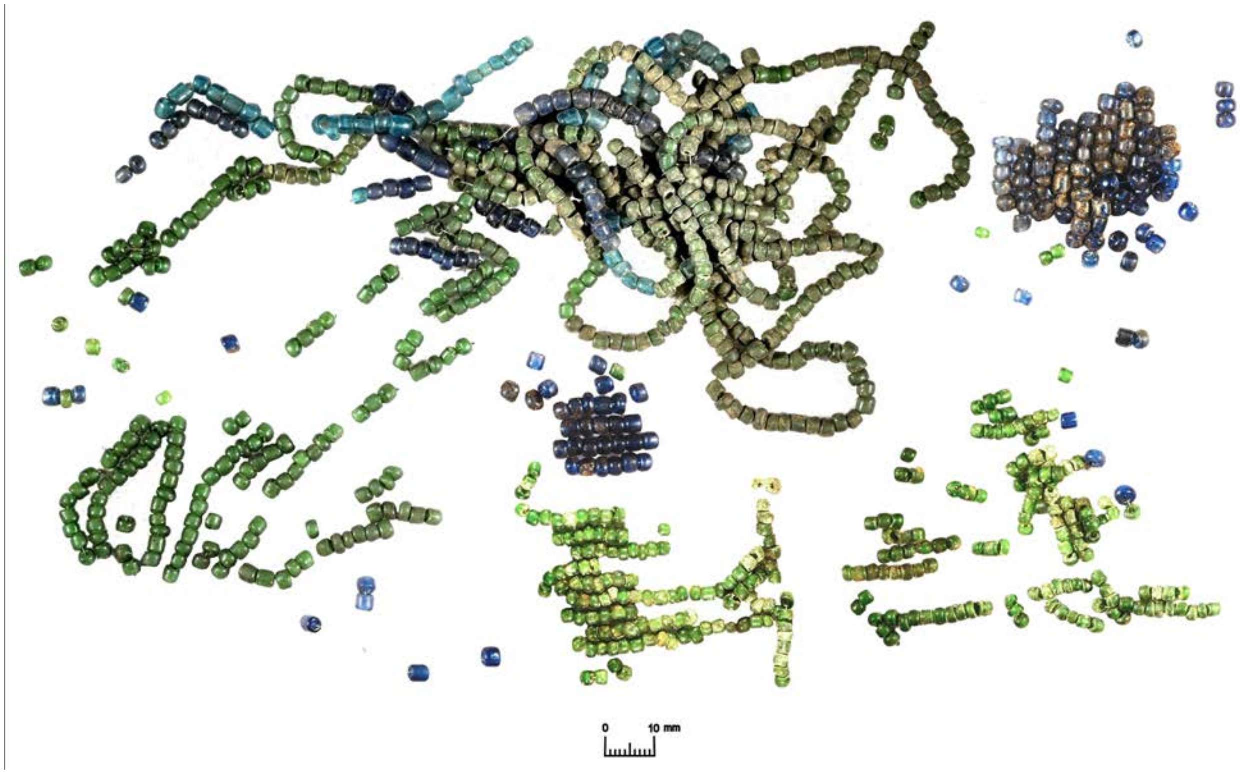

Figure 149. Glass-bead patterns from LAN-62, human-burial Feature 313.

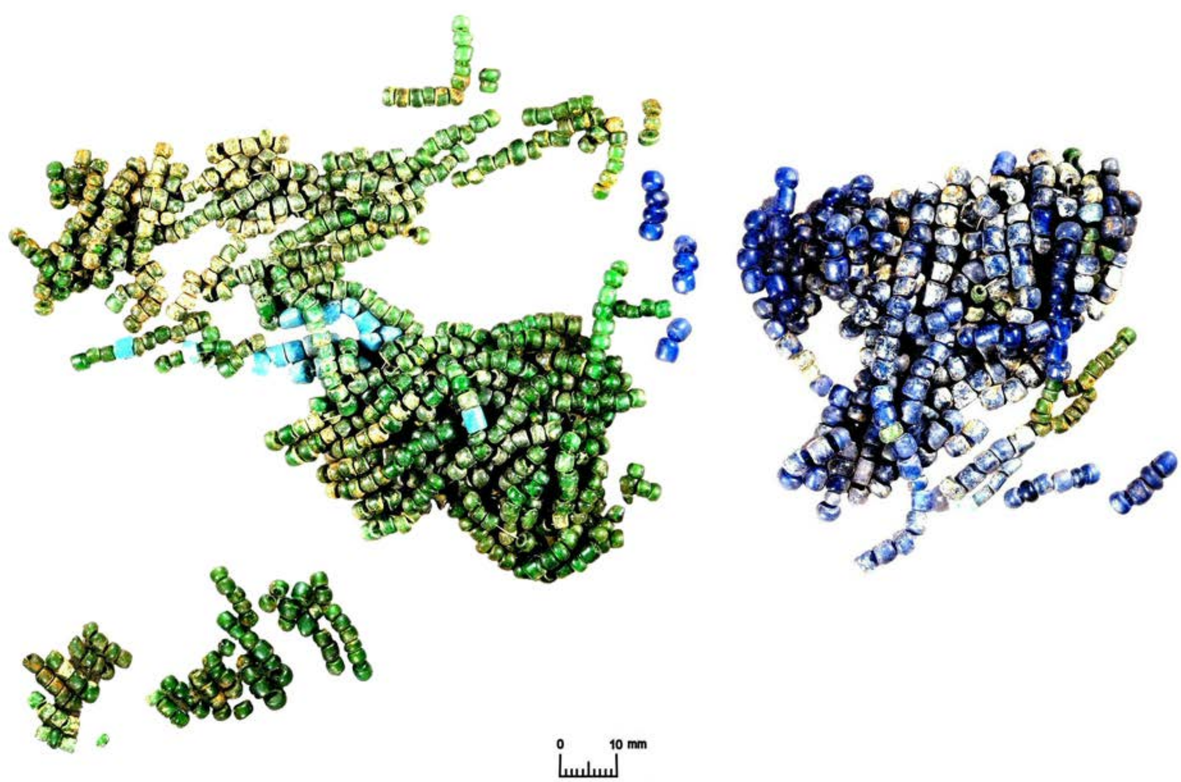

Figure 150. Glass-bead pattern from LAN-62, human-burial Feature 327.

Figure 151. Glass-bead pattern from LAN-62, human-burial Feature 438.

Human-Burial Features

As indicated above, half of the glass beads recovered from LAN-62 were associated with 155 burial features (Figure 152; see Appendixes F.22–F.29). The area of the site containing the principal concentration of burial features with glass beads was approximately 60 m^2, covering an area 8.5 m (northeast-southwest) by 7 m (northwest-southeast). Within this concentrated area were 132 burial features; another 23 were on the edges or outside the concentration (see Figure 152). Fifty-seven percent of the beads in burials were associated with only 8 burial features, each of which had more than 1,000 beads (see Appendix F.24). Of the 155 burials, 114, or 73.5 percent, had fewer than 100 beads each, and 71, or 45.8 percent, had fewer than 10 beads each.

The majority of the burial features contained human remains from more than one individual, but generally the burials consisted of a single primary individual with associated disturbed and fragmentary remains of multiple other individuals. Of the 155 burial features, 119 had one or two primary individuals, and the remaining 36 had partial remains of one to eight individuals (see Appendix F.27).

Studying the physical remains of human interments allows aspects of wealth and status of individuals to be inferred. In this chapter, we discuss details of glass-bead patterns in relation to burial, but much of the discussion related to wealth and status is presented in Volume 5 of this series. Age, sex, associated material culture, orientation of the body, and spatial locations of interments within a communal burial area are 5 of the more common attributes used for such studies, but Goldstein (1981:59) described an additional 12. Together, these 17 attributes can be grouped into four major categories: burial-area attributes, burial contents, treatment of the body, and biological attributes. No single material-cultural class, such as glass beads, can possibly provide an accurate representation of the complexity of social and economic behavior within a society, but isolating a single class of goods and then comparing attributes of that class to other burial attributes can provide social and economic inferences that can be evaluated using other analytical techniques.

Using this approach, glass beads associated with burials at LAN-62 were compared to ethnohistoric and historical evidence of glass-bead usage. These comparisons allowed us to answer a number of questions pertaining to the four main burial-analysis classes discussed above. Specifically, we wished to address questions relating to the attributes of the glass beads themselves, such as possible cultural practices associated with the interment of the dead, the absolute and relative values of glass beads, and temporal phases for the use of specific colors of glass beads. We also wished to examine biological and physical attributes of the burials themselves, including age, sex, skeletal articulation, orientation and position of the body, and spatial relationships, such as the locations of all burials with glass beads, combinations of biological and physical-placement attributes, and quantities of glass beads

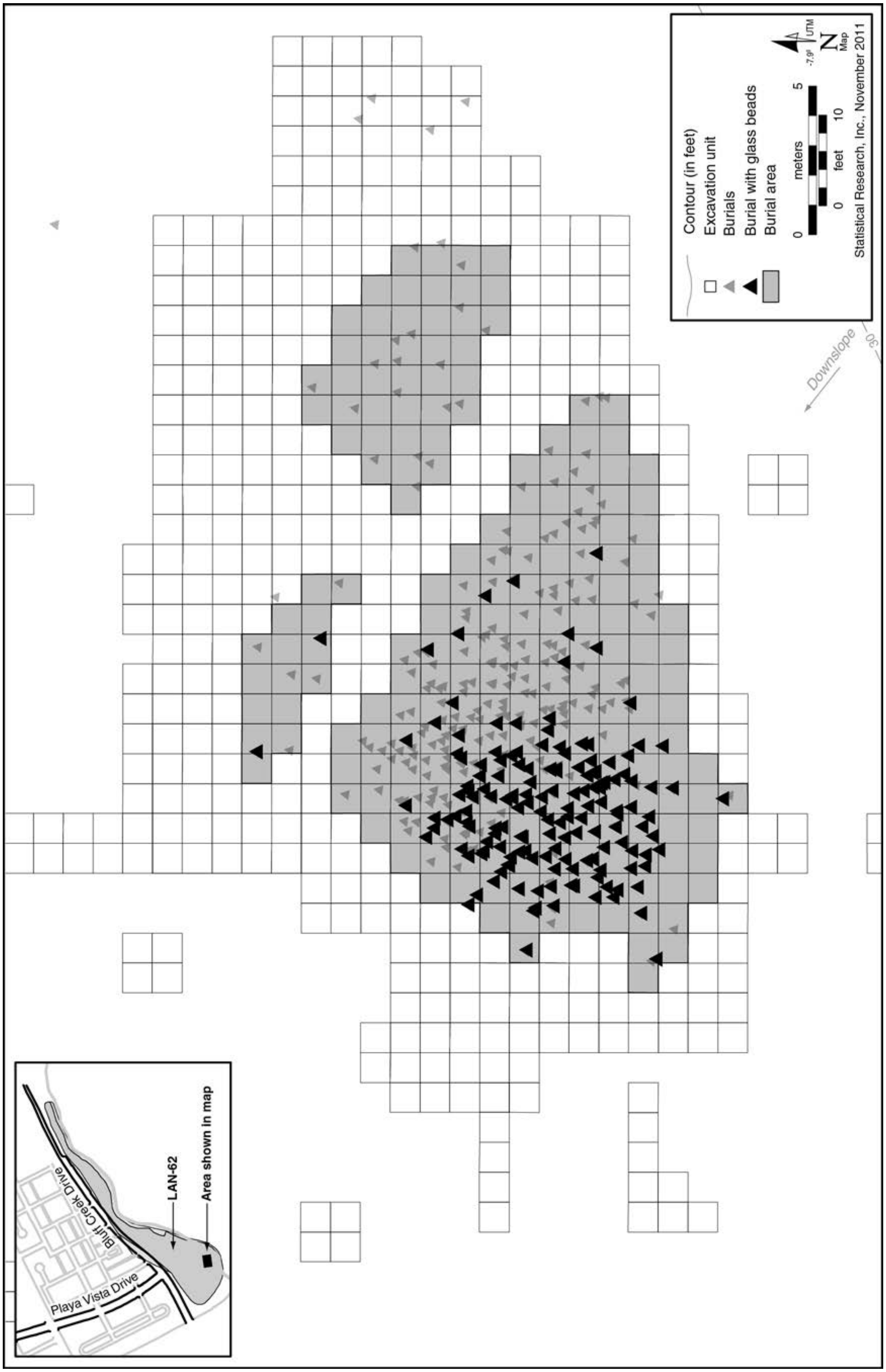

Figure 152. Burial features with glass beads at LAN-62.

by temporal phases. Information derived from these comparisons was used to address both individual and communal burial practices as they changed through time.

General Observations

There were 29 cremations at LAN-62, and none had glass beads in direct association. One cremation, burial Feature 363, had 195 glass beads recovered from its soil matrix, but it appears that all of them came from 1 to 3 burial features located above the cremation (burial Features 14, 50, and 280). These 3 burial features had over 3,000 glass beads, and it is likely that some were displaced downward as a result of bioturbation. This evidence indicates that for an original glass-bead burial collection, approximately 6 percent of the beads could have been displaced by bioturbation, thus contaminating adjacent burial features. For this reason, when considering comparative bead-collection information for these 155 burial features, those with fewer than 10 beads each generally were removed from consideration, and often the threshold was much higher—i.e., between 10 and 100 beads per feature. Also, burials lacking primary individuals generally were eliminated for comparative purposes.

See Appendixes F.27–F.29 for a review of attributes of burial features with glass beads. The demographic distribution of the primary individuals associated with the 155 burial features with which glass beads were associated included 3 fetuses, 10 infants, 4 children, 8 subadults, and 100 adults. The adults included 48 females or possible females and 25 males or possible males. Excluding burial features with fewer than 10 glass beads, the demographic distribution included 3 fetuses, 8 infants, 1 child, 4 subadults, and 47 adults. The adults included 27 females or possible females and 10 males or possible males (see Appendixes F.28 and F.29).

One striking pattern is that there were two to three times as many female than male burials with glass beads. What this signifies is unclear, but it could indicate a societal pattern. Johnson (1988b:141–142) noted that at various Spanish missions in the territory of the Chumash between the years 1690 and 1765, there were more females than males, upwards of a 2:1 ratio. Beginning in 1780, the ratio reversed for a 10-year period and then reversed again from 1795 to 1800. What the ratio at LAN-62 signifies cannot be addressed simply by counting individuals with glass beads.

Burials with only a few beads generally had purple, blue, and/or green beads; a few had clear, red, or black beads. It is highly likely that the beads found in burials with limited numbers of glass beads were not interred with the remains but, rather, were intrusive, resulting from disturbance by subsequent burials and soil bioturbation processes. As discussed in a later section of this chapter, most individuals buried outside or on the edges of the concentration of burials with glass beads had only one or two glass beads each, and many of those were males.

Inlaid and overlaid decorated beads (Varieties 14, 31, 46, 51, 63, 65, 68, and 87) were rare for burial features, and Varieties 83, 86, and 108 were not associated with burial features. Only 9 burial features had 1 or 2 decorated beads each. Eight burial features that had inlaid- and overlaid-decorated, wound beads had a total number of glass beads exceeding 70 and averaging 957 beads per burial. Eleven of the 20 burial features with 338–2,555 glass beads each had segments of multicolored strands and patterns, and 75 percent of the 8 burial features with more than 1,000 glass beads apiece had beaded strands and patterns (see Appendixes F.20–F.24 and 6.27; Figures 145–149). For burials with glass-bead clusters, strands or patterns were examined in detail to determine whether these groups of beads could be correlated with similar material at other sites (Table 132). For more discussion of strands and color patterns, see the more expanded discussion below.

Unique Burials

One unusual burial (burial Feature 63) had only two glass beads, although these were unusual: red, shaped, free-wound beads overlaid with simple brownish yellow, combed loops. Burial Feature 63 consisted of a 25–35-year-old male placed in a semiflexed position on his right side and oriented to the southwest with his head facing north. In addition to the two glass beads, the feature contained a perforated and incised steatite tablet and a fire-affected pestle fragment. Burial Feature 63 was the only burial with inlaid- and overlaid-decorated, wound beads that did not have large numbers of other types of glass beads. Burial Feature 280 had 2 decorated beads within its total collection of 2,555 beads.

Glass-Bead Strands and Patterns

During the excavation of burials from LAN-62, strands and patterned groups of glass beads were uncovered (see Table 132). They were photographed in situ, and when possible, strands were restrung on monofilament line to preserve patterns of colors and arrangements of bead varieties (see Appendix F.20; Figures 145–147).

Fifty-three bead strands were recovered from LAN-62; these consisted of one to nine varieties of beads totaling 3–444 beads. Strands consisting of a single color and those that duplicated other strands were not reproduced photographically, but unique strands were photographed. Repetitive colors for strands included alternating patterns of 4 white beads followed by 4 red-on-green beads (see Figure 145:2). Alternating-red-and-white strands have been reported ethnographically (Hudson and Blackburn 1985:298). Also, white and red, as well as black, were associated with burials (Merriam 1962:78–79), and multiples of four were used in the calculation of currency (Hudson and Blackburn 1987:280). Other patterns included 1 blue bead followed by 1 red-on-green bead (see Figure 145:3a–f) and 1 white bead followed by 1 blue or purple bead (see Figure 147:1a–c). The former pattern also has been reported ethnographically (Hudson and Blackburn 1985:297, 305).

Additional patterns included various combinations of green and blue beads with occasional black beads (see Figure 145:1a–c and 4); blue, purple, green, red, red-on-green, and light-purplish red beads (see Figures 146:1–3 and

Table 132. Ethnohistoric Information for Possible Identification of the Glass-Bead Clusters, Strands, and Patterns Associated with Burial Features from LAN-62

Burial Feature	Primary Individual		Glass Beads				Comments after Viewing Field Drawings (also see Appendix F.16)
	Sex	Age	No.	Phase	Cluster	Placement	
7	(female)	18–25	19	3	2	facial area of the cranium and left tibia	The small cluster of glass beads in the region of the face could represent a beaded nasal ornament. The cluster at the tibia has no ethnohistoric analogy, but based on the positions of the arms, this cluster could have been associated with the wrist of one arm extending across the body with the hands resting in the region of the knee. If so, this cluster could have come from a beaded bracelet; if not, then the cluster may represent a grave offering.
8		25–35	70	2	2	neck area of the cranium and knee	A small cluster of blue glass beads found in the neck area probably represents a beaded necklace. A small cluster of large, blue glass beads found at the knee has no ethnohistoric analogy. It could represent the beaded portion of a skirt, but no other ornaments were found that would support this interpretation. More likely, this is a small burial offering.
9	5 disturbed individuals	5 disturbed individuals	338	4	4	above burial feature	A probable burial offering.
10	(female)	30–40	272	4	1	inside an abalone shell	A possible burial offering.
11	female	20–30	122	3	1	cranium and around vertebrae	A probable necklace.
31	(female)	28–40	32	4	2	on thoracic vertebrae; 6 glass beads with numerous shell beads	A probable burial offering.
38	(female)	20–30	262	3	3	head/neck, abdomen, hand/knee	A small cluster of blue glass beads below the ribs in the region of the abdomen could be a possible burial offering. The clusters at the neck and wrist probably represent parts of a necklace and bracelet.
50		20–30	391	3	1	cranium	No further information was obtained from the field drawings. Numerous strands of shell beads were observed near the top of the cranium and neck. If the glass beads were intermingled with these, they could represent strings of currency.
69	female	20–35	191	1	1	neck	A probable necklace.
76	(male)	23–30	91	3	1	top of head	Sixteen glass beads were found in association with nearly 4,000 shell beads in strands, probable strings of currency, wrapped around the head.
85		30–40	425	3	1	beneath a *comal* that may be part of burial Feature 327	A possible burial offering.

continued on next page

Burial Feature	Primary Individual		Glass Beads				Comments after Viewing Field Drawings (also see Appendix F.16)
	Sex	Age	No.	Phase	Cluster	Placement	
90		infant	520	4	1 strand (see Figure 146:1)	chest	A single strand of 444 predominately blue with a few purple, green, black, and red glass beads with a single columella bead. This probably is a necklace. It was associated with strands of separately strung shell beads that probably represented burial offerings of strings of currency.
96		infant	376	3	2 strands (see Figure 145:2)		A strand of alternating 4 red and 4 white glass beads, probably a small necklace.
110	(female)	20–30	326	3	concentrations	head, neck, chest, back	Concentrations of beads (no information as to whether they were shell and/or glass beads) about the top of the head were adjacent to an abalone shell, suggesting a possible grave offering. Those about the neck presumably came from a necklace. Those about the chest and back may be either grave offerings or parts of an embroidered or decorated woman's cloak.
112	6 disturbed individuals	6 disturbed individuals	2,328	4	20 strands (see Figure 146:2)		Three glass beads recovered from inside a stone bowl probably were a grave offering. Locations for the glass-bead strands did not appear in feature drawings or field notes.
155	female	30–45	2,148	3	9 strands (see Figure 145:3a–f)	head, face/neck, chest, arm, between legs	There may have been one multicolored strand (composed of most of the strands recovered) with alternating red and blue (and an occasional purple) glass beads. These appear to have been in the area of the neck and probably represent a necklace.
196		infant	160	4	1		No additional information.
198	2 disturbed individuals	2 disturbed individuals	490	4	1	head	A cluster of blue glass beads that was probably a grave offering.
204	(female)	16–20	783	4	3+	head, pelvis, legs	A cluster of blue glass beads, some appearing to have been strung. A possible grave offering of a string of currency.
223	(female)	18–25	433	4	1 strand (see Figure 145:4)	atop humerus	A short strand of green glass beads found in association with a variety of shell beads, probably a burial offering.
225		25–35	201	4	strand(s)	adjacent to clavicle	Two rows of blue glass beads, probably strands. A possible burial offering.
243		30–45	292	3	1	chest	A cluster of shell and glass beads beneath a charcoal concentration and atop a textile, probably a burial offering at the bottom of the burial pit.
244	female	20–30	1,926	4	1 strand (see Figure 146:3)	cranium	A short segment of green, blue, and purple glass beads associated with clusters of shell beads, possibly a grave offering or strings of currency.
265	(female)	25–35	63	3	1 strand	torso	A short strand of purple and white glass beads along with short strands of shell beads adjacent to a basket inside a copper bowl, possibly a grave offering.

Burial Feature	Primary Individual		Glass Beads				Comments after Viewing Field Drawings (also see Appendix F.16)
	Sex	Age	No.	Phase	Cluster	Placement	
280	7 disturbed individuals	7 disturbed individuals	2,555	4	1 pattern (see Figure 148)		A long strand of purple beads associated with multiple strands of blue, green, and yellow beads interspersed with larger, red beads, probably a burial offering of strings of currency and ornamental strands (necklaces?).
282	male	20–30	1,147	4	1 strand	head	No additional information.
313		fetus	2,942	3	1	5 glass beads	No additional information; possibly a grave offering.
		25–35	2,942	3	2 patterns (see Figure 149)	head, face, pelvis, legs	Multiple strands of green, blue, and purple glass beads that are probably grave offerings of strings of currency. Multiple segments of green and purple glass beads that appear to have been embroidered in a pattern onto a textile, probably an embroidered garment, such as a woman's skirt.
327		infant	2,212	3	1 pattern (see Figure 150); 1 cluster?, see burial Feature 85		Masses of green and purple glass-bead strands, possibly two long strands, probably a grave offering of strings of currency.
334		20–30	328	3	1		Possibly associated with burial Feature 461. No additional information.
438	female	25–35	1,399	3	1 pattern (see Figure 151); 1 cluster	near head, pelvis	Strands of green, blue, red, and large, purple glass beads; possible embroidered patterns of blue and white glass beads. Probably grave offerings of strings of currency mixed with ornamental strings.
461		16–17	4		1		Possible cluster; see burial Feature 334. No additional information.

147:2 and 4); and brownish yellow and clear beads (see Figure 147:3). The longest strand recovered was a predominantly blue strand of 444 beads (see Figure 146:1) that also contained a columella-shell bead.

Glass-bead patterns were defined by masses of beads consisting of short segments of strands and/or intertwined strands. When encountered, these were strung on monofilament line, stitched to paper backing, and then mounted on stiff pieces of cardboard. Once photographed, the beaded patterns were digitally separated from their backing; the digital image removed the backing, but the physical strands were left attached to the backing paper (see Appendix F.21).

Five patterns were recovered from LAN-62 and consisted of two to eight varieties and 144–987 beads. Strands of colors with patterns included mixed combinations of predominantly purple and blue beads, yellow beads, and green beads (see Figure 148), as well as mixed combinations of green beads and purple and blue beads (see Figure 149 [top]). Other patterns included parallel rows of strands of green, purple, and blue beads (see Figure 149 [bottom]) and masses of strands of green beads with occasional blue beads or purple and blue beads (see Figure 150). Mixed strands of beads were also recovered, including large, purple necklace beads; green beads; and red, blue, purple, green, and black beads (see Figure 151). Some patterns appeared to represent strands sewn to something, such as an article of clothing, but most appeared to be free strands of beads.

Ethnohistoric Beaded Material Culture

Beads and beaded articles used by the Tongva and Chumash have been documented in a variety of ethnohistoric sources (e.g., Blackburn 1963; Blackburn and Hudson 1990; Boscana 1846, 1978; Geiger and Meighan 1976; Hudson and Blackburn 1982, 1983, 1985, 1986, 1987; Iovin 1963; Johnston 1955–1958, 1962; Merriam 1962; Reid 1926). Items and cultural practices identified as involving the use of beads were arranged by functional categories (see Appendix F.30). From this list, there are only a few that may be correlated with the beads and bead strands from the burial area of LAN-62, including burials and ritual. Differential preservation, bioturbation, cultural disturbance, and reinterment of earlier graves contributed greatly to what has or has not been observed and recovered; so, it must be assumed that other beaded items and practices originally associated with individuals buried at LAN-62 did not preserve.

In a reply to the October 6, 1812, *Interragatorio* sent from Cadiz, Spain, to the Spanish colonies regarding the Natives in their districts, various responses were submitted by the Franciscan padres at the California missions. Among them was a reply dated February 3, 1814, from Mission San Fernando Rey in which Frays Pedro Múñoz and Joaquin Pascual Nuez noted that "[i]f a pagan Indian dies they dig a deep hole. In this they put a pot, a basket, an otter skin and two or three dollars worth of beads [i.e., 3–4 1-*peso* strings]. On this they place the corpse and then cover it with earth" (Geiger and Meighan 1976:97).

Given the total number of beads recovered from LAN-62 and the understanding that a U.S. dollar could purchase an 8-yard string of beads in 1852 (Reid 1926:25), the total worth of the bead collection at LAN-62 could be less than $25. Unfortunately, there currently is no corresponding price for a quantity of beads that can be used to calculate a cost-per-bead quantity for the Mission period. However, the relative price in the mid-nineteenth century does illustrate that by 1850s standards, if $3–4 worth of beads were deposited at the site per burial, then the total number of individuals receiving such an amount might number fewer than a dozen. Given that glass beads were associated with 155 burial features, there is a discrepancy between the historical observation and the archaeological record. This may suggest that most burials had less than a string placed with each of them, and perhaps only a handful each of loose beads in some instances. As discussed by Steve Hackel in Volume 5 of this series, Native Californians were often paid with glass beads for their labor in the fields of ranchos and pueblos in the Los Angeles Basin during the Mission period. The value of these beads in 1850s U.S. dollars or Spanish *reales* might not have been particularly high, but it is unknown how many glass beads Gabrielino workers were paid for a day's labor.

Of the 155 burial features, 4 primary individuals had more than 1,724 glass beads each (an average number of beads per *peso* or dollar string), and none had enough to constitute two strings, or $2 worth of beads. Additionally, 2 primary individuals were associated with more than 1,000 glass beads. These 6 burial features were clustered in a 4.4-by-2.5-m area within the southwestern portion of the main burial area.

Burial Feature 155

This burial feature consisted of an adult female and isolated human remains associated with at least three additional individuals and a total of 2,148 glass beads, including nine short glass-bead strands (see Figure 145:3a–f) placed about the head, face, neck, chest, and arms and between the legs. The short strands all had alternating red and blue (with an occasional purple) glass beads and appeared to have been recovered in the area of the neck, probably indicating the presence of a necklace; other unstrung glass beads possibly represent grave offerings. Thus, the strands were probably ornamental rather than strings of currency. The glass-bead colors fell within Phase 3 of the glass-bead sequence. The burial feature also contained more than 1,270 shell beads, including a strand of Pismo-clam tube beads recovered from the individual's neck region. Of the shell beads with narrow time ranges of use, many dated between A.D. 1770 and A.D. 1816.

A number of other artifacts could not be directly associated with any individual in the burial feature, including a cobble manuport, two fire-affected cobble fragments, two metal fragments, an iron dart point, a copper or brass eyelet used for jewelry, ocher fragments, several concentrations of fibrous botanical material, a fragment of worked whale bone, and a Gifford-type, worked Pismo-clam ornament. The worked-whalebone fragment was found approximately 10 cm north of the primary inhumation, and the concentrations of fibrous botanical material with a woven appearance were recovered from near the legs of the primary inhumation and may have been pit liner or clothing.

Burial Feature 244

An adult female, as well as isolated human remains of at least two additional individuals, was identified with 1,926 glass beads, including one short glass-bead strand (see Figure 146:3). Additional glass beads recovered from the burial-feature fill may have originated with this large cluster of beads. Comprising green, blue, and purple glass beads and found with clusters of shell beads in the area of the head, this strand could represent a grave offering, perhaps of a string of currency. The glass beads fell within Phase 4 of the glass-bead sequence. A cluster of shell beads was also recovered from the head area of the burial individual. Dates for shell beads range widely, but many date to A.D. 1770–1800 and A.D. 1800–1816. The feature also contained fragments of a stone bowl that conjoined with other fragments found in adjacent burials.

Burial Feature 282

This burial feature contained an adult male and isolated human remains from at least two other individuals, as well as 1,147 glass beads, including one short glass-bead strand that was found near the primary individual's head. The beads fell within Color Phase 4. Approximately 100 shell beads were also recovered from the feature. The Historical period shell beads dated to A.D. 1800–1816. In addition to beads, a number of other artifacts were recovered, including a Cottonwood Triangular projectile point, an anvil with asphaltum on it, a chopper, a grooved abrader found sitting on a recycled steatite fragment, an edge-modified flake, 2 lithic flakes, and 2 pieces of FAR.

Burial Feature 313

This burial feature contained a total of 2,942 glass beads that were found with a fetus and an adult (probably female, based on the association of the fetus), as well as isolated human remains associated with at least one additional person. Multiple strands of green, blue, and purple glass beads, identified as Phase 3 in the glass-bead sequence, were recovered and probably represent a grave offering of strings of currency. The clusters of glass and shell beads were located above the legs and pelvis, immediately west of the face, immediately east of the posterior cranial vault, and immediately south of the adult. The southern concentration of beads was the largest, measuring 30 cm in diameter. These clusters totaled over 2,500 glass beads and over 900 shell beads. The majority of the shell beads were semiground olivella-shell disk beads, which have a date range of approximately A.D. 1800–1816. Some shell beads were covered in ocher. Also associated with the adult was what appeared to be a pattern of glass and shell beads embroidered to a textile. These may represent a beaded woman's skirt (see Figure 149). The shell beads sewn onto this textile dated to A.D. 1800–1816.

In addition to glass and shell beads, there was a large number of other objects, including a decomposed reed bundle, three large fragments of wooden planks (one of which had a drilled hole in it), one cast-copper button, two possible gun barrels rusted together, one probable gun barrel (with glass and shell beads inside and wooden fragments adhering to the outside), one indeterminate metal object, two steatite disk beads, one biface fragment, one flake, four FAR fragments (including one mano fragment), a large amount of ocher, a ground stone pestle, and seven manuport cobble fragments covered in ocher that refit into two complete pebbles.

Burial Feature 327

This burial feature contained an infant (4–6 months old) with a total of 2,212 glass beads, including multiple strands of green and purple glass beads. Comingled with these glass beads was a roughly similar number of shell beads, of which many dated to A.D. 1800–1816. These were probably a grave offering of strings of currency (see Figure 150). The glass beads fell within Phase 3 of the glass-bead sequence. The presence of asphaltum beneath the burial feature suggests that the burial pit for the infant was lined. Besides glass and shell beads, a single piece of FAR was recovered.

Burial Feature 438

This burial feature contained an adult female and isolated human remains of at least two other individuals, as well as 1,399 glass beads, including one large glass-bead pattern composed of short strands of green, blue, red, and large, purple glass beads (see Figure 151) and possible embroidered patterns of blue and white glass beads. These were probably strings of currency mixed with ornamental strings. The string of beads was found approximately 22 cm south of the primary individual. Associated with this concentration was a disk-shaped shell ornament. Approximately 5 cm west of the glass-bead cluster was a large piece of asphaltum. The glass beads were identified as Phase 3 of the color sequence. The burial feature also contained a metal hoe blade placed at the female's feet, 5 fragments of a cast-copper button, 2 indeterminate iron nail fragments, 1 iron knife fragment, a fire-affected mano fragment, abalone shells placed next to the head and on the chest, ocher, 2 bifaces, basketry fragments, and other shell beads. Dates for the shell beads ranged widely; the outer edge of the range was within the early Historical period. One shell-bead type (semiground olivella-shell disk beads) clearly dated to the Historical period: A.D. 1800–1816.

Summary of Burial Features

Clearly, only a few individuals interred at LAN-62 received enough glass beads to compose a single string. Of those that did, all had beaded strands and/or glass-bead color patterns and were associated with what appeared to be relatively late interments (if the glass-bead color phases described below can be inferred to represent temporal periods). Of the six burial features listed above, four appeared to be associated with adult females, two with fetuses or infants, and one with a male. Strings of glass-bead currency, ornamental strings, and/or embroidered garments were associated with these individuals, perhaps suggesting relatively greater wealth and/or higher status.

Individuals with glass beads who were interred at LAN-62 most commonly had what have been interpreted as grave offerings, strings of currency, and necklaces (see Table 132). Almost all were from what appeared to be relatively late interments (i.e., later Mission period), except for possible grave offerings and/or necklaces from two relatively early interments, burial Features 8 and 69. Grave offerings associated with more of the relatively early interments would be difficult to detect because of the paucity of glass beads associated with these individuals (i.e., 12–38 glass beads per individual for relatively early burials vs. 309–386 glass beads per individual for relatively late burials).

Individuals buried at LAN-62 who had possible ornamental items with glass beads were relatively uncommon. Necklaces were the most common, possibly occurring with eight individuals. The only other possible ornamental items noted were two bracelets, one nasal ornament, and two embroidered textiles, possibly women's skirts. A relatively thick, black coating was observed on many Variety 4 (blue) and Variety 23 (brownish yellow) glass beads and one Variety 80 (purplish blue) glass bead from LAN-62. The coating likely was residue from asphaltum, indicating its use as an adhesive for the attachment of beads to rigid objects (e.g., steatite-vessel rims). However, no such vessels with attached glass beads were recovered with buried individuals. Chester King (1990a:195) noted that shell and glass beads generally were not strung together. Several examples of shell and glass beads strung together were found at LAN-62; a single columella-shell bead strung with a long strand of primarily blue glass beads was recovered from burial Feature 90 (see Figure 147:1). These beads were collected separately and were not restrung during collection. Few examples of shell and glass beads strung together were indicated in the field notes or feature drawings examined (see Chapter 3 this volume).

Other Features

Four types of Native cultural features other than human-burial features yielded, in total, 4,194 glass beads (Table 133; see Appendixes F.31 and F.32). The contexts included artifact concentrations, rock clusters, a pit, an animal burial identified in the burial area, FBs 3 and 4, and features located throughout LAN-62 A. The collection consisted of 37 different glass-bead varieties of mostly drawn (96 percent) and wound (4 percent) beads. All of the general colors of glass beads recovered from human-burial features were also identified in the non-human-burial features and included mostly green beads (47.5 percent), followed in decreasing frequency by purple (31.5 percent), blue (8.7 percent), clear/white (1.9 percent), and yellow (0.4 percent) beads (Table 134).

The Gabrielino/Tongva, like many Takic-Uto-Aztecan groups, celebrated deaths with a mourning ceremony (see Merriam 1962). It is reasonable to infer that some of the cultural features with uniquely decorated beads and bead strands may represent locations in which burial offerings or mourning ceremonies occurred. The following is a discussion of analysis results by analytical context and feature type.

Glass Beads from Nonburial Contexts in the Burial Area

The burial area, defined as the area immediately surrounding and including the main concentration of human burials, contained several nonburial contexts from which glass beads were also recovered. These nonburial contexts yielded a total of 3,755 glass beads, comprising 90 percent of the analyzed collection from non-human-burial feature contexts (see Tables 133 and 134).

Artifact Concentrations

The vast majority (87.7 percent) of analyzed glass beads from nonburial contexts in the burial area were recovered from seven artifact concentrations that yielded, in total, 3,679 glass beads. These artifact concentrations were clustered within a 4-by-2-m area in the central portion of the main burial area. Contents of these artifact concentrations varied and consisted, in part, of concentrations of glass and shell beads (Features 68, 70, 75, and 78), basketry fragments and charcoal (Feature 35), water-bottle-basketry fragments covered with ocher (Feature 119), and a cache of stone artifacts, including what appeared to be a ritually killed steatite bowl, a drill point, steatite tablets, and flecks of charcoal (Feature 252).

Glass beads were classified into 36 different bead types consisting of varieties of drawn, cut (0.5 percent) and rounded (94.7 percent); free wound, unshaped (0.9 percent) and shaped (3.7 percent); and furnace wound, shaped (0.2 percent). Glass beads exhibited a wide range of generalized colors and included primarily green (50.8 percent), purple (27.8 percent), blue (8.5 percent), clear/white (5.5 percent), red (5.3 percent), black (1.7 percent), and yellow (0.3 percent). In total, 135 decorated glass beads were identified in Features 68, 70, 75, and 252 and included varieties inlaid with combed, horizontal loops (Feature 68); varieties with pressed sides (Features 68, 75, and 252); and bipyramidal varieties with pressed sides (Features 68, 70, and 252).

Several artifact concentrations contained relatively unusual glass beads. Feature 68 yielded 1,408 glass beads, 7 of which were inlaid-decorated, wound beads and 1 of which was a chevron bead. In addition to loose glass beads, a total of 144 glass beads comprised various segments of strands of alternating blue and white beads (see Figure 147:1a–c). Feature 78 also contained a strand made up of 63 blue and purple glass beads.

Because of the overlapping of these artifact concentrations with various burial features, it is unclear which beads may or may not have been intrusive. It is possible that one or more of the artifact concentrations could represent burial offerings. Based on spatial proximity and similarity in glass-bead types, Feature 68 may be associated with burial Features 14 or 276, Feature 70 may be associated with burial Features 218 or 220, and Feature 252 may be associated with burial Features 14 or 363.

Table 133. Classes, Varieties, Quantities, and Time Ranges for Glass Beads from LAN-62 Nonburial Features and Feature Block Contexts, by Analytical Context

Feature Type/Context	Class Attributes			Quantity			Estimated Time Ranges for Diagnostic Beads (A.D.)
	Manufacture		Finishing	No. of Varieties	No. of Decorated Beads	Total No. of Beads	
	Primary	Secondary					
	Burial Area						
Artifact concentrations							
Feature 35	drawn		cut	1	—	1	1771–1860, 1782–1905
	drawn		rounded	7	—	46	1771–1860, 1782–1905
	wound	free wound	shaped	1	—	1	1771–1860, 1782–1905
Subtotal (Feature 35)				9	—	48	
Feature 68	drawn		cut	4	1	10	1771–1860, 1771–1900, 1781–1860, 1781–1856, 1782–1905, 1782–present
	drawn		rounded	10	—	1,312	1771–1860, 1771–1900, 1781–1860, 1781–1856, 1782–1905, 1782–present
	wound	free wound	unshaped	5	—	25	1771–1860, 1771–1900, 1781–1860, 1781–1856, 1782–1905, 1782–present
	wound	free wound	shaped	8	47	55	1771–1860, 1771–1900, 1781–1860, 1781–1856, 1782–1905, 1782–present
	wound	furnace wound	shaped	3	6	6	1771–1860, 1771–1900, 1781–1860, 1781–1856, 1782–1905, 1782–present
Subtotal (Feature 68)				30	54	1,408	
Feature 70	drawn		rounded	9	—	68	1771–1860
	wound	free wound	shaped	1	1	1	1771–1860
Subtotal (Feature 70)				10	1	69	
Feature 75	drawn		cut	2	—	3	1771–1860, 1782–1905, 1782–present
	drawn		rounded	8	—	1,401	1771–1860, 1782–1905, 1782–present
	wound	free wound	shaped	1	1	1	1771–1860, 1782–1905, 1782–present
Subtotal (Feature 75)				11	1	1,405	
Feature 78	drawn		cut	1	—	3	
	drawn		rounded	4	—	196	
Subtotal (Feature 78)				5	—	199	
Feature 119	drawn		rounded	3	—	5	
Feature 252	drawn		cut	3	—	3	1771–1860, 1782–1905, 1782–present

continued on next page

Feature Type/Context	Class Attributes			Quantity			Estimated Time Ranges for Diagnostic Beads (A.D.)
	Manufacture		Finishing	No. of Varieties	No. of Decorated Beads	Total No. of Beads	
	Primary	Secondary					
	drawn		rounded	8	—	456	1771–1860, 1782–1905, 1782–present
	wound	free wound	unshaped	2	—	7	1771–1860, 1782–1905, 1782–present
	wound	free wound	shaped	5	78	79	1771–1860, 1782–1905, 1782–present
Subtotal (Feature 252)				18	78	545	
Subtotal (artifact concentrations)				—	134	3,679	
Rock cluster							
Feature 29	drawn		rounded	1	—	1	1771–1860
Pits							
Feature 122	drawn		cut	1	—	1	1771–1860, 1782–1905
	drawn		rounded	8	—	55	1771–1860, 1782–1905
	wound	free wound	shaped	1	1	1	1771–1860, 1782–1905
Subtotal (Feature 122)				10	1	57	
Feature 450	drawn		rounded	2	—	16	
Subtotal (pits)				—	1	73	
Animal burial							
Feature 307	drawn		rounded	2	—	2	1771–1860
Subtotal (burial-area nonburial features)				—	135	3,755	
FB 3							
Artifact concentrations							
Feature 384	drawn		rounded	8	—	101	1771–1860
Feature 433	drawn		rounded	2	—	8	1771–1860
Feature 456	drawn		rounded	1	—	1	
Subtotal (artifact concentrations)				—	—	110	
Rock clusters							
Feature 331	wound	free wound	shaped	1	1	1	
Feature 673	drawn		rounded	1	—	1	
Subtotal (rock clusters)				—	1	2	

Feature Type/Context	Class Attributes			Quantity			Estimated Time Ranges for Diagnostic Beads (A.D.)
	Manufacture		Finishing				
	Primary	Secondary		No. of Varieties	No. of Decorated Beads	Total No. of Beads	
Excavation units							
	drawn		cut	1	—	1	1771–1860, 1782–1905, 1782–present
	drawn		rounded	9	—	322	1771–1860, 1782–1905, 1782–present
	wound	free wound	shaped	1	1	1	1771–1860, 1782–1905, 1782–present
Subtotal (excavation units)				11	1	324	
Subtotal (FB 3 features)				—	2	436	
	FB 4						
Excavation unit							
	drawn		rounded	1	—	1	
	Sitewide Features						
Artifact concentrations							
Feature 2	drawn		rounded	1	—	1	
Feature 670	drawn		rounded	1	—	1	
Subtotal (artifact concentrations)				—	—	2	
Subtotal (sitewide features)				—	—	2	
Total				—	137	4,194	

Table 134. Glass-Bead-Color Quantities from LAN-62 Nonburial Features and Feature Block Contexts, by Analytical Context

Feature Type/Context	Glass-Bead Color							Total
	Purple	Green	Blue	Red	Clear/ White	Black	Yellow	
	Burial Area							
Artifact concentrations								
Feature 35	22	12	9	1	3	1	—	48
Feature 68	195	998	77	75	14	46	3	1,408
Feature 70	15	8	22	17	2	—	5	69
Feature 75	425	747	38	13	180	2	—	1,405
Feature 78	93	8	98	—	—	—	—	199
Feature 119	1	3	—	—	—	1	—	5
Feature 252	273	93	70	90	3	14	2	545
Subtotal	1,024	1,869	314	196	202	64	10	3,679
Rock cluster								
Feature 29	—	—	—	1	—	—	—	1
Pits								
Feature 122	9	26	13	3	5	—	1	57
Feature 450	3	13	—	—	—	—	—	16
Subtotal	12	39	13	3	5	—	1	73
Animal burial								
Feature 307	—	1	—	1	—	—	—	2
Subtotal (burial-area nonburial features)	1,036	1,909	327	201	207	64	11	3,755
	FB 3							
Artifact concentrations								
Feature 384	67	12	8	—	3	8	3	101
Feature 433	3	2	2	—	1	—	—	8
Feature 456	—	—	1	—	—	—	—	1
Subtotal	70	14	11	—	4	8	3	110
Rock clusters								
Feature 331	—	—	—	1	—	—	—	1
Feature 673	1	—	—	—	—	—	—	1
Subtotal	1	—	—	1	—	—	—	2
Excavation units	211	70	27	1	7	6	2	324
Subtotal (FB 3 features)	282	84	38	2	11	14	5	436
	FB 4							
Excavation units	1	—	—	—	—	—	—	1
	Sitewide Features							
Artifact concentrations								
Feature 2	1	—	—	—	—	—	—	1
Feature 670	—	—	—	—	—	1	—	1
Subtotal	1	—	—	—	—	1	—	2
Subtotal (sitewide features)	1	—	—	—	—	1	—	2
Total	1,320	1,993	365	203	218	79	16	4,194

Although dating is tentative, considering that some glass beads may have intruded into the features or were possibly displaced from the underlying matrix or nearby features, colors indicate that glass beads from artifact concentrations may have fallen within the Phase 1 (Feature 78), Phase 3 (Features 35, 75, and 119), and Phase 4 (Features 68, 70, 252) color sequences. Comparisons of temporally diagnostic beads in these features indicated relatively broad time ranges (ca. A.D. 1771–1905), with the exception of Feature 70, which contained glass beads dating to ca. A.D. 1771–1760 (see Table 133). In addition to glass beads, shell beads were recovered from several artifact concentrations. Shell beads dating to the early Mission period were identified in Features 35, 68, and 70, and shell beads dating to the late Mission period were found in Feature 75. For each of these features, shell-bead dates corresponded with time ranges identified for associated diagnostic glass beads.

Rock Cluster

Rock-cluster Feature 29 contained a single glass bead identified as a drawn, rounded, red bead dating to A.D. 1771–1860. The feature was located in the central-eastern portion of the main burial area and consisted of a stone bowl containing two fused shell beads, a scattering of ground stone artifacts, and a piece of worked bone with asphaltum. Several burial features were located adjacent to Feature 29, but it is unclear which, if any, of them might be associated with the rock cluster.

Pit Features

In total, 73 glass beads were recovered from two pits (Features 122 and 450) located within a 4-by-3-m area in the central portion of the main burial area. Feature 122 consisted of a concentration of charcoal and dark soil that formed a pit containing glass and shell beads and fragments of faunal bone and shell. Feature 450 was identified as a pit with an extremely hard but patchy, compact surface matrix overlying numerous human burials. Glass beads in both of the features may have intruded from the underlying matrix or adjacent burial features.

Glass beads consisted of 10 different varieties of drawn, cut beads (1.4 percent) as well as wound, unshaped (97.3 percent) and shaped (1.4 percent) beads. Most (53.4 percent) of the glass beads were green, followed in decreasing frequency by blue (17.8 percent), purple (16.4 percent), clear/white (6.8 percent), red (4.1 percent), and yellow (1.4 percent). Feature 450 contained only green (n = 13) and purple (n = 3) beads. The presence of yellow beads indicates possible activities associated with the Phase 4 color sequence. A single decorated bead was identified in Feature 122: a red, bipyramidal bead with pressed sides. Temporally diagnostic glass beads in Feature 122 indicated that activities in this area may date to between A.D. 1771 and 1905. Shell beads with narrow time ranges recovered from Feature 122 dated to A.D. 1770–1800.

Animal Burial

An animal burial (Feature 307) in the western portion of the main burial area consisted of a cluster of unarticulated canine bones, some of which were burned and exhibited cut marks. The feature also contained two red and green, undecorated, rounded glass beads in addition to flaked stone debitage and unworked faunal bone. Given the unusual context and the disarticulated, possibly disturbed, condition of the canine, it is likely that the glass beads associated with this feature were intrusive from one of the nearby human burials.

FB 3

FB 3 was composed of excavation units and features located in the western portion of LAN-62, adjacent to the main burial area. It was a well-defined area adjacent to the burials and may have been associated with activities in the main burial area during the Protohistoric and Mission periods. FB 3 was characterized by a series of tightly clustered features, including artifact concentrations, rock clusters, thermal features, and pits. One of the features (Feature 384) may represent the remains of mourning-ceremony activities. FB 3 yielded a total of 436 analyzed glass beads (see Table 133) classified into 10 different types. All but 2 free-wound varieties were drawn varieties. Unlike in nonburial contexts from the burial area, which contained mostly green glass beads, purple glass beads dominated (64.7 percent) the FB 3 collection, followed in decreasing frequency by green (19.3 percent), blue (8.7 percent), black (3.2 percent), clear/white (2.5 percent), yellow (1.1 percent), and red (0.5 percent) (see Table 134). No glass-bead strands were identified in situ or during analysis in FB 3.

Artifact Concentrations

Three artifact concentrations contained glass beads: Features 384, 433, and 456, located within a 5-by-3-m area. Features 433 and 456 were characterized as pit-like concentrations of artifacts within Feature 384, a large activity area that contained concentrations of charcoal; basketry fragments, many of which were burned; FAR; and fragments of unworked shell and bone. The 110 glass beads contained in these three features were classified into eight different varieties of undecorated, drawn, rounded varieties. Glass-bead colors included purple (63.6 percent), green (12.7 percent), blue (10.0 percent), black (7.3 percent), clear/white (3.6 percent), and yellow (2.7 percent). Although some glass beads may have intruded from other features or underlying matrix, bead colors indicated that activities associated with the artifact concentrations may be associated with the Phase 2 (Feature 433) and Phase 4 (Feature 384) color sequences, although diagnostic glass beads from Features 384 and 433 ranged widely through time (A.D. 1771–1860). Shell beads recovered from the three features also ranged widely through time, but beads with narrow time ranges indicated activities ca. A.D. 1800–1816.

Rock Clusters

Two rock clusters within FB 3, Features 331 and 673, contained a single glass bead each. A decorated, wound, shaped, bipyramidal, red bead with pressed sides was recovered from Feature 331, and Feature 673 yielded a drawn, round, purple glass bead. Concentrations of FAR, unworked-shell and -bone fragments, and charcoal were recovered from Feature 331, and Feature 471 yielded a small cluster of FAR and a few fragments of unworked shell. Considering the nature of these features and the low frequencies of beads, the glass beads may have intruded from the overlying matrix or adjacent features.

Excavation Units

Excavation units within FB 3 yielded an additional 324 glass beads of 11 different varieties of drawn, cut (n = 1); drawn, rounded (n = 322); and wound, shaped (n = 1) beads. Glass-bead colors included all of those identified in FB 3 artifact-concentration and rock-cluster contexts and consisted of purple (65.1 percent), green (21.6 percent), blue (8.3 percent), clear/white (2.2 percent), black (1.9 percent), yellow (0.6 percent), and red (0.3 percent). The low frequencies of black (n = 6) and yellow (n = 2) beads provided some evidence, though limited, for activities during Phases 3 and 4. Time ranges for diagnostic glass beads were between A.D. 1771 and 1905.

FB 4

FB 4 was composed of excavation units and features located in the central portion of the main excavation area of LAN-62 A and the eastern portion of the main burial area, approximately 9 m east of FB 3. This activity area dates to the Intermediate period. Analysis included a single glass bead recovered from EU 418, along the southern edge of the feature block (see Table 133). The glass bead was a purple, undecorated, drawn, shaped bead (see Table 134). Also recovered from the same excavation level (Level 58) were unworked shell and bone, flaked stone debitage, and FAR. An overlying level (Level 48) yielded a shell bead dating to A.D. 1800–1816. Considering the Intermediate period age for FB 4 and the low number of Historical period artifacts, the glass bead was likely intrusive.

Sitewide Features

Glass beads were also identified in two artifact concentrations outside the main burial area and feature blocks. Feature 2, consisting of a concentration of faunal bone, a stone biface, and tarring pebbles, was relatively isolated 12 m southwest of the main burial area. Feature 670, 2 m west of the main burial area and between FBs 3 and 7, consisted of a metate and a mano. A single undecorated, drawn, shaped glass bead was recovered from each of these features (see Table 133). The beads in Features 2 and 670 were purple and black, respectively (see Table 134). Feature 2 also contained a Historical period mother-of-pearl button. Considering the paucity of Historical period artifacts in the two features, the two glass beads likely intruded from the surrounding matrix or, in the case of Feature 670, from nearby features.

Glass-Bead Collection from LAN-211

In 1999, LAN-211 was augered, mechanically trenched to define its boundaries, and subsequently tested with a total of 17 1-by-1-m units excavated by shovel and trowel (Altschul et al. 2003:69). In total, 20 glass beads were recovered, and Robert Gibson (2001:19–20; see also Altschul et al. 2003:211–213) undertook their analysis. The small collection was made up of the following: 17 undecorated, monochrome, rounded, drawn, green (n = 7), purple (n = 5), blue (n = 4), and clear (n = 1) glass beads; 2 undecorated, polychrome-red-on-green, rounded, drawn glass beads; and 1 undecorated, monochrome-red, spheroidal, wire-wound glass bead. Only the drawn glass beads and the single wound variety were similar to the 99 glass beads recovered from later excavations (discussed below). Gibson (2001:19) concluded that the glass-bead collection fell within the shell-bead date range of A.D. 1500–1800, with the wound bead possibly dating to A.D. 1816 or later. From the present study, it has been concluded that the Historical period components of both LAN-62 and LAN-211 were contemporary, dating to around the late eighteenth century to the 1810s.

Data recovery excavation yielded a total of 99 glass beads from excavation units and a feature in FB 1 (Table 135; see Appendixes F.33–F.35). FB 1 consisted of a large activity area composed mainly of hearth and rock-cluster features. The LAN-211 glass-bead collection consisted of one class of drawn beads with three methods of finishing, three types, and 14 varieties (Figure 153). The drawn beads included both cut and rounded beads; rounded beads were finished by the *a speo*, *ferraccia*, and hot-tumbling methods. There were 7 varieties of transparent beads, predominantly green, blue, and purple; 1 variety of a translucent blue; and 2 varieties of opaque black and blue beads.

All bead varieties recovered from LAN-211 were identical to varieties recovered from the burial area of LAN-62, and the bead-color percentages were similar (see Tables 131 and 135). For these reasons, both collections are regarded as contemporary. However, unlike at LAN-62, glass-bead strands were not identified at LAN-211, decorated glass beads were nearly absent, and frequencies within a single feature or excavation unit never exceeded four glass beads. These differences likely stem from different types of activities carried out at the two sites, with glass beads at LAN-62 largely associated with burial-related activities. For more complete descriptions of the bead classes, types, and varieties, see the previous section on LAN-62. Photographs of the bead varieties from LAN-211 were not taken, because the varieties are identical to those from LAN-62 (see Figures 132–137).

FB 1

Analysis of glass beads from a hearth (Feature 4) and excavation units within FB 1 included a total of 42 glass beads representing eight different varieties of undecorated, drawn, rounded beads

Table 135. Classes, Varieties, Quantities, and Time Ranges for Glass Beads from LAN-211, by Analytical Context

Feature Type/ Context	Class Attributes		Quantity		Estimated Time Range for Diagnostic Beads (A.D.)
	Primary Manufacture	Finishing	No. of Varieties	Total No. of Beads	
			Inside FB 1		
Hearth (Feature 4)	drawn	rounded	1	1	
Excavation units	drawn	rounded	8	41	1771–1860
Subtotal			—	42	
			Outside FB 1		
Excavation units	drawn	cut	2	2	1782–1905
		rounded	8	55	1771–1860
Subtotal			—	57	
Total			—	99	

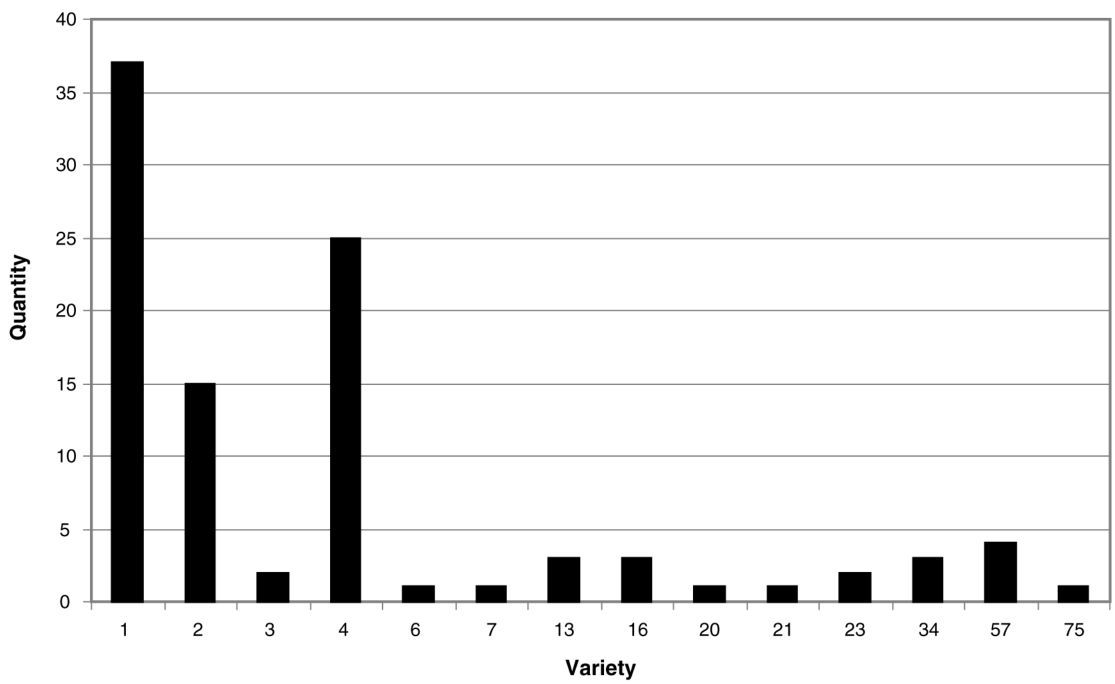

Figure 153. Frequencies of glass-bead varieties from LAN-211.

(see Table 135). Glass-bead colors consisted of mostly purple (n = 18) in addition to lower frequencies of green (n = 11), blue (n = 7), black (n = 3), red (n = 2), and clear/white (n = 1). Glass beads were dispersed throughout FB 1, but most clustered in the central and western portions of the feature block. With the exception of a single glass bead, the beads were recovered from excavation units adjacent to features. A hearth (Feature 4) in the central portion of FB 1 contained the single undecorated, drawn, rounded, red bead. Feature 4 also contained 2 shell beads dating to A.D. 1500–1700 as well as unworked faunal bone and shell and a variety of lithic artifacts, including a Cottonwood Triangular projectile point, bifaces, core hammerstones, tarring pebbles, debitage, and FAR. Considering this earlier date, the glass bead was likely intrusive. Of note for FB 1 was the absence of yellow glass beads associated with Phase 4 and the limited number of black beads representing Phase 3. Only 2 glass beads from FB 1 were temporally diagnostic; 1 each was recovered from EUs 106 and 407, and these dated to A.D. 1771–1860.

Outside FB 1

The area outside FB 1 contained 57 glass beads identified on the same horizontal level as FB 1. It is possible that some of the glass beads outside FB 1 may have intruded from inside FB 1, or the other way around. Glass beads from outside FB 1 represented 10 varieties of drawn, cut (n = 2) and rounded (n = 55) beads (see Table 135). The 2 cut, drawn beads were undecorated and monochrome: a blue bead and a purple bead recovered from EUs 182 and 398, respectively. The two units were located in the central portion of the excavation area, 4.3 m apart. Relative proportions of glass-bead colors were similar to those inside the feature block and included purple (n = 20), green (n = 14), blue (n = 13), red (n = 6), and clear/white (n = 2). The area outside FB 1 contained 2 yellow beads recovered from two units located 1 m apart, EUs 124 and 201. The yellow beads indicated activities during Phase 4. The same excavation levels in both units also contained shell beads dating to A.D. 1800–1816. Other than the presence of yellow glass beads, frequencies, types, colors, and spatial distributions of glass beads adjacent to features were similar to those in FB 1 and the surrounding area. Glass beads did not appear to be directly related to activities associated with rock-cluster and hearth features, which were likely used for domestic activities.

Glass-Bead Collection from LAN-2768

In total, 20 glass beads were recovered from LAN-2768, from general mechanical-stripping contexts rather than features. These beads comprised two classes of drawn beads, one class of wound beads, and two classes of mold-pressed beads, including five bead types and nine bead varieties (Table 136; Figures 154 and 155; see Appendix F.36). See Appendix F.37 for a detailed discussion of bead types recovered from LAN-2768. The drawn beads included both cut and rounded beads; rounded beads were possibly finished by hot tumbling. The wound beads were shaped, free-wound beads, and the mold-pressed beads were finished by fire- and acid-polishing methods. These beads were not found in diagnostic contexts but, rather, in stripping units and similar general contexts.

Table 136. Glass-Bead Collection from LAN-2768, by Primary Category

Categories		No. of Varieties	Tertiary Total		Secondary Total	
Secondary	Tertiary		Quantity	Percentage	Quantity	Percentage
Manufacturing Types						
Drawn beads					7	35.0
	cut, drawn beads	4	5	25.0	—	
	rounded, drawn beads, possibly hot tumbled	1	2	10.0	—	
Wound beads	shaped, free wound	2	10	50.0	10	50.0
Mold-pressed beads					3	15.0
	fire polished	1	2	10.0	—	
	acid polished	1	1	5.0	—	
Total (manufacturing types)		9	20	100.0	20	100.0
Decoration						
Undecorated		5	17	85.0	—	
Decorated		2	3	15.0	—	
Total (decoration)		7	20	100.0	—	
Color						
Clear/white		2	3	15.0	—	
Black		4	12	60.0	—	
Red		—	—	0.0	—	
Yellow		1	2	10.0	—	
Green		—	—	0.0	—	
Blue		—	—	0.0	—	
Purple		2	3	15.0	—	
Total (color)		9	20	100.0	—	
Color Layering						
Monochrome		9	20	100.0	—	
Polychrome		—	—	0.0	—	
Total (color layering)		9	20	100.0	—	

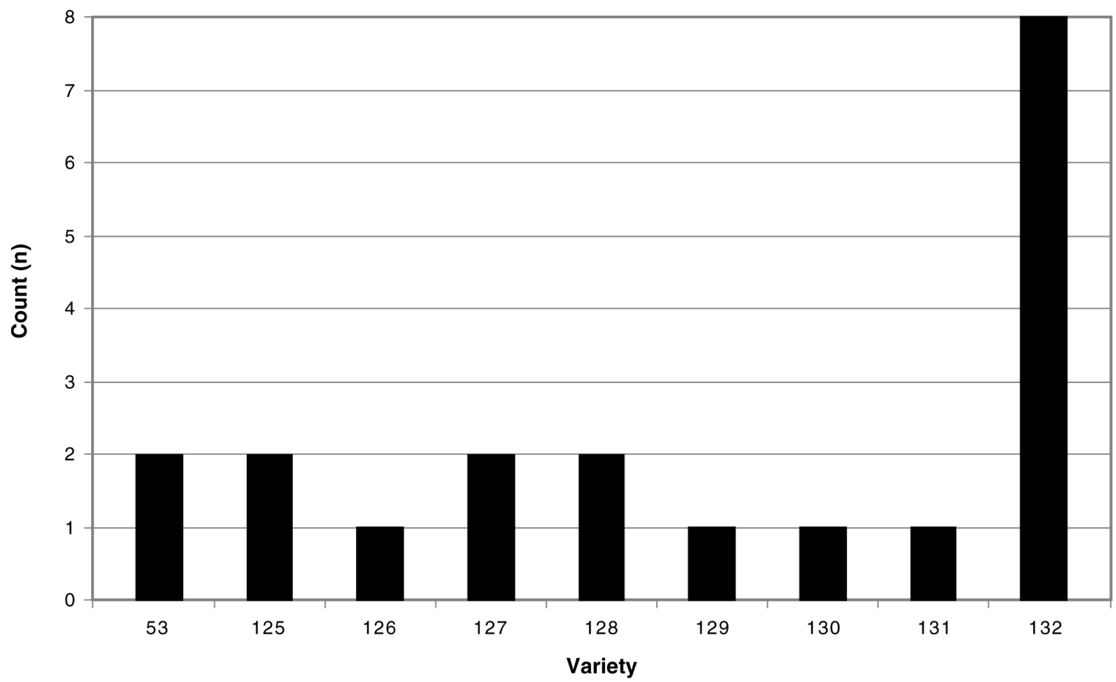

Figure 154. Frequencies of glass-bead varieties from LAN-2768.

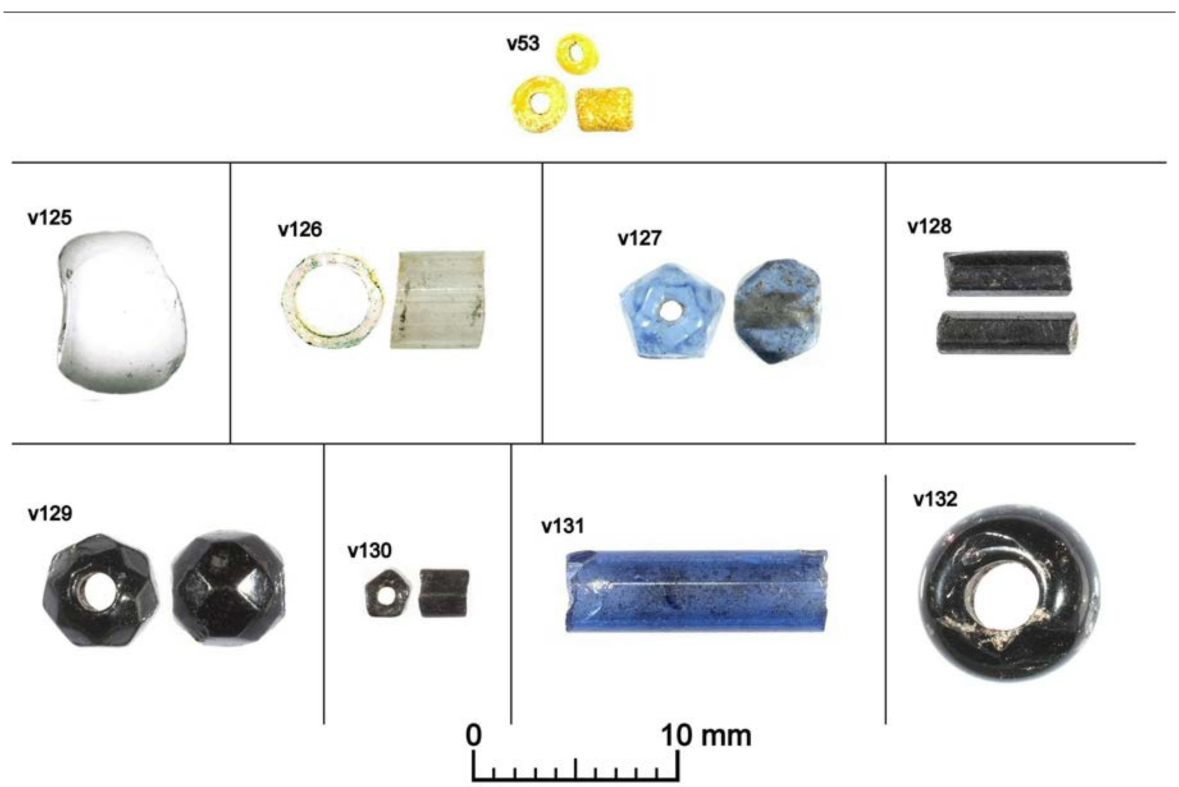

Figure 155. Glass-bead types and varieties from LAN-2768.

Of the bead varieties recovered from LAN-2768, only one is identical to a variety recovered from the burial area of LAN-62. The bead-color percentages were also very different from those at LAN-62; the small collection from LAN-2768 was dominated by black beads (see Tables 131 and 136). The LAN-2768 collection also included two mold-pressed bead varieties with technological attributes dating to the mid- to late nineteenth century. For these reasons, the LAN-2768 collection is regarded as much later in age than the collections from LAN-62 and LAN-211. The glass beads from LAN-2768 appeared to represent a post-Mission period collection and were possibly associated with the Mexican rancho period (the mid-1830s to the mid-nineteenth century) and/or the American period (the mid- to late nineteenth century).

At LAN-2768, two types of mold-pressed beads were recovered: fire polished and acid polished (see Appendix F.36). There were two fire-polished beads; each was five-sided and had three rows of molded and ground facets; a horizontal, straight mold seam; and a vertical, pierced, cylindrical perforation. To remove the fins of glass remaining after the beads were released from their molds, facets were ground around the circumferences of the beads. To finish its appearance, each bead was finally fire polished. This technique appeared to have been earlier than the acid-polishing method used to finish the second type of mold-pressed bead from LAN-2768.

Only one acid-polished bead was recovered from LAN-2768. It had seven sides; five rows of patterned, molded facets; a zig-zag, horizontal mold seam; and a vertical, pierced, cylindrical perforation. To remove the fin of glass remaining after the bead was released from its mold, the fin was broken, and the bead was then immersed into an acid bath, presumably hydrofluoric acid (HF). This process removed all remnants of the fin and rounded the margins of the facets. This technique, plus the use of a zig-zag mold seam, generally indicates that the bead was produced during the latter half of the nineteenth century. No beads of this variety have been reported from other western North American sites.

Glass- and Ceramic-Bead Collection from LAN-193

In total, 14 glass or ceramic beads were recovered from LAN-193, comprising three classes of wound glass beads, one class of mold-pressed glass beads, and one class of Prosser-molded ceramic beads, including seven bead types and 12 bead varieties (Tables 137 and 138; Figure 156). The wound beads were unshaped and shaped, free wound and shaped, furnace beads, and the mold-pressed bead was finished by fire polishing. A detailed discussion of the different bead types identified at LAN-193 is presented in Appendix F.38. These beads were not found in diagnostic contexts but, rather, in stripping units and similar general contexts.

Of the bead varieties recovered from LAN-193, only one is identical to a variety recovered from the burial area of LAN-62. The bead-color percentages were also very different from those at the other sites. The LAN-193 collection was dominated by white beads and also included one mold-pressed glass-bead variety with technological attributes dating to the late nineteenth century and four Prosser-molded ceramic-bead varieties that had to have been manufactured after 1840, when this bead class was first patented (Sprague 1983). For these reasons, the LAN-193 collection is regarded as much later than the collection from LAN-62 and probably later than the LAN-2768 bead collection, which lacked Prosser-molded ceramic beads. It is a post-Mission period glass-bead collection; some beads were possibly associated with the Mexican rancho period (the mid-1830s to the mid-nineteenth century), but most were probably associated with the early American settlement period (the mid- to late nineteenth century).

Ethnohistoric Comparisons

Comparative Regional Archaeological Sites in California

There were a number of regional sites for which information was located that could be used for comparative purposes. These sites are grouped into Native and colonial Spanish sites, and their comparative information is discussed below and in the following sections.

Gabrielino/Tongva and Chumash Archaeological Sites

At least 32 Gabrielino/Tongva and Chumash archaeological sites within the Southern California Bight have contained glass beads roughly dating to the early Mission period (see Appendix F.39). It is highly probable that this list is incomplete; it only represents those sites identified in the literature located for this study. Because of varying descriptions and a lack of illustrations for the glass beads reported, it is impossible to make direct comparisons among the bead collections. However, 15 had adequate descriptive information to compare percentages of glass-bead colors.

Gabrielino/Tongva and Chumash sites with glass beads include burial grounds and habitation sites. The only sites with human burials that provided useful comparative information were the Ventureño Chumash Medea Creek and Humaliwo sites, the Chumash burial area at Helo', and three burials at Smugglers Cove on the Chumash-occupied island of Santa Cruz (see Appendix F.39).

Table 137. Glass- and Ceramic-Bead Varieties from LAN-193

Variety No.	Method of Manufacture	Finish or Shape	Diaphaneity	Color	Decoration and Comments	Karklins Number	Quantity
42	free wound	spheroidal	transparent	light blue	Very fragile.	WIb	1
114	shaped, furnace wound	spheroidal	transparent	light yellowish green	Very fragile.	WIb	1
115	shaped, furnace wound	spheroidal	opaque	black	Small perforation.	WIb	2
116	shaped, free wound	spheroidal	transparent	purple	Very fragile.	WIb	1
117	shaped, free wound	spheroidal	opaque	white (bluish)	Small perforation. Selective dark staining of fibers of glass, giving an appearance of a spiral decoration. Fragile.	WIb	2
118	Prosser molded	spheroidal	transparent	light yellow	Wide horizontal band around circumference. Prosser-molded technique not patented until 1840.	none	1
119	mold pressed	cuboidal	transparent	clear (white)	Fire polished. Four molded, flat sides and two molded, flat ends. Vertical, straight mold seam diagonally across each end and along opposite edges. Vertical, pierced, cylindrical perforation.	none	1
120	shaped, furnace wound	ellipsoidal	transparent	dark purple	Very fragile.	WIc	1
121	Prosser molded	spheroidal	opaque	yellowish green	Wide horizontal band around circumference. Prosser-molded technique not patented until 1840.	none	1
122	Prosser molded	tapered, cylindrical	opaque	white	Prosser-molded technique not patented until 1840.	none	1
123	Prosser molded	spheroidal	opaque	white	Wide horizontal band around circumference. Prosser-molded technique not patented until 1840.	none	1
124	shaped, furnace wound	spheroidal	transparent	clear (white)		WIb	1
Total							14

Table 138. Glass- and Ceramic-Bead Collection from LAN-193, by Primary Category

Categories		No. of Varieties	Tertiary Total		Secondary Total	
Secondary	Tertiary		Quantity	Percentage	Quantity	Percentage
Manufacturing Types						
Wound beads					9	64.3
	unshaped, free wound	1	1	7.1	—	
	shaped, free wound	2	3	21.4	—	
	shaped, furnace wound	4	5	35.7	—	
Mold-pressed beads	fire polished	1	1	7.1	1	7.1
Prosser molded		4	4	28.6	4	28.6
Total (manufacturing types)		12	14	100.0	14	100.0
Decoration						
Undecorated		8	10	71.4	—	
Decorated		4	4	28.6	—	
Total (decoration)		12	14	100.0	—	
Color						
Clear/white		5	6	42.9	—	
Black		1	2	14.3	—	
Red		—	—	0.0	—	
Yellow		1	1	7.1	—	
Green		2	2	14.3	—	
Blue		1	1	7.1	—	
Purple		2	2	14.3	—	
Total (color)		12	14	100.0	—	
Color Layering						
Monochrome		12	14	100.0	—	
Polychrome		—	—	0.0	—	
Total (color layering)		12	14	100.0	—	

Figure 156. Glass- and ceramic-bead types and varieties from LAN-193.

Medea Creek (LAN-243) (ca. 1500–1785)

The Medea Creek site was excavated in the 1960s under less-than-ideal recovery conditions (see King 1974; L. King 1982). It is an inland Chumash burial ground located in the Santa Monica Mountains that contained an estimated 397 primary and secondary burials and was in use during the Protohistoric period and the very early Historical period, ca. A.D. 1500–1785. It is likely that the burial area ceased to be used prior to much direct contact with the mission system (Martz 1984). Even though it was located inland, there were grave goods, such as fishhooks and the possible remains of wooden canoes, to indicate that at least some of individuals interred were connected economically to coastal subsistence activities (King 1974; L. King 1969, 1982; Van Horn 1987b). Of the 441 glass beads, 435 were identified by Clement Meighan (L. King 1982:494). Over 90 percent of the glass-bead total was found in association with only 3 individual burials. Burial Feature 205 alone had 300 beads. An additional 101 were with burial Feature 164, and burial Feature 234 had 15 beads. No other burial had more than 3 beads, and a few were scattered in features, backdirt, and other more or less isolated contexts (L. King 1982:495).

Humaliwo or Malibu (LAN-264) (ca. 1785–1805)

Of all the sites with human interments, this site has been studied in the greatest detail and has provided the most information that can be compared to the burial features at LAN-62 (see Bickford 1982; Gamble 2008; Gamble et al. 1995; Gamble et al. 1996; Gamble et al. 2001; Gibson 1975, 1987; Green 1999, 2001; King 1981, 1996; L. King 1982; Meighan 1981, 1987:193). Humaliwo was a Chumash village that over 100 converts left for the missions between 1790 and about 1810 (King and Johnson 1999:Table 6.1). A burial ground at this site showed that during that same time, some 130 adult Native Americans died and were buried in the Native community (Gamble et al. 2001; Meighan 1987:193; Suchey et al. 1972; Walker et al. 1996). Depending on the published source, roughly 15,000–17,000 glass beads were recovered from Humaliwo (Gibson 1975, 1987; King 1996) (see Appendix F.39). Green (1999:Chapter 6, Part 1, Figure 16) noted that only 19 (38 percent) of the 50 burials at Malibu Creek contained glass beads. The 50 burials included 26 male burials, of which only 12 (24 percent of all burials) had glass beads, and 24 female burials, of which only 7 (14 percent of all burial) had glass beads.

Helo' Burials (SBA-46) (Protohistoric Period to Early Historical Period)

The site of Helo' is located on Mescalitan Island, within the town of Santa Barbara. Burials from this large site were excavated during the late 1800s by two archaeologists, Harry Yarrow and Ronald Olsen. More recent work at the site by modern archaeologists (e.g., Gamble 1990) has shown evidence of good preservation of houses and other cultural material. This Chumash site appeared to have been occupied until approximately 1805. Within the site boundaries, there were several burial areas. Yarrow and Olsen both excavated in what is referred to as "Cemetery D" (Gamble 2008:206–209). From 16 early Historical period burials at Helo', 2,329 glass beads were recovered that could be identified by bead type and color (Gamble 1991; King 1988, 1990a, 1990b) (see Appendix F.39). Gamble (2008:Table 20) argued for a minimum of at least 2,500 glass beads but did not specify bead types or colors. Overall, glass-bead counts differed among the various reports. This glass-bead collection was more similar to the Humaliwo collection than either the earlier collection from Medea Creek or the later burial area at LAN-62.

Santa Cruz Island Burials and Sites

At least seven Historical period Chumash sites with glass beads have been excavated (Graesch 2000; Kennett et al. 2000; King 1988, 1990a) (see Appendix F.39). In addition, Ronald Olson (1928) excavated 69 burials, of which 7 had glass beads along with shell beads. At Smugglers Cove (SCRI-138), 3 Historical period burials were excavated at SCRI-138 that provided useful comparative information. Four other sites on Santa Cruz Island also provided useful comparative information for glass-bead colors.

Remaining Chumash Sites

Of the remaining Chumash sites with glass beads, only Talepop (LAN-229) (King 1986; L. King 1982) and Xonxon'ata (SBA-3404) (Hildebrandt 2004) had published information that could be used for comparative purposes (see Appendix F.39). Both of these sites had a limited number of glass beads (Talepop: 16–60 glass beads, depending on the source; Xonxon'ata: 20–125), and only Talepop had a yellow bead. The glass-bead collection from Xonxon'ata is most similar to the collection from Medea Creek, and the Talepop collection was most similar to that of Humaliwo.

Gabrielino/Tongva Sites

Of the sites with glass beads found within the territory of the Gabrielino/Tongva, the only Channel Island site identified was the Ledge site (SCLI-126) on San Clemente Island (Rechtman 2000) (see Appendix F.39). Based on the presence/absence of glass-bead colors, the Ledge site collection lacked yellow and black beads and was most similar to the collection from Humaliwo. The only other site with glass-bead descriptions that were useful for comparative purposes was ORA-287 at Newport Bay (King 1986) (see Appendix F.39). Based on the presence/absence of glass-bead colors, this site's collection was most similar to that of LAN-62 but, curiously, lacked green beads.

Alta California Colonial Sites

Of the 14 Spanish colonial sites with glass beads examined for this study, 13 had glass-bead descriptions adequate for comparisons (see Appendixes F.16, F.17.1–F.17.26, and F.40.1–F.40.22). Surprisingly, these 14 Spanish colonial site excavations produced a combined total of just under 14,000 glass beads, and 2 of the sites—Missions Santa Clara de Asis and San Buenaventura—provided over 10,000 of that total. The vast majority of the glass beads recovered from the Spanish colonial sites could not be attributed to distinct temporal periods; rather, they were associated with the entire Historical period occupation of the sites (the late eighteenth through twentieth centuries). However, a few were recovered from relatively narrowly dated contexts.

Both the percentage of bead colors and the presence of specific glass-bead types provided useful comparative information for evaluating a possible temporal sequence for bead-color acceptance and for defining a glass-bead type collection for Spanish Alta California colonial sites (the number of sites and their glass-bead details are too numerous to discuss here; see Appendixes F.17.1–F.17.26 and F.40.1–F.40.22).

Relative and Temporal Dating of the PVAHP Glass-Bead Collection

Dating Glass Beads from the PVAHP Sites

The glass beads recovered from two sites, LAN-62 and LAN-211, were manufactured in Europe during the late eighteenth century and the first quarter of the nineteenth century, a time span corresponding to the early to middle Mission period, 1769 to the 1820s. Glass beads from these two sites did not include varieties that only could have been acquired after the first quarter of the nineteenth century. At the remaining two PVAHP sites, LAN-193 and LAN-2768, there were glass- and ceramic-bead varieties that postdated the first quarter of the nineteenth century or could only have been manufactured after 1840.

LAN-62 and LAN-211 were contemporary, dating to the early Mission period, from the late eighteenth century to the 1810s. The glass-bead collection at LAN-62 can be subdivided into early (Phases 1 and 2) and late (Phases 4 and 5) based on relative percentages of glass-bead colors (see below). LAN-211 can be associated with the latest glass-bead color phase, indicating that its occupation was contemporary with the terminal period of occupation of the burial area at LAN-62.

LAN-2768 and LAN-193 had glass-bead varieties that were not associated with sites dating to the early to middle Mission period (ca. 1769 to the mid-1820s). Furthermore, LAN-2768 had varieties that were available during the late Spanish Alta California colonial and Mexican Alta California rancho periods, from the mid-1820s to the late 1840s. By contrast, LAN-193 had varieties that were available during the late Mexican Alta California rancho period (post-1840) and more easily available during the American California settlement period (the mid- to late nineteenth century).

Glass-Bead Proveniences

During the early Mission period, the majority of drawn and wound glass beads from Europe were manufactured in Murano, Venice, Italy. Rounded, drawn beads from LAN-62 and LAN-211 appeared to have been rounded by at least three methods: the *a speo*, *ferraccia*, and hot-tumbling methods. The *a speo* and *ferraccia* methods were commonly employed prior to the second quarter of the nineteenth century. The method for hot tumbling drawn glass beads was purportedly not invented until 1817, but until additional historical and archaeological research can verify this date, it would be premature to use it as a terminus a quo date. It does appear, though, that sites with hot-tumbled drawn beads in western North America have tended to date to the second quarter of the nineteenth century or later.

Wound beads with shaped sides had numerous variations, based on the number of sides present, and were relatively crudely manufactured in both their material composition and their design attributes. At LAN-62, the various varieties of beads of this style often exhibited eroded and pitted surfaces with a patina. Other varieties of similar diaphaneity and color were often shiny and well made. This suggests a relatively lower level of bead-making technological skills than the more-refined technologies known to exist in Murano, Holland, and Bohemia. It is possible that they may have been manufactured in one of the lesser-known European bead-making centers, perhaps one or more of those in Spain.

Relatively large, faceted, cut, drawn glass beads were generally manufactured in Bohemia and originally were copies of more expensive, cut-crystalline beads. They were most common during the early to late nineteenth century. The cut-crystal varieties of the sixteenth and early seventeenth centuries are commonly associated with eastern North American Spanish colonial sites and have not been reported from Alta California sites.

Temporal Sequences at PVAHP Sites Based on Glass-Bead Colors

Western North American Native Bead-Color Preferences

Prior to the arrival of Europeans, western North American Natives manufactured beads in a variety of colors, including white, gray, black, red, brownish yellow, green, blue, and purple, and from many materials. There is limited information regarding the cultural significance of colors for the Chumash and Gabrielino/Tongva. The Gabrielino/Tongva apparently recognized six primary colors, including white (*Arawatay*), black (*Yupiha*), red (*Quaóha*), yellow (*Payuhuwi*), green (*Tacap*), and blue (*Sacasca*) (Reid 1926:5). Native shell beads were made of almost clear abalone; white clam, dentalium, and olivella; black mussel; red scallop hinge and abalone; bluish olivella; and purple mussel shells (Hudson and Blackburn 1985:283–293).

Once sustained, direct contact with Spanish colonists occurred, selection and rejection of bead colors reflected choices made by the Gabrielino/Tongva and Chumash through time. Initial colors of choice among most western North American Natives appears to have been principally white and secondarily blue (see Ahler and Drybred 1993; Davis 1972; Moulton 1983–1997), with the exception of Spanish Alta California, where, according to the archaeological record, blue glass beads were the most common (Crull 1997:125).

With ever-increasing contact, western North American Natives began accepting a greater range of unfamiliar colors through time. Perhaps within one generation of contact, red, green, red-on-green, red-on-yellow (if available), red-on-white (if available), and purple became accepted. Pastel colors, decorated beads, and faceted beads also became accepted relatively quickly (see Combes 1964; Kidd and Kidd 1970; Ross 1990). This pattern of acceptance represents a working hypothesis for bead-color preferences, and until definitive studies of Native color occurrences are completed, any comments represent interpretive speculation.

Various Chumash and Gabrielino/Tongva sites with glass beads, including both burial and nonburial areas, have had adequate numbers of beads to make comparisons on the basis of color, as discussed below (Table 139; for data from these sites, see Appendixes F.41–F.44). The majority of these sites appeared to fall within the Mission period, and it is obvious that the vast majority of these sites were dominated by green, blue, and purple glass beads, almost to the exclusion of all other colors. White glass beads do not appear to have been a major commodity sought by Chumash and Gabrielino/Tongva.

Table 139. Comparison of Percentages of Glass-Bead Colors for Burial Sites within Chumash and Tongva Territories

Site	Context and Reference Information	No./ Percent	Colors							Total
			White	Black	Red	Brown/ Yellow	Green	Blue	Purple	
Chumash										
Medea Creek, LAN-243	12 Historical period burials, ca. 1500–1795 (C. King 1982).	no.	22	—	1	—	213	46	153	435
		percent	5.1		0.2		49.0	10.6	35.2	100.0
Humaliwo, LAN-264	87 Historical period burials, ca. 1775–1805.									
	(King 1986:7).[a]	no.	—	—	—	—	—	—	—	15,229
		percent								100.0
	(King 1996:34–44).[b]	no.	163	89	668	20	5,629	4,500	6,213	17,282
		percent	0.9	0.5	3.9	0.1	32.6	26.0	36.0	100.0
	(Green 1999:Appendix A, Part 2).	no.	217	15	496	20	4,491	4,322	6,209	15,770
		percent	1.4	0.1	3.1	0.1	28.5	27.4	39.4	100.0
Helo', SBA-46	16 Historical period burials (King 1988; 1990a:8.46–8.47).[c]	no.	50	97	15	—	266	1,052	849	2,329
		percent	2.1	4.2	0.6		11.4	45.2	36.5	100.0
Smugglers Cove, SCRI-138	3 Historical period burials (King 1988; 1990a:8.46–8.47).[d]	no.	2	—	—	—	314	114	134	564
		percent	0.4				55.7	20.2	23.8	100.0
Tongva										
LAN-62 burial site	155 Historical period burials, late eighteenth century to the 1810s.[e]	no.	2,835	1,555	4,500	1,903	20,017	8,478	18,677	57,965
		percent	4.9	2.7	7.8	3.3	34.5	14.6	32.2	100.0

[a] Total for site does not match totals reported in King (1988, 1990a:8.46–8.47, 1996:1, 34–44).
[b] See Table 4.3.2 for distribution of common glass beads by shell-bead subphases. Total for site does not match totals reported in King (1986:7, 1988, 1990a:8.46–8.47).
[c] Only includes "common" types of drawn beads. Totals for blue beads and cemetery do not match totals reported in King (1990c:296). Source for data not provided.
[d] Only includes "common" types of drawn beads. Totals for blue beads and cemetery do not match totals reported in King (1988; 1990a:8.46–8.47). See Table 4.3.3 for distribution by individual burial. Source for data not provided.
[e] 11 beads could not be identified by color.

Data from five sites in the Southern California Bight (Medea Creek, Humaliwo, Helo', Smugglers Cove, and LAN-62) demonstrate changes through time for the acceptance of glass-bead colors (see Table 139). Most notably, approximately 95 percent of the beads at the earliest Chumash sites were in the green, blue, and purple color groups. By contrast, LAN-62, the only Gabrielino/Tongva site of the five discussed, dated slightly later than the others (from the late 1700s to the 1810s) and had approximately 81 percent of the beads in those same color groups. Other bead colors, such as clear/white, black, red, and brown/yellow, were more common at LAN-62 than at the other four sites.

Medea Creek and Smugglers Cove appeared to represent the earliest sites. Based upon descriptions and associated type numbers for Meighan's California bead typology, all glass beads from Medea Creek were Karklins Type IIa, except for one Type IVa red-on-green bead. This glass-bead collection represents the earliest documented for the Mission period; 49 percent of the beads were green, 35 percent were purple, and 10 percent were blue (see Table 139).

Three burials at Medea Creek contained over 90 percent of the glass beads and included the following (L. King 1982: 222, 224–225, 241, 245–246, 251):

> **Burial Feature 205**, a 25–35-year-old male, contained 302 glass beads (78 percent blue and 22 percent purple). These beads were recovered from around the neck and wrist, at the knee, and under an arm.
>
> **Burial Feature 164**, a disturbed burial of unknown age and sex, contained 101 glass beads (89 percent purple, 6 percent blue, and 5 percent white) in a cluster below the shin.
>
> **Burial Feature 234**, a highly disturbed burial of unknown age and sex with a fragmentary skull and mandible, contained 15 glass beads (87 percent clear and 13 percent blue) with a strand at the neck.

Of the 668 glass beads recovered from three Smugglers Cove burials, 564 were identified by color and demonstrated that 99.6 percent were green, purple, and blue; the remaining 0.4 percent were clear or white. Two of the three burials had only green, purple, and blue glass beads. Of significance are the absence of red, black, and yellow beads and the absence of clear/white beads from two of the three burials, which suggests that these burials may have been associated with the very early Historical period, similar to the burials from Medea Creek.

Four nonburial areas on Santa Cruz Island also provided useful comparative information regarding glass-bead colors (data from these sites are presented in Appendix F.44). Of significance is that two sites were dominated by green, blue, and purple beads, with only one bead each of clear/white and red. The remaining two sites had a few yellow beads, along with red and clear/white beads; one had black beads, as well. These sites possibly represent two different temporal periods, corresponding to earlier vs. later phases of the Mission period.

Medea Creek and Smugglers Cove burials had approximately 36–188 glass beads per burial; the highest percentages were green and purple beads. The precise method for collecting beads at Medea Creek was not reported, but suffice it to note that it involved techniques that, for the period the site was excavated (1960s), were less rigorous than the techniques used at LAN-62. For general comparative purposes, though, there does appear to have been a temporal trend from a few beads per burial to many more beads per burial.

The Humaliwo burials (LAN-264) and Helo' burial (SBA-46) glass-bead collections contained approximately 145–187 beads per burial, more than in burials at Medea Creek but similar to the number in Smugglers Cove burials. These two collections also had lower percentages of green beads and higher percentages of blue and red beads. Of these four earlier sites, only Humaliwo had yellow beads. Looking at individual burials or groups of burials at these two sites also demonstrated that a sequence of burials by quantities of glass-bead colors may exist. For example, as detailed in Appendix F.42, there appear to be patterns with color that correspond to burials containing the sequence of shell beads. King (1996:38–40) divided burials at Humaliwo into six phases based on their associations with shell-bead types. The burials associated with the earliest of these phases (Humaliwo A) had no black or yellow beads and only one bead apiece that was clear/white or red. None of the six phases had yellow beads.

King (1990a:296) identified glass beads by color for 16 burials at Helo' (see Appendix F.43 for data comparable with those from other sites discussed in this section). There were 9 burials without clear/white, black, red, and yellow beads; 3 burials with clear/white beads but no black, red, or yellow beads; and 4 burials with clear/white, black, and/or red but no yellow beads. None of the burials had yellow beads. This pattern was duplicated for nonburial areas of the site, as well (see data presented in Appendix F.44).

Each of the 16 burials contained between 2 and 545 glass beads, and as with the burial features at LAN-62, there appear to be groups of burials that can be separated on the basis of the presence/absence of specific bead colors. Nine of the burials contained only green, blue, and/or purple beads, and the 7 remaining burials contained additional clear/white, black, and/or red beads. None contained yellow glass beads.

The collection from LAN-62 had approximately 188 beads per burial (for those with beads), more than the burials at Humaliwo, Helo', and Smugglers Cove. These changes in quantities per burial and color percentages suggest that more glass beads were available and more colors were utilized at LAN-62.

Of 10 Chumash and Gabrielino/Tongva nonburial sites with glass beads, 5 lacked yellow beads, 2 had either a single clear/white or red bead and no black or yellow beads, and 5 had various combinations of clear/white, black, red, and yellow beads. As with the burial areas, these nonburial areas appeared to demonstrate a similar temporal sequence of glass-bead colors, with yellow beads the last to have been accepted.

The data from these early Spanish period burial areas demonstrate that, at least for coastal southern California, the preferred colors were purple, green, and blue. This is detailed in part through comparing glass beads to independent shell-bead chronologies, as was done for the Chumash site of Humaliwo (see Appendix F.42). During the initial contact period, beads of these three colors may have been considered by regional coastal groups as variations of a single color. Later, finer distinctions must have been made, because the relative percentages for each of these three colors appear to have changed through time.

Temporal Bead Sequence for Burial Features from LAN-62

Based on changes in glass-bead colors over time, dates for temporally diagnostic beads, and the association of glass beads in burial features with relatively tight depositional sequences, it may be possible to create a temporal bead sequence for the project area that, in turn, can be used to cross-date the stratigraphic sequences from the project sites. In an attempt to isolate burials with unique glass-bead-color characteristics, two approaches were undertaken:

1. High-frequency comparisons: comparisons of burial features with the highest percentages of colors associated with features having more than 20 beads of a single color.

2. Low-frequency comparisons: comparisons of burial features with low percentages of colors associated with features having between 10 and 40 beads.

As a result, burial features containing primary individuals associated with glass beads were grouped into four temporal phases based on glass-bead color sequences (Table 140). The following is a discussion of phases for burials with high and low frequencies of glass beads.

High-Frequency Comparisons

Burial features were identified that had unusually high percentages of beads for each of the seven color categories: clear/white, black, red, brown-yellow, green, blue, and purple. To compensate for bioturbation, only features with 20 or more glass beads of a single color were considered (see Appendixes F.23–F.45). Isolating only those burial features with relatively high percentages for each of the colors resulted in the identification of 61 burial features with 20 or more glass beads that had relatively high percentages of beads of one or more colors (see the shaded portions of Appendixes F.45.1–F.45.7 and F.46.1). Organizing these 61 burial features by associations of glass-bead colors resulted in the identification of four color groupings:

Group 1: Purple, green, and blue glass beads (4 burial features) (see Appendix F.47.1)

Group 2: Purple, green, blue, and red glass beads (7 burial features) (see Appendix F.47.2)

Group 3: Purple, green, and/or blue with or without red and with white and/or black glass beads (44 burial features) (see Appendix F.47.3)

Group 4: Purple, green, blue, red, and yellow with white and/or black glass beads (11 burial features) (see Appendix F.47.4).

Low-Frequency Comparisons

Twenty-two burial features contained a total of between 10 and 40 glass beads, of which less than 20 beads were of a single color. These features were sorted into four common groups of color associations (see data presented in Appendix F.48):

Group 1: Purple, green, and/or blue glass beads (4 burial features).

Group 2: Purple, green, and/or blue with or without red and/or white glass beads (8 burial features).

Group 3: Purple, green, and/or blue with or without red and/or white and with black glass beads (5 burial features).

Group 4: Purple, green, and/or blue with red, yellow, and white and/or black glass beads (5 burial features).

Table 140. Hypothesized Glass-Bead Color Sequence from Early (Phase 1) to Late (Phase 4) for Burial Features at LAN-62

Phase	Glass-Bead Colors Present	Burial Features
1	purple, green, and/or blue	46, 63, 64, 69, 71, 80, 98, 100, 173, 228, 268, 311, 371, 375, 500, 522, 538, 543, and 552.
2	purple, green, and/or blue with red and/or white	8, 53, 101, 120, 143, 344, 372, and 415.
3	purple, green, and/or blue with red and/or white and black	5, 6, 7, 11, 14, 34, 38, 50, 52, 60, 76, 85, 96, 103, 105, 110, 134, 153, 155, 177, 218, 227, 243, 265, 313, 319, 320, 323, 327, 334, 349, 408, 429, and 438.
4	purple, green, and/or blue with red, white, and/or black and yellow	10, 13, 31, 42, 57, 59, 90, 152, 165, 170, 191, 196, 204, 222, 223, 225, 244, 276, 277, and 282.

Comparisons of bead colors from burial features at LAN-62 did not produce clear evidence of a transition of bead colors that could be correlated to a firm temporal sequence, but there were suggestive correlations that appeared to indicate a possible sequence. These correlations suggested a four-phase temporal sequence among the burials at LAN-62 that closely parallels the stratigraphic sequence of the features recorded during excavation. The comparative results of burial features with relatively high and low frequencies of glass beads demonstrated similar groups of colors based upon various combinations of the following:

1. Purple, green, and/or blue glass beads.
2. Purple, green, and/or blue with red and/or white glass beads.
3. Purple, green, and/or blue with red and/or white and black glass beads.
4. Purple, green, and/or blue with red, white, and/or black and yellow glass beads.

Assuming that bead-color complexity increased with time, these four groups could be viewed as glass-bead-color temporal phases; comparisons with other burial areas in the region support this inference (see Table 139).

The earliest phase for glass beads appears to consist of individuals with purple, green, and/or blue glass beads that were less abundant compared to later phases (i.e., generally 1–2 beads per individual). Only adults, evenly divided between males and females, were associated with this phase (Figures 157–160). These burials were more widely distributed than those of later phases. The only extended individual with glass beads, a male, was associated with this phase, whereas all others were either flexed or semiflexed and tended to be oriented east to southeast, facing down (Figure 161). Females were flexed four times more often than males and were more likely to be buried on either their left or their right sides, whereas males were more likely to be buried in supine or prone positions.

The second phase appears to consist of individuals with purple and green beads, at times combined with blue, red, and clear/white beads. These burials were three times more frequent in the burial area than those in the earliest Phase 1. There were almost twice as many adults as subadults, but subadults had twice as many glass beads (see Figures 157 and 158). Individuals were twice as likely to be flexed vs. semiflexed; most were buried on their left sides and oriented southeast (see Figure 161).

The third phase appears to consist of individuals with purple, green, and/or blue with or without red and/or clear/white and black glass beads, which were 10 times more frequent than the second phase and 32 times more frequent than the earliest phase. This phase appears to represent a peak in the number of individuals buried with glass beads as well as the one with the highest frequency of glass beads. There were three times more adults than subadults, but subadults had twice as many glass beads (see Figures 157 and 158). There were twice as many females as males, with three times more glass beads for females (see Figures 159 and 160). Individuals were six times as likely to be buried flexed as semiflexed; females were generally on their right or left sides, and males were either on their left sides or prone, oriented southeast (see Figure 161). Almost half of the individuals had red ocher, including twice as many females as males and six times as many adults as subadults.

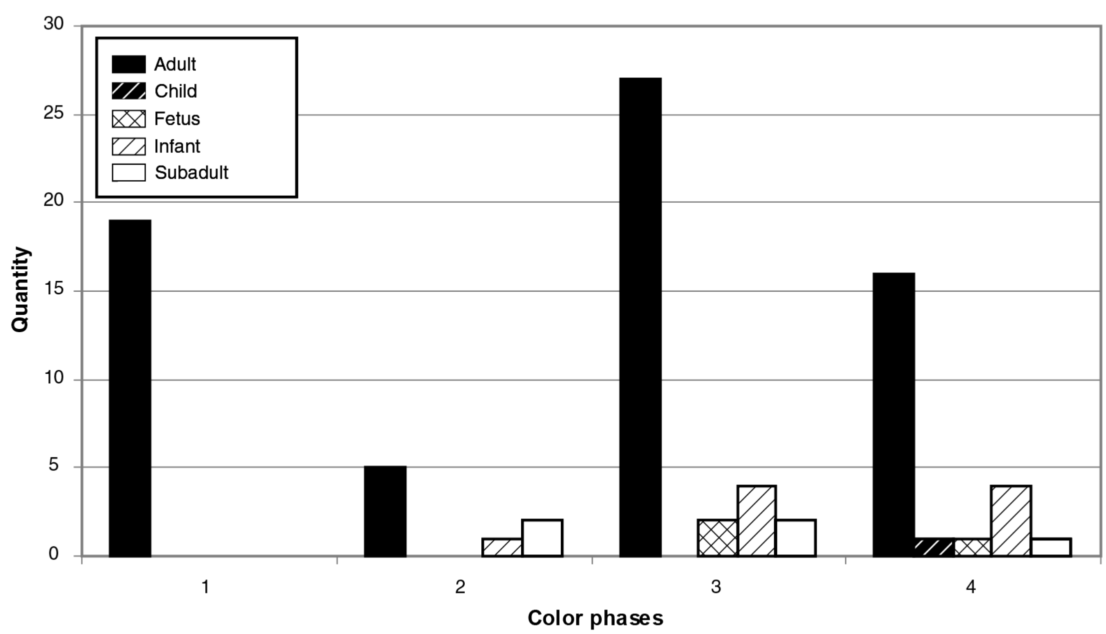

Figure 157. Frequencies of burial features containing glass beads, LAN-62, by age of primary individual and color phase.

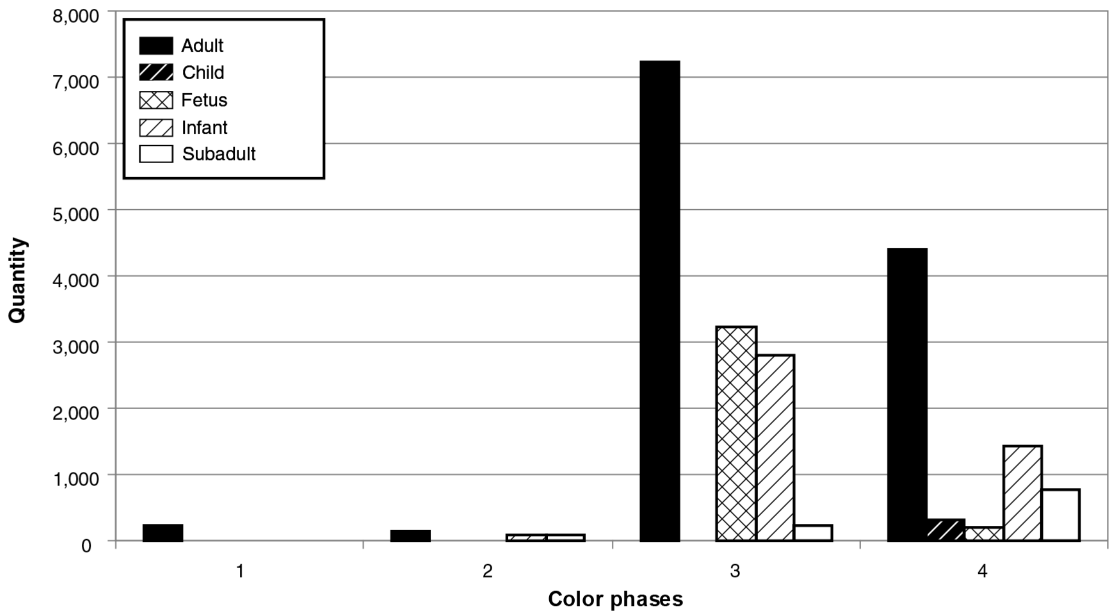

Figure 158. Frequencies of glass beads in burial features, LAN-62, by age of primary individual and color phase.

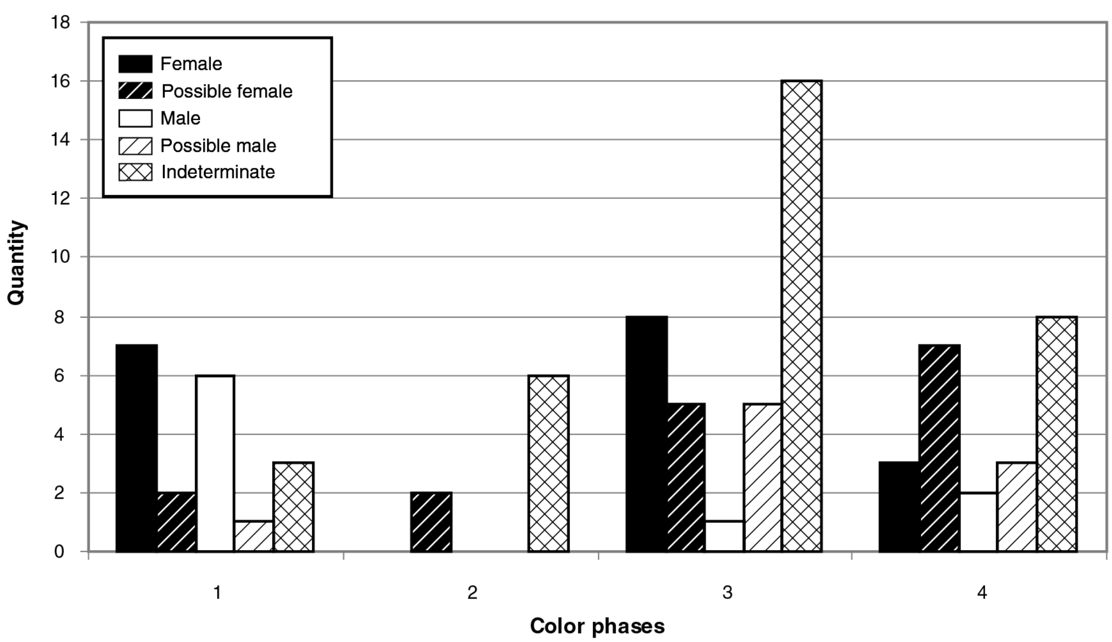

Figure 159. Frequencies of burial features containing glass beads, LAN-62, by sex of primary individual and color phase.

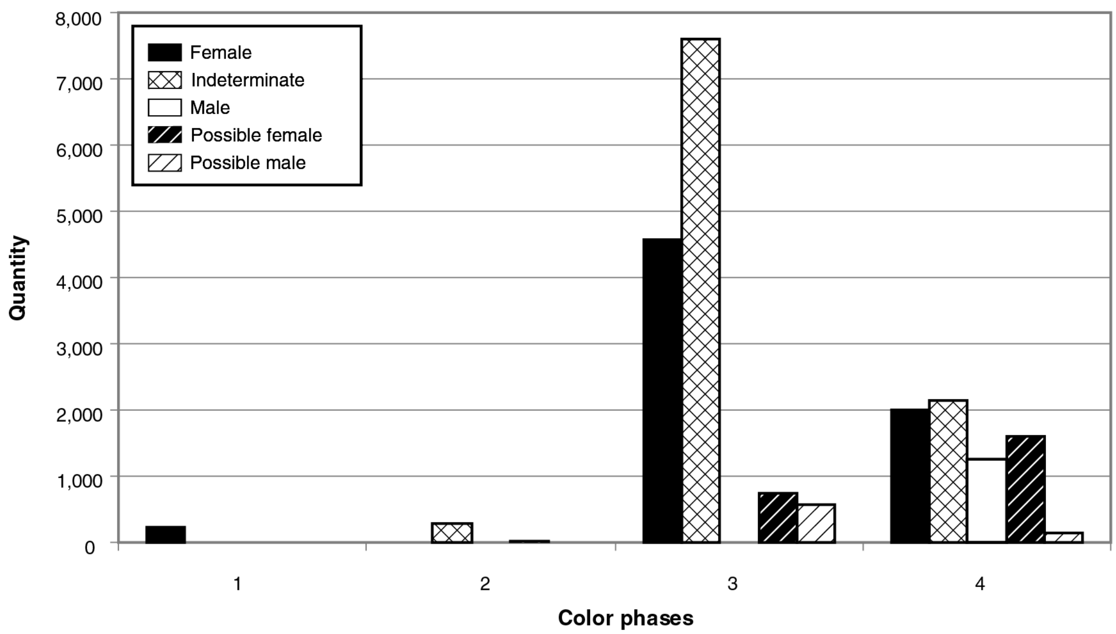

Figure 160. Frequencies of glass beads in burial features, LAN-62, by sex of primary individual and color phase.

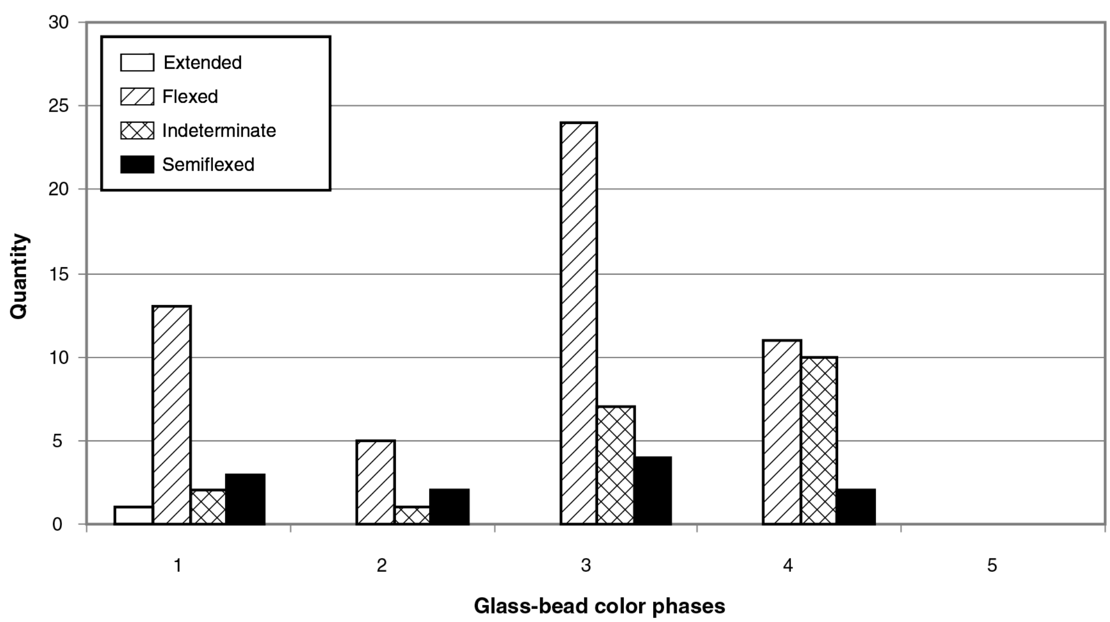

Figure 161. Frequency of burial features, LAN-62, by burial position of primary individual and glass-bead color phase.

The latest phase appears to consist of individuals with approximately 20 percent fewer beads, overall, than the third phase. In addition, these individuals were buried with purple and green beads, at times also with blue, red, and yellow beads together. In addition, some individuals had clear/white or black beads. There were twice as many females as males and adults as subadults (see Figures 157–160). Individuals were five times as likely to be buried flexed as semiflexed; 70 percent were buried on their left sides, including three times as many females and males, and most were oriented generally south to southeast (Table 141; see Figure 161).

A number of trends are apparent in this four-phased sequence. If this sequence represents a temporal shift, then individuals in the two earliest phases were buried with very few beads, whereas individuals in the two latest phases had 8–32 times more glass beads. Moreover, in the earliest phase, only 10 percent of the individuals had red ocher, and none had red glass beads, whereas in the last three phases, 25–46 percent of the individuals had red ocher, and most had red beads. The only individual buried in an extended position was a male from the earliest phase. During the earliest phase, males were more likely to be buried in prone or supine positions. During the third phase, males were still buried in prone or supine positions, but there appears to have been a preference for placement on their left sides. This preference was not apparent in the final phase. During the earliest phase, individuals were likely to be oriented east to southeast, facing down, but by the last phase, individuals were likely to be oriented south to southwest, facing west to northwest.

Comparisons with Other Alta California Sites

From the data observed from all the Chumash and Gabrielino/Tongva sites with glass beads, it is inferred that changes in relative percentages of glass-bead colors do have temporal significance. This has been tested with independent shell-bead data from the burial area at Humaliwo, among other sites. The earliest sites had relatively high percentages of green, blue, and purple beads; low percentages of clear/white and red beads; and no black or yellow glass beads. Later sites had relatively high percentages of green, blue, and purple beads; moderate percentages of red beads; and low percentages of clear/white, black, and yellow glass beads. The latest sites had lower percentages of green, blue, and purple beads; moderate percentages of clear/white and red beads; and low percentages of black and yellow glass beads.

During the initial two phases, when purple, green, blue, white, red, and a few white and/or black glass beads were available, the number of beads per burial was low, perhaps even dropping with the acceptance of different varieties. By the last phase, the full range of glass-bead colors was accepted, and quantities increased 8–32 times. This dramatic increase mimics the changes among the regional burial grounds (see Table 139; Appendixes F.49–F.52), increasing from average lows of 45–223 beads per burial for Humaliwo Phases A–B and Smugglers Cove and 12–38 beads per burial for the first two phases at LAN-62 (discounting the 36 beads per burial at the earliest Medea Creek burial ground because of drastically different recovery techniques) to peak average highs of 502–627 for Humaliwo Phases C–D and 386 for LAN-62 burials during the third phase and then dropping to a lower average of 221–309 for Humaliwo Phases E–F and the fourth phase at LAN-62 (see Appendixes F.29 and F.42).

Compared to all burial areas with glass beads in the region, there appears to be a temporal pattern of fewer glass beads per individual for the earliest burials. The latest burials all appear to have contained higher quantities of yellow beads than earlier burials. This suggests that relative dating of early to middle Mission period Native American sites in the region may be possible using the relative frequencies of purple, green, and/or blue vs. the addition of red, clear/white, black, and yellow glass beads. Those sites with the fewest purple, green, and/or blue glass beads may represent the earliest phase, and those with relatively high quantities of yellow beads may represent the latest phase.

Changes in relative numbers of glass beads per burial suggest that during the initial phase of the Mission period, glass beads were relatively rare and that they increased through time in quantity, the number of colors accepted, and the number of different types available. Later, as Native populations declined, the average number of beads per burial declined. To evaluate this inference, relative numbers and percentages of white shell beads should be compared to the glass-bead frequencies.

There is a profound lack of white glass beads from most Chumash and Gabrielino/Tongva sites, suggesting that these beads were not substituted for white shell beads in areas where the production of shell beads occurred or was controlled.

Table 141. Predominant Traits in Features with Glass Beads, LAN-62

Trait	Glass-Bead Phase 1	Glass-Bead Phase 2	Glass-Bead Phase 3	Glass-Bead Phase 4
Sex	both	unknown	female	both
Age	adult	adult	adult	adult
Number of beads	few	few	high	high
Burial position	flexed	flexed/semiflexed	flexed	flexed
Bead colors	purple/green/green	purple, green, blue, and red or white	purple, green, blue (red or white), and black	purple, green blue (red or white), and black and yellow

However, for the northernmost areas of the Chumash territories and the southernmost areas of the Gabrielino/Tongva territories, there appear to have been higher quantities of white glass beads, as discussed earlier (see Appendixes F.41–F.44). Because these areas were probably not involved in the production and primary distribution of shell beads, it appears that inhabitants may have accepted white glass beads as substitutes for shell beads. Strings of purple, green, and blue beads did augment the use of strings of shell beads as currency for these two cultures.

Another interesting correlation of glass beads within the Spanish colonial borderlands is the presence of relatively high percentages of red glass beads. The preponderance of red beads at relatively early Native American sites in the northern coastal and Mono-Inyo regions of California is unique for western North America. Among hot-tumbled, drawn beads, early Native American sites have been generally dominated by white and blue beads that correspond to common varieties of pre-contact shell beads. Exceptions to this trend include the Kashaya Pomo in the vicinity of the Russian American Company at Fort Ross, California, and the Paiutes of the western Great Basin. The dominant colors of glass beads from the 1812–1840 Fort Ross Native Alaskan Village site (SON-1897) were white, red, black, and green (Ross 1995, 1997:193). The high percentage of red beads corresponds with similar high percentages in the Native American collections from the Inyo-Mono region (Ross 2004). These shared preferences probably reflect Native American color values unrelated to Euroamerican and Asian-American trade goods available through indirect or direct contact.

For the coastal Gabrielino/Tongva, there was a relatively high percentage of red glass beads in the LAN-62 collection (7.8 percent of the collection). Most notable were the red, wound beads with pressed sides and facets (Karklins Types WIIm and WIIp). In western North America, these bead types appear to have been concentrated within the sphere of influence of the Spanish Alta California borderlands. It is clear from the comparison of the relative percentage of red beads from the Chumash and Gabrielino/Tongva burial areas (see Table 139) that by the early nineteenth century, more red beads began to be accepted.

To compare the relative quantities of yellow beads at the two Chumash sites of Medea Creek and Humaliwo with those from LAN-62, few to no yellow beads were associated with the Chumash sites, whereas a relatively high percentage of the glass-bead collection at LAN-62 consisted of yellow beads. This represents a significant shift and probably reflects a temporal difference. From the earliest of the three burial areas at Medea Creek, no yellow beads were recovered; from the later burial area of Humaliwo, 0.1 percent of the glass-bead collection was composed of yellow beads; and at the latest of the three, LAN-62, yellow beads comprised 3.3 percent of the glass-bead collection and were only associated with the latest glass-bead color phase. Because the interments at Humaliwo ceased in ca. 1805, this suggests that interments at LAN-62 ceased somewhat later, perhaps a decade or more later. From this temporal relationship, it is inferred that for the coastal Gabrielino/Tongva, the use of glass beads continued to increase after 1804, unlike for the Chumash. If that is true, then the decline in the ratio of glass beads to shell beads may not have occurred among the Gabrielino/Tongva as it did for the Chumash after 1804 (King 1990a:194). To evaluate this inference, a comparison should be made between the ratios of glass and shell beads for interments at LAN-62 prior to and after the introduction of glass beads, as well as after the occurrence of yellow beads during glass-bead Color Phase 4. It is hypothesized that the ratios should be different from those at the Chumash sites.

Clearly, from a comparison of the relative percentages, glass-bead colors from Spanish Alta California colonial sites do not conform to a single common standard, and different bead colors have appeared at different sites. This suggests that local Natives influenced at least the colors acquired by each of the colonial establishments and perhaps the glass-bead varieties accepted, as well. But there does appear to be a general pattern of high percentages of green, blue, and purple beads from the earliest contexts, with white and red composing the next-highest percentages, followed by relatively low percentages of black and yellow glass beads. This pattern appears to reflect a similar sequence observed repeatedly for the Chumash and Gabrielino/Tongva sites examined above, reinforcing the likelihood that it reflects a temporal sequence from the early to the late Mission period.

Glass-Bead Values

Historical Glass-Bead Absolute Values

After the arrival of the Spanish and from the 1830s, during the Mexican period, the basis for regional currency used by Spanish colonists in Alta California was the *peso* or, more accurately, the *peso duro*, and post-1845, during the American period, it was the dollar. A *peso* was equal to eight *reales*, or more precisely, the *reales de plata mexicana* (i.e., pieces of Mexican silver). In 1840, a *peso* equaled 27.0602 g, and a dollar equaled 26.9535 g, or 99.6 percent of a *peso* (Doursther 1965[1840]:324–327).

Measures for beads among the Chumash and Gabrielino/Tongva were determined by the length of a string of beads, and depending upon the type of bead, values varied. One of John P. Harrington's informants noted that the Native method for valuing a bead string was related to the Spanish *reales*, a unit no longer in use in the early 1910s. For the most common beads, one *real,* or bit (i.e., piece of eight), was equivalent to roughly 44 or 48 *pouces*. Values were based upon multiples of four, and this would coincide with the 44-*pouce* string length (Hudson and Blackburn 1987:276, 280).

Reid (1926:25) reported that for the mid-1850s, during the American period, an 8-yard string equaled $1. About 1916, when John P. Harrington photographed a Kitanemuk informant, Magdalena Olivas, he calculated that the length of a bit-length string (using the traditional method for hand-measuring strings) was "a yard and 5 inches," or 41 inches (Hudson and Blackburn 1987:275). Erminie Voegelin (1938:52), working in the 1930s with the Tübatulabal, concluded that the Chumash standard unit for a length of beads (*kilahil,* or [Chumash] *stu*) was "about 45 inches." The average of these two estimations is close to 44 inches, which would result in a 48-*pouce* string of beads during the Spanish period.

As early as 1769, cartographer Miguel Costansó (1970:92–93) noted for the Chumash region that strings of shell beads were valued as a form of monetary exchange or money (Hemert-Engert and Teggart 1910:139). Within a generation, naturalist José Longinos Martínez, traveling throughout California in 1792, noted that with the introduction of glass beads by the Spanish, strings of glass beads also were valued and used much like money is today (Simpson 1938:45). Assuming that a 1-*real* string of common shell beads was equivalent to a string of common blue beads—i.e., undecorated, monochrome-blue, cylindrical, rounded, drawn glass beads (PVAHP Variety 2 beads)—it is possible to estimate the total number of beads per string. Such beads measured 3–8 mm in diameter, with an average of presumably about 5 mm. If a single 1-*real* string of these beads equaled 1,113.3 mm, then there would be approximately 223 beads per string. Expanding this average to the range of 3–8 mm per bead, a 1-*real* string could contain approximately 139–371 beads. For a *peso*-length string, this would equal 1,112–2,968 (1,784, using average-sized beads).

If a string of beads was equal to 12$^{1}/_{2}$ cents and there were 223 beads per string, dividing this number into the total of 6,021 Variety 2 blue beads recovered from LAN-62 would equal a total value of approximately $3.37. Applying this method of calculation to the more common Variety 1 purple (n = 18,037) and Variety 4 green (n = 19,941) beads, the total number of the most common colors of small, rounded, drawn glass beads would equal 43,999, or 197 1-*real* strings, or $24.66 worth of beads.

Archaeological Glass-Bead Relative Values

No comparative values for specific varieties of glass beads used during the Mission period exist that can be applied directly to varieties of glass beads recovered archaeologically. The approach used here assumes that there was a monetary value for glass beads (i.e., how inexpensive or expensive they were for the Spanish to purchase). It also assumes that this Spanish value was transferred to the Chumash and Gabrielino/Tongva, through rewards, in-kind payment for services, or direct purchases of glass beads. This is reasonable, given that Native Californians were paid for labor by ranchos, among other institutions, with glass beads (see the chapter by Steve Hackel in Volume 5 of this series).

Relative values of archaeological varieties can be established using factors such as labor required to manufacture beads in Europe, decoration, and size. Thus, it is possible to establish relative values, ranging from lowest to highest, based upon the relative cost of materials and techniques of manufacture for glass beads (Tables 142 and 143). These relative values then can be used to establish relative values for each bead variety (see Appendix F.53) and to rank specific burial features of primary individuals with 100 or more glass beads at LAN-62 (Table 144).

Table 142. Glass- and Ceramic-Bead Relative Values for Bead Types from PVAHP Sites

Relative Value	Bead Types
Highest	Bead Varieties 88 and 97
	Polychrome, multisided, decorated, rounded, drawn glass beads with ground facets.
High	Bead Varieties 14, 31, 46, 51, 63, 65, 68, 83, 86, 87, and 108
	Polychrome, multisided, undecorated, cut, drawn glass beads with ground facets.
	Monochrome, decorated, wound glass beads.
Low	Monochrome and polychrome, cylindrical, undecorated and decorated, cut, drawn glass beads with and without ground facets.
	Monochrome, cylindrical and multisided, rounded, drawn glass beads with ground facets.
	Monochrome, cylindrical, decorated, rounded, drawn glass beads.
	Polychrome, multisided, rounded, drawn glass beads.
	Monochrome, undecorated, wound glass beads.
	Monochrome and polychrome, shaped, wound glass beads.
	Monochrome, undecorated, fire-polished, mold-pressed beads with and without facets.
	Monochrome, undecorated and decorated, Prosser-molded beads.
Lowest	Monochrome, cylindrical, undecorated, cut, drawn glass beads.
	Monochrome and polychrome, cylindrical, undecorated, rounded, drawn glass beads.

Table 143. Glass-Bead Relative Values and Estimated Relative Wealth for LAN-62

Relative Value		Quantity	Percentage	Estimated Relative Wealth	
Relative Value	Relative Scale			Quantity × Relative Scale	Percentage
Highest	125	2	0.00	250	0.39
High	25	21	0.04	525	0.83
Low	5	1,120	1.93	5,600	8.85
Lowest	1	56,935	98.03	56,935	89.93
Total		58,078	100.00	63,310	100.00

Table 144. Relative-Wealth Values for Burial Features with 100 or More Glass Beads, LAN-62, by Relative Age and Sex

Burial Feature	Glass-Bead Count	Relative Value						Relative Wealth		
		Lowest	×1	Low	×5	High	×25	Total	Wealth (Total/Count)	Rank[a]
69 (female)	191	191	191		0		0	191	1	1
90[b]	520	520	520		0		0	520	1	1
225 (female)	201	201	201		0		0	201	1	1
327[b]	2,212	2,212	2,212		0		0	2,212	1	1
313[b]	2,942	2,929	2,929	13	65		0	2,994	1.02	1
282 (female)	1,147	1,138	1,138	9	45		0	1,183	1.03	1
110 (female)	326	323	323	3	15		0	338	1.04	1
85 (female)	425	421	421	4	20		0	441	1.04	1
243 (female)	292	289	289	3	15		0	304	1.04	1
196[b]	160	158	158	2	10		0	168	1.05	1
10 (female)	271	267	267	4	20		0	287	1.06	1
438 (female)	1,399	1,378	1,378	21	105		0	1,483	1.06	1
96[b]	376	370	370	6	30		0	400	1.06	1
223 (female)	433	426	426	7	35		0	461	1.06	1
244 (female)	1,926	1,899	1,899	26	130	1	25	2,054	1.07	1
323[b]	177	174	174	3	15		0	189	1.07	1
334 (female)	328	322	322	6	30		0	352	1.07	1
38 (female)	262	257	257	5	25		0	282	1.08	1
50 (female)	390	382	382	8	40		0	422	1.08	1
408 (female)	470	456	456	14	70		0	526	1.12	2
165[b]	197	191	191	6	30		0	221	1.12	2
155 (female)	2,145	2,084	2,084	60	300	1	25	2,409	1.12	2
204 (female)	783	756	756	27	135		0	891	1.14	2
319 (male)	222	214	214	8	40		0	254	1.14	2
227 (female)	368	353	353	15	75		0	428	1.16	2
276[b]	321	307	307	14	70		0	377	1.17	2
105[b]	289	274	274	15	75		0	349	1.21	2
14 (male)	247	238	238	8	40	1	25	303	1.23	2
170[b]	291	271	271	20	100		0	371	1.27	3
11 (female)	122	108	108	14	70		0	178	1.46	4
222[b]	445	380	380	65	325		0	705	1.58	5
Average									1.11	
Standard deviation									0.13	

[a] 1 = below average; 2 = average (standard deviation = +1); 3 = above average (standard deviation = +2); 4 = high (standard deviation = +3); 5 = highest (standard deviation = +4).
[b] Fetuses, infants, and children.

Using the average value and its standard deviation calculated for all individuals listed in Table 144, there are five potential ranks of glass-bead values. The vast majority of the burial features thus evaluated can be considered to possess average or below-average Spanish glass-bead values. Only 3 burial features out of the 31 evaluated were above average: 2 fetuses or subadults and 1 female. Of the 12 burial features that had average or above-average glass-bead values, 5 were fetuses to subadults, 5 were females, and 2 were males. Finally, of the 19 burial features that were below average, 13 were female, and 6 were fetuses to subadults. There appears to be a lack of correlation among quantities of glass beads and the sex and ages of individuals. Also, there is no correlation between the relative values of glass beads and the color phases defined earlier or in the distribution of individuals by rank. If rankings for Spanish glass-bead values had validity, then correlations should have been present, and they were not.

If there are no correlations, then the Gabrielino/Tongva did not value glass beads according to Spanish values. Thus, some other cultural factors existed, such as indigenous wealth and status. If Spanish glass-bead values were valid, then other classes of material goods will have to be evaluated and compared to the relative values established in Table 144. It would also be imperative that burials be sorted chronologically. Once burials are sorted chronologically, we can assume that the remaining variation in grave inclusions marks differences in status (Wason 1994:94). For LAN-62, the only potential temporal sequence available to the author is the postulated glass-bead color sequence discussed earlier.

Ages of Individuals with Glass Beads

There is a correlation between the ages of individuals and the quantities of glass beads interred with the individuals at LAN-62 (see Appendix F.54). Fetuses, infants, children, and subadults had almost twice as many glass beads (an average of 415 glass beads per burial) as adult females (an average of 252 glass beads) and four times as many as adult males (an average of 111 glass beads).

Mapping the spatial locations of individuals with glass beads buried at LAN-62 by age indicated that there may be a correlation between age and spatial location. Fetuses, infants, and children were buried in a northeast-southwest linear pattern in the southwestern quadrant of the main concentration of individuals with glass beads (Figure 162). Subadults were buried in a small cluster adjacent to this linear pattern (Figure 163). Adult females with glass beads were buried in a cluster in the southwestern quadrant of the main concentration of individuals with glass beads (see Figure 163). Males with glass beads were not clustered, and one-third or more were outside the main concentration of individuals with glass beads (see Figure 163). The distribution of adult males was similar to distributions of all individuals for glass-bead Color Phases 1 and 2, as well as for distributions of individuals with limited quantities of glass beads. These spatial distributions based on age and sex could not be further subdivided into groups of individuals with low vs. high quantities of glass beads.

Sex of Individuals with Glass Beads

At Humaliwo, it was noted that males received more artifacts than females (Green 1999:Chapter 6, Part 1). This was not the case for individuals buried at LAN-62. Of the 155 burial features at LAN-62 with glass beads, 73 had primary individuals that could be identified by sex, including 48, or 65.8 percent, females or possible females and 25, or 34.2 percent, males or possible males (see Appendix F.27). Excluding burial features with fewer than 10 glass beads, distribution included 37 identified by sex, including 27, or 73 percent, females or possible females and 10, or 27 percent, males or possible males (see Appendixes F.28 and F.29). These frequencies differ significantly from the numbers at Humaliwo, indicating that there was roughly a 2:1 ratio of females to males with glass beads at LAN-62, as opposed to a roughly 2:1 ratio of males to females at Humaliwo.

In addition to twice as many female burials with glass beads than male burials at LAN-62, females also averaged more than twice the number of glass beads per individual than males (see Appendix F.55). During the earliest three color phases, females had four times as many beads per burial as males. This ratio dropped to 3.2:1 by Phase 4 (Table 145). Clearly, females were accorded differential treatment from males, but whether this was the result of personal-adornment practices, wealth, and/or status cannot be answered on the basis of glass beads alone. What is known is that cultures that accorded females higher status than males were exceedingly rare (Wason 1994:99).

Quantities of Glass Beads

As noted previously, six burial features with primary individuals and 1,000 or more glass beads each appeared to have strands of glass beads and possible garments embroidered with glass beads. All six appeared to be relatively late interments (based on their associations with glass-bead Color Phases 3 and 4). The spatial distribution of these individuals did not establish that they were buried in a unique location of the burial area. Rather, they were intermingled with many other individuals with low quantities of glass beads.

Of the 61 burial features with 20 or more glass beads each and relatively high percentages of beads of one or more colors, 44 contained primary individuals that had relatively high percentages of glass beads of a single or multiple colors (see the shaded portions of Appendixes F.45.1–F.45.7 and F.46.2). Only a few burial features at LAN-62 had clearly defined glass-bead strands (burial Features 90, 280, 313, and 327); others had what may have been longer strands (burial Features 96 and 155), and still others had relatively large quantities of glass beads that were not identified during excavation as being in strands but may have been in strands and subsequently highly disturbed. To evaluate possible associations, the location of each individual was mapped by glass-bead color phase.

All but one individual in this group were concentrated in the southwestern portion of the main concentration of individuals with glass beads. The single individual outside

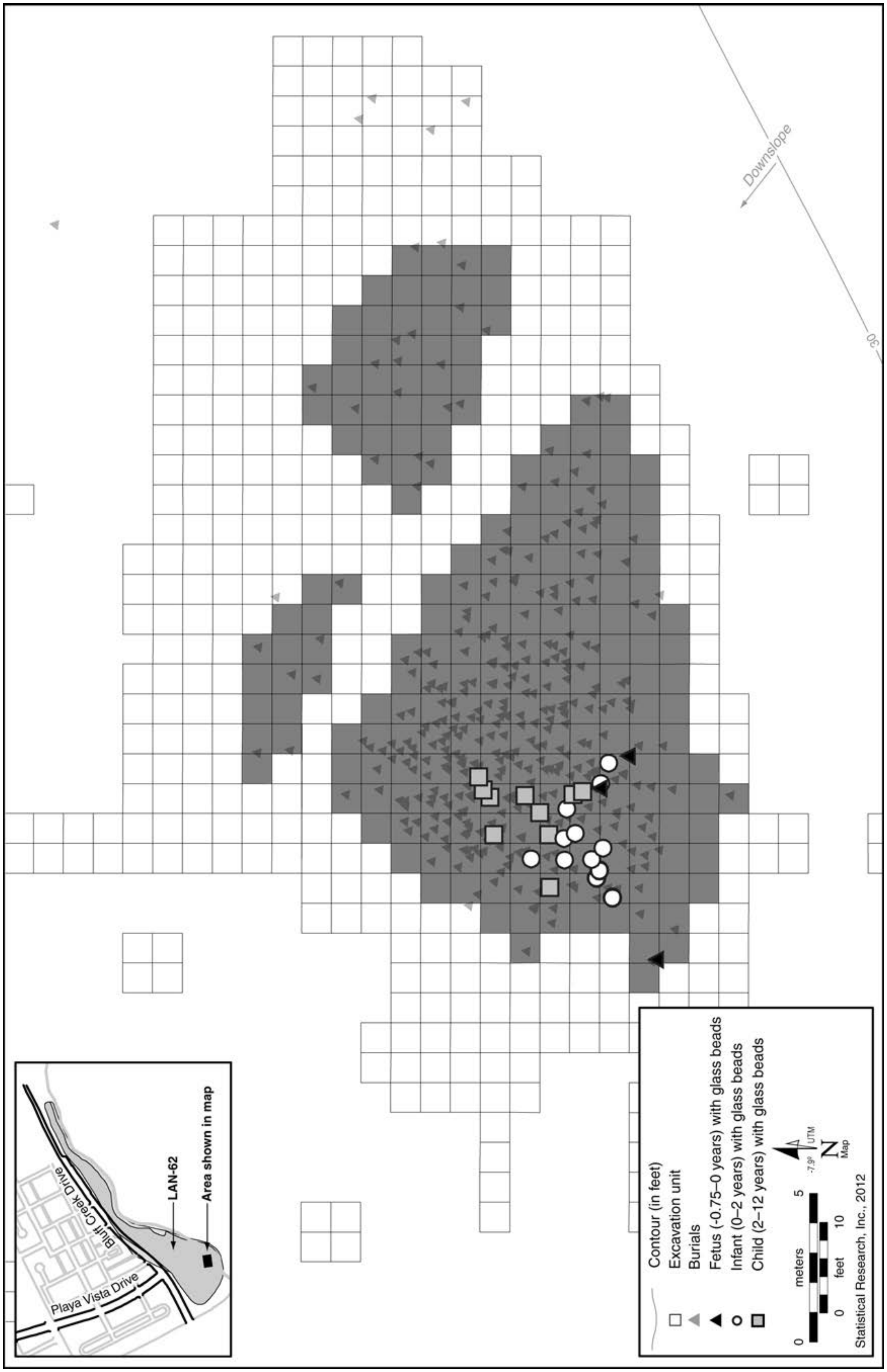

Figure 162. Locations of fetuses, infants, and children with glass beads, LAN-62.

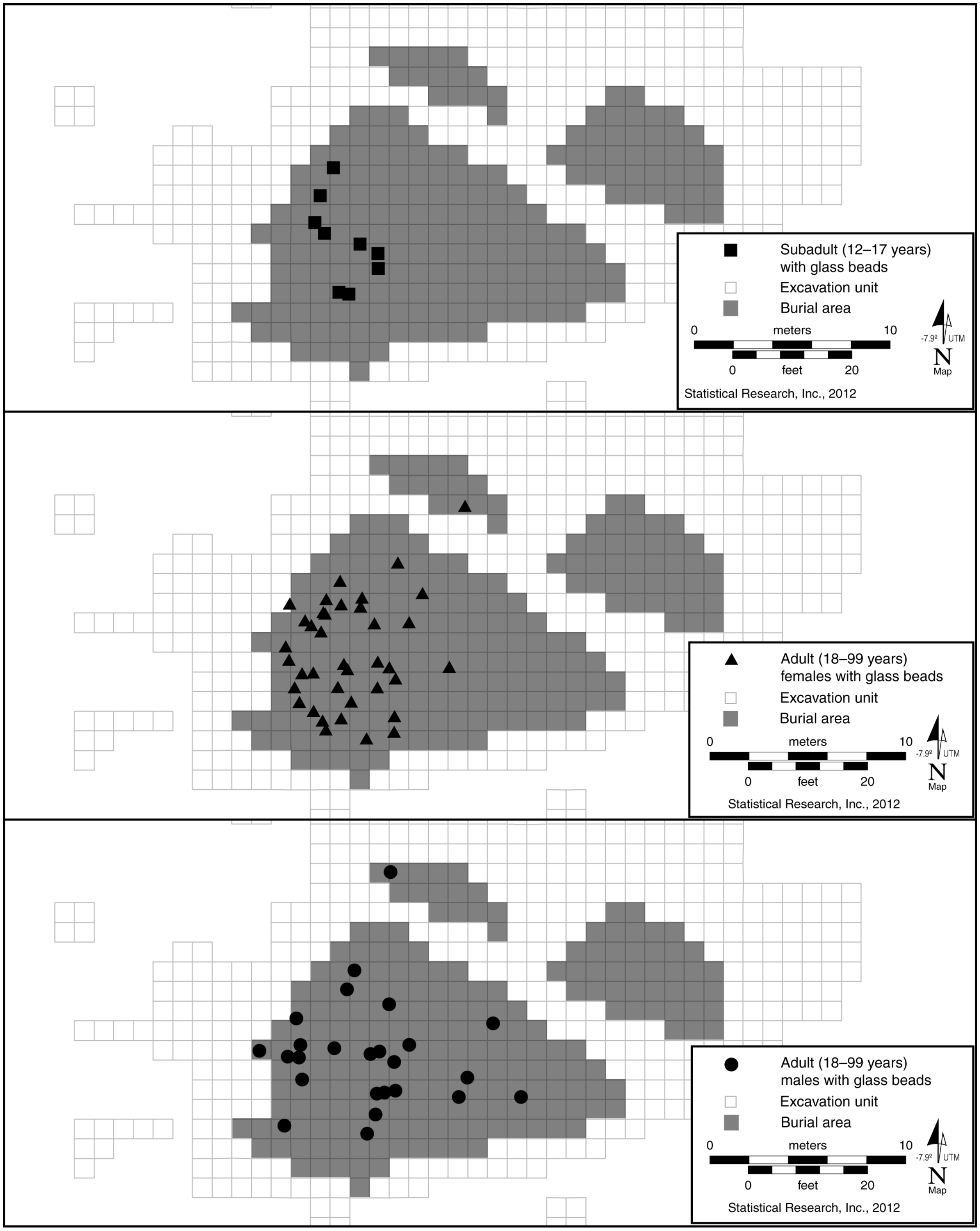

Figure 163. Locations of subadults, adult females, and adult males with glass beads, LAN-62.

Table 145. Burial Attributes Associated with Individuals at LAN-62, by Glass-Bead Color Phase and Primary Burial Attribute

Burial-Attributes Variation	Glass-Bead Color Phase								Total	
	1		2		3		4			
	No.	%	No.	%	No.	%	No.	%	No.	%
Beads per Burial Feature										
Individuals	19	22.4	8	9.4	35	41.2	23	27.1	85	100.0
Glass beads	237	1.1	304	1.4	13,517	63.9	7,110	33.6	21,168	100.0
Average number of beads per individual	12		38		386		309		249	
Sex										
Female	9	56.3	2	100.0	13	68.4	10	66.7	34	65.4
Male	7	43.8	—		6	31.6	5	33.3	18	34.6
Unknown indeterminate	3		6		16		8		33	
Subtotal (sex)	19	100.0	8	100.0	35	100.0	23	100.0	85	100.0
Age										
Fetus	—		—	0.0	2	5.7	1	4.3	3	3.5
Infant	—		1	12.5	4	11.4	4	17.4	9	10.6
Child	—		—		—		1	4.3	1	1.2
Subadult	—		2	25.0	2	5.7	1	4.3	5	5.9
Adult	19	100.0	5	62.5	27	77.1	16	69.6	67	78.8
Subtotal (age)	19	100.0	8	100.0	35	100.0	23	100.0	85	100.0
Burial Type										
Extended	1	5.9	—		—		—		1	1.5
Semiflexed	3	17.6	2	28.6	4	14.3	2	15.4	11	16.9
Flexed	13	76.5	5	71.4	24	85.7	11	84.6	53	81.5
Unknown indeterminate	2		1		7		10		20	
Subtotal (burial type)	19	100.0	8	100.0	35	100.0	23	100.0	85	100.0
Body Position										
Left Side	7	38.9	5	83.3	15	55.6	12	70.6	39	57.4
Right Side	4	22.2	—		6	22.2	2	11.8	12	17.6
Supine	2	11.1	—		2	7.4	—		4	5.9
Prone	5	27.8	1	16.7	4	14.8	3	17.6	13	19.1
Unknown indeterminate	1		2		8		6		17	
Subtotal (body position)	19	100.0	8	100.0	35	100.0	23	100.0	85	100.0
Body Orientation										
North	1	5.6	—		—		—		1	1.4
Northeast	3	16.7	1	14.3	—		—		4	5.5
East	3	16.7	1	14.3	6	19.4	3	17.6	13	17.8
Southeast	4	22.2	3	42.9	14	45.2	4	23.5	25	34.2
South	3	16.7	—		8	25.8	7	41.2	18	24.7
Southwest	1	5.6	—		2	6.5	3	17.6	6	8.2
West	3	16.7	1	14.3	1	3.2	—		5	6.8
Northwest	—		1	14.3	—		—		1	1.4
Unknown indeterminate	1		1		4		6		12	
Subtotal (body orientation)	19	100.0	8	100.0	35	100.0	23	100.0	85	100.0

continued on next page

Burial-Attributes Variation	Glass-Bead Color Phase								Total	
	1		2		3		4			
	No.	%	No.	%	No.	%	No.	%	No.	%
	Body Facing									
North	3	20.0	1	16.7	1	3.7	2	11.8	7	10.8
Northeast	1	6.7	—		—		—	0.0	1	1.5
East	1	6.7	—		4	14.8	1	5.9	6	9.2
Southeast	—		1	16.7	—		1	5.9	2	3.1
South	1	6.7	—		2	7.4	2	11.8	5	7.7
Southwest	—		—		3	11.1	1	5.9	4	6.2
West	—		3	50.0	11	40.7	4	23.5	18	27.7
Northwest	2	13.3	—		4	14.8	4	23.5	10	15.4
Up	—		—		—		—		—	
Down	7	46.7	1	16.7	2	7.4	2	11.8	12	18.5
Unknown indeterminate	4		2		8		6		20	
Subtotal (body facing)	19	100.0	8	100.0	35	100.0	23	100.0	85	100.0
	Red Ocher Association									
Present (individuals)	2	10.5	2	25.0	16	45.7	7	30.4	27	31.8
Absent (individuals)	17	89.5	6	75.0	19	54.3	16	69.6	58	68.2
Subtotal (red ocher)	19	100.0	8	100.0	35	100.0	23	100.0	85	100.0

this cluster was burial Feature 277, on the eastern edge of the main concentration. There was no separation among the individuals according to glass-bead color phases. This suggests that the primary locations for these individuals were within a relatively small (approximately 5-by-5.5-m) area in the southwestern quadrant of the main concentration.

In total, 29 burial features contained both glass and shell beads directly associated with the burial individuals. Of these burials, more than half (n = 16) had glass-bead frequencies that were higher than shell-bead frequencies. Comparisons of glass- and shell-bead counts for the burials revealed that most features had either much higher or lower glass-bead than shell-bead frequencies, typically varying by 15 percent or greater. Three burial features were the exceptions, with each feature containing high shell- and glass-bead frequencies. Each of these three burial features (burial Features 155, 313, and 327) had a shell- and glass-bead count exceeding 1,000. Nevertheless, it appears that one bead material, either glass or shell, was deposited in slightly greater quantities. Comparisons of placement of glass and shell beads in the 29 features revealed that more than half (57.9 percent) of the 19 burial features had glass and shell beads arranged in identical locations. For example, in burial Feature 204, concentrations of glass and shell beads were recovered from the head, chest, and leg areas of the individual. In burial Feature 31, glass and shell beads were recovered from the neck region of the individual, although glass beads were also recovered from the chest region. Most often, shell and glass beads were recovered from the head region (63.6 percent), followed in decreasing occurrence by the chest/abdomen area (45.5 percent), neck (27.3 percent), and legs and arms (each 9.1 percent). This overlap in arrangement indicates that mourners followed similar burial practices when it came to the placement of shell and glass beads.

Although infrequent, glass and shell beads were also found directly associated with one another, either strung together or sewn together as part of the same textile. Three burial features contained glass and shell beads directly associated with one another: burial Features 76, 313, and 376. In burial Feature 76, shell and glass beads were strung together in a pattern of shell beads (red abalone disks and olivella disks) followed by a series of five glass beads, each series alternating between red and blue glass beads. Burial Features 313 and 376 contained shell and glass beads sewn together on textiles. Other burial individuals may have, at one time, been buried with glass and shell beads strung together or used to decorate the same object. Evidence of additional associations was not observed in situ during excavation. Beads may have been displaced as a result of bioturbation, intrusion by other burial features, other ground disturbance, or decomposition, among other factors.

Spatial Distributions of Burials with Glass Beads

Green (1999:Chapter 6, Part 2) noted that for burials at Humaliwo, spatial distributions indicated that individuals possessing high percentages of grave goods, notably beads including yellow glass beads, were outside the cluster of other individuals with lower percentages. If this statement reflected the actual locations of high-status burials outside a central cluster of lower-status burials, then this would be the reverse of what has occurred within many less-complex societies. However, Gamble et al. (2001:196) stated that "[a]lthough people with few beads are scattered throughout the cemetery, they are concentrated along the western edge and perimeter of the burial area." This is more typical of less-complex societies. For example, O'Shea found that among Historical period Arikara burials, rank could be indicated in alternative ways. In cases checked against independent records, rank was variously marked, chiefly by central location among burials (Wason 1994:68, citing O'Shea [1984:271]).

At LAN-62, the pattern of spatial locations of individuals with low vs. high percentages of glass beads indicates that individuals with fewer glass beads were more likely to be located outside the major concentration of individuals with high percentages of glass beads. This also is reflected in the distribution of individuals associated with glass-bead Color Phases 1 and 2.

Phase 1 and 2 color-sequence distributions indicate that these individuals tended to be more widely dispersed than individuals associated with Phases 3 and 4. Also, individuals associated with Phase 1 tended to be located outside the primary concentration of all individuals with glass beads. Because Phase 1 and 2 individuals had much lower quantities of glass beads (12–38 glass beads per individual) than did Phase 3 and 4 individuals (249–309 glass beads per individual) (see Table 145) and over one-third of the males with glass beads were located outside the main concentration, the precise relationship between quantities and other attributes is somewhat clouded.

Communal Burial Practices as Reflected by the Presence of Glass Beads

Based on associations of glass beads with individual burials and the spatial distribution of these burials at LAN-62, the Gabrielino/Tongva appear to have created a structured burial area that also appears to have changed through time. Individuals with glass beads were buried within a relatively restricted area of the burial area, and the majority were confined to an 80-m^2 area; the main concentration of 132 individuals was within a 60-m^2 area, and the majority of the individuals with high quantities of glass beads clustered within a 25-m^2 area in the southwestern quadrant of the main concentration. Earlier burials with glass beads appear to have been less concentrated than later burials, and many were outside the main concentration.

Spatial distributions by age and sex appear to indicate that adult females with glass beads were clustered in the southwestern portion of the main concentration and adult males were less concentrated and occurred in a high percentage outside the main concentration. Fetuses, infants, children, and subadults with glass beads also appear to have been buried in linear and clustered patterns in the southwestern portion of the main concentration. There is evidence to suggest that most of the burials with fewer glass beads were outside the main concentration, but this correlation is clouded because of the distribution of adult-male burials with glass beads and earlier vs. later burials that exhibit a similar pattern.

A comparison of the orientation of individual burials at three sites is provided in Table 146. Burials at the Medea Creek and Humaliwo sites were oriented primarily toward the west, and those with glass beads at LAN-62 were oriented toward the southeast. Comparing burials with and without glass beads at LAN-62, it appears that there may have been a transition of burial orientations from primarily east prior to the introduction of glass beads to southeast with the introduction of glass beads. The two Ventureño Chumash sites shared common burial orientations toward the west.

In addition to the transition of burial orientations, it previously has been noted that prior to the Mission period, cremations were common. However, after the introduction of glass beads for burials at LAN-62, there were no cremations with glass beads. From these transitions, it can be inferred that Spanish colonization did have an impact on cultural and possibly spiritual practices, at least for one traditional

Table 146. Comparison of Compass Orientations of Burials in the Medea Creek, Humaliwo, and LAN-62 Burial Areas

Compass Orientation	Medea Creek	Humaliwo	LAN-62: All Burials with Primary Individuals	LAN-62: Total No. of Glass Beads	LAN-62: Burials with Fewer than 10 Glass Beads	LAN-62: Burials with 10 or More Glass Beads
North	8	2	4	2	2	—
Northeast	1	1	34	27	6	1
East	1	3	57	40	8	9
Southeast	—	2	61	28	13	20
South	9	8	38	14	8	16
Southwest	69	12	19	10	4	5
West	127	12	19	10	7	2
Northwest	24	1	9	5	3	1
Total	229	33	85	39	22	24

Note: See Table 145 and Green (2001:323).

Gabrielino/Tongva burial area. Similar transitions during the Historical period with other classes of material culture should allow more-complex inferences to be postulated.

Temporal and Cultural Conclusions

Glass beads recovered from four Native American sites in the PVAHP can be ascribed to three temporal periods. Glass beads from LAN-62 and LAN-211 are associated with the early to middle Mission period (the late eighteenth century to the 1810s), and beads from LAN-2768 likely date to from the late Mission period to the Mexican Alta California rancho period (1820s–1840s). Glass beads from LAN-193 are ascribed to the late Mexican Alta California rancho period to the American California settlement period (the 1830s to the late-nineteenth century).

Glass beads from LAN-2768 and LAN-193 were very different from and larger and relatively more expensive than those recovered from Spanish early to middle Mission period sites. Native Americans presumably received glass beads as in-kind payment for services and/or acquired them through direct purchase (see the chapter by Steve Hackel in Volume 5 of this series). Because of the nonexistence of comparative archaeological glass-bead collections from similar regional sites for this period and the lack of feature associations or temporal/stratigraphic separations at these sites, little can be inferred from the glass beads regarding the ethnicity or culture of the inhabitants.

All the glass beads from LAN-62 or LAN-211 appeared to date to the early to middle Mission period; none could be ascribed to the earlier Protohistoric (A.D. 1540–A.D. 1769) or the later late Mission, Mexican Alta California rancho, or American California settlement period. Based on the limited number of associations with features and the lack of stratigraphic or temporal separation, glass beads from LAN-211 provided limited information for cultural inferences. The LAN-211 glass-bead collection was contemporary with the collection from the burial area of LAN-62 and with other late-occupied Chumash and Gabrielino/Tongva sites in the Southern California Bight, although the glass beads from LAN-211 dated slightly later (ca. 1810) than those recovered from most late-occupied Chumash sites, which appeared to have been abandoned during the first decade of the 1800s.

The extremely large collection of glass beads from LAN-62 has been subdivided temporally, spatially, and culturally, providing numerous temporal and cultural inferences. Temporally, there appeared to be at least early, middle, and late phases for the glass beads corroborated by similar collections from other regional Chumash and Gabrielino/Tongva sites in the Southern California Bight.

The LAN-62 burial area included 155 burial features with glass beads; none of these burials was a cremation. Glass beads associated with these individuals appeared to have been deposited as currency, ornamental items, and burial offerings. When existing burials had been disturbed, it appeared that they had been reburied, possibly with new grave offerings. Glass beads were also associated with areas of the burial area that did not contain the remains of individuals. These areas may represent burial-offering locations.

For the Gabrielino/Tongva, glass beads functioned both as currency and ornamentation. Burials at LAN-62 with higher quantities of glass beads may reflect greater wealth and/or status. Fetuses to subadults were buried in a pattern and were clustered within a larger concentration of females in the southwestern portion of the main burial area. Males were more frequently buried outside this main concentration, as were individuals with fewer glass beads, and in earlier interments.

The earliest phase for glass beads appears to consist of individuals with purple, green, and/or blue glass beads, which were relatively few in quantity compared to later phases (i.e., generally 1–2 beads per individual). Only adults with glass beads were associated with this phase, evenly divided between males and females. The burials were more widely dispersed than in later phases. The only extended individual with glass beads at the site, a male, was associated with this phase; all others were either flexed or semiflexed and tended to be oriented east to southeast, facing down. Four times more females than males were flexed, and females were more likely to be buried on either their left or their right sides; males were more likely to be buried supine or prone.

The second phase appears to consist of individuals with purple, green, and/or blue with or without red and/or clear/white glass beads, which were three times more frequent than in the earliest phase. There were almost twice as many adults as subadults, but subadults had twice as many glass beads. Individuals were twice as likely to be flexed vs. semiflexed, and most were buried on their left sides, oriented southeast.

The third phase appears to consist of individuals with purple, green, and/or blue with red and/or clear/white and black glass beads, which were 10 times more frequent than in the second phase and 32 times more frequent than in the earliest phase. This phase appears to represent a peak in the number of individuals buried with glass beads and is the phase with the highest frequency of glass beads. There were three times more adults than subadults, but subadults had twice as many glass beads. There were twice as many females as males and three times more glass beads for females. Individuals were six times as likely to be buried flexed as semiflexed; females were generally either on their right or on their left sides, and males were either on their left sides or prone, oriented southeast. Almost half of the individuals had red ocher, including twice as many females as males and six times as many adults as subadults.

The latest phase appears to consist of individuals with purple, green, and/or blue with red, yellow, and clear/white and/or black glass beads, which were 20 percent less frequent than in the third phase. There were twice as many females as males and twice as many adults as subadults; both groups had approximately a 3:2 ratio of glass beads per individual.

Individuals were five times as likely to be buried flexed as semiflexed; 70 percent were buried on their left sides, including three times as many females and males, and most were generally oriented south to southeast.

The LAN-62 glass-bead collection appeared to be later than the Ventureño Chumash burials at Medea Creek and Humaliwo; the Medea Creek collection was the earliest of the three. Compared to all burial areas with glass beads in the region, there appears to be a temporal pattern of fewer glass beads per individual for the earliest burials. The latest burials all appear to have contained higher quantities of yellow beads than did earlier burials. This suggests that relative dating of early to middle Mission period Native American sites in the region using the relative frequencies of purple, green, and/or blue vs. the addition of red, clear/white, and black, and yellow glass beads may be possible. Those sites with the fewest purple, green, and/or blue glass beads may represent the earliest phase, and those with relatively high quantities of yellow beads may represent the latest phase.

There was a marked lack of white glass beads at most centrally located Chumash and Gabrielino/Tongva sites, suggesting that these beads were not substituted for white shell beads in areas where the production of shell beads occurred or was controlled, although the northernmost areas of the Chumash territories and the southernmost areas of the Gabrielino/Tongva territories appear to have had higher quantities of white glass beads. Because these areas were probably not involved in the production and primary distribution of shell beads, it appears that inhabitants may have accepted white glass beads as substitutes for shell beads. Strings of purple, green, and blue beads did augment the use of strings of shell beads as currency for these two cultures.

Based on the relatively high percentages of yellow glass beads recovered from LAN-62, it appears that the quantity and variety of glass beads may have increased after perhaps 1805—unlike for the Chumash, for whom glass beads and site occupations dropped dramatically. This suggests that the Gabrielino/Tongva may have occupied their traditional sites perhaps a decade to a generation longer than their Chumash neighbors.

From the changes in time of the relative quantities of glass beads associated with interred individuals within the Chumash and Gabrielino/Tongva territories, it is argued here that during the initial phase of the Mission period, glass beads were relatively rare and that glass beads increased through time in quantity, colors accepted, and the number of different types and varieties available. Later, toward the terminal phase of Native site occupations, the quantity of glass beads appears to have declined.

Native American Ceramic Artifacts from the Ballona

Christopher P. Garraty

In total, 120 Native American ceramic artifacts and 188.4 g (632 individual pieces) of burned soil fragments, possibly daub, were recovered during excavations at five sites in the PVAHP. Native American ceramics are relatively low-fired, earthenware ceramic artifacts constructed using pre-contact manufacturing techniques and raw materials that are distinct from European or Old World ceramic traditions. (European-style ceramic artifacts are discussed in Chapter 8 of this volume). This distinction is crucial, because many of these artifacts were recovered from Mission period contexts in which European-style ceramic artifacts also were present.

The 120 indigenous-style ceramic artifacts include 87 body sherds, 7 rim sherds, 4 modeled artifacts (effigy or figurine fragments), 3 cylindrical pieces, and 19 indeterminate ceramic artifacts (mostly tiny fragments with no visible surface finish). Most indigenous ceramic artifacts recovered from the PVAHP have brown or gray pastes and lack painted decoration. The majority (107 ceramic artifacts, or 89 percent of the collection) are from a large Mission period activity area (FB 1) and associated subfeatures at LAN-211. A small handful of ceramic artifacts were recovered from LAN-62, LAN-193, LAN-2676, and LAN-2768 and in scattered locations at LAN-211 outside FB 1. No whole or reconstructible vessels were recovered, and ceramic artifacts were generally very small. All but 5 sherds measured less than 5 cm^3 in size; the additional 5 sherds were only slightly larger. Analysts generally are unable to infer detailed form information from very small sherds.

This chapter includes five sections. The first section is a brief overview of ceramic use among the Gabrielino-Tongva inhabitants of the Los Angeles coastal area. The second section outlines the methods and recording procedures used for the data collection. The third section presents the results of analyses of this small collection of ceramic artifacts and is subdivided into discussions of results for the entire project collection (first part) and results pertaining to each of the five sites (second part). The fourth section presents the results of a geochemical-provenance study of 43 ceramic artifacts from the PVAHP using laser ablation–inductively coupled plasma–mass spectroscopy (LA-ICP-MS). This LA-ICP-MS study was conducted by Gena Granger and Adrian Bella, under the supervision of Dr. Hector Neff, at the Institute for Integrative Research in Materials, Environments, and Societies (IIRMES), California State University, Long Beach.

In the final section, the findings are discussed in the context of broader research questions of the PVAHP. Despite the small sample size, the ceramic analyses provide grounds for interpretations of site function, settlement, and subsistence practices during the contact period, especially at LAN-211. One important research question for the PVAHP concerns whether the Gabrielino continued to practice a mobile hunter-gatherer subsistence strategy during the period of Spanish missionization in the late 1700s and early 1800s. A second important question explores the reasons and conditions under which Gabrielino peoples adopted ceramic-container technology during the Mission period. The answers to these questions, in turn, will shed light on the relationships between the Gabrielino peoples and European (mission, pueblo, and rancho) populations during the Mission period, one of the principal research issues for the PVAHP (Vargas et al. 2003). For additional information regarding the information presented in this chapter, please see Appendixes G.1–G.3.

Indigenous Ceramics among the Gabrielino-Tongva

Relative to other, more-sedentary Native American groups in western North America (e.g., those in the desert Southwest), the Gabrielino-Tongva adopted ceramic-container technology very late in time. With the exception of a transitory era of ceramic use during the early Intermediate period (8500–6600 B.P.) (see Drover et al. 1979), ceramic-container technology does not appear to have been widespread in the Los Angeles coastal area before European contact. Indigenous ceramic artifacts are present in many Historical period Gabrielino sites from the late 1700s and later, but whether the Gabrielino adopted ceramic-container technology prior to European contact is an open question (Cameron 1999; McLean 2001). At the time of her writing, Kealhofer (1991:338) observed that no definitively prehistoric pottery sherds were recovered from sites in the greater Los Angeles area, with the exception of a modest number of foreign imports from the desert Southwest (e.g., Hohokam Red-on-buff and Cibola White Ware) (see Koerper et al. 1978:44; Ruby and Blackburn 1964). Ten years later, McLean (2001) made a similar case that no ceramic artifacts were recovered from *unambiguous* prehistoric contexts in Orange County (again, excluding a handful of intrusive foreign wares).

In contrast to the Gabrielino peoples, prehistoric hunter-gatherer groups in the inland deserts and coastal mountains of southern California (e.g., Serrano and Cahuilla) began using pottery by about A.D. 800 (Moratto 1984:425); some coastal groups (e.g., Luiseño) had adopted pottery technology by A.D. 1200 (Moratto 1984:154–155) and possibly as early as the late first millennium A.D. (Griset 1996). Hence, Gabrielino groups very likely were aware of ceramic-container technology among neighboring coastal and inland populations, and some Gabrielino groups occasionally may have acquired ceramic vessels through trade or as gifts, but pottery clearly never became an important component of the prehistoric Gabrielino economy.

Sites in coastal southern California generally include low densities of ceramic artifacts (Cameron 1999; McLean 2001:93–94), as is typical of hunter-gatherer sites (see Arnold 1985:109–110). Where sherds are present at sites in the Gabrielino territory, sherd densities are particularly low, compared to other regions of southern California. Cameron (1999) listed sherd counts from 15 sites in Gabrielino territory in Orange County and southwestern Los Angeles County that ranged from 1 sherd to over 200 sherds per site. All but 3 sites (ORA-13B, ORA-119a and ORA-196) contained fewer than 50 sherds, and 8 of the 15 sites included fewer than 10 each. Even though the volume of excavated area varied among these sites, which complicates this pattern, the general scarcity of indigenous sherds in Cameron's small sample is telling, and the sample excluded dozens of other sites from which no indigenous ceramic artifacts were recovered. Her results suggest that even after European contact, Gabrielino peoples were reluctant to invest in ceramic-container technology. In this light, the recovery of 120 ceramic artifacts in the current project area, including 94 vessel sherds, represents an important sample that will shed new light on the spread of indigenous ceramic-container technology in the Gabrielino territory during the Mission period (see below).

Whether Historical period Gabrielino groups manufactured their own pottery or acquired it from external sources is also an open question. Alfred Kroeber (1922:276, 1925:628–629) claimed that the Gabrielino did not manufacture their own pottery, but J. P. Harrington (1942) claimed that they did, around that time (the 1920s). The overall dearth of ceramic artifacts at Gabrielino sites argues against local production, although Koerper et al. (1978) made a case for indigenous pottery production at two Gabrielino sites in Orange County. Johnston (1962) aptly viewed this question not as a matter of groupwide acceptance of or "cultural tendency" for pottery making but as a matter of resource availability in different areas of the Gabrielino territory. Groups inhabiting the coastal areas, where steatite vessels were readily available, were less likely to make and use pottery than groups inhabiting areas away from the coast and/or closer to neighboring pottery-making groups.

Gabrielino peoples likely acquired pottery sporadically through trade or gifting with the neighboring inland groups, especially the Serrano and Cahuilla (Johnston 1962:31; Kealhofer 1991:341; Koerper et al. 1978:50–51; Montgomery 1998, 2002), though apparently not on a significant scale. Another possibility is that some Gabrielino individuals manufactured pottery seasonally during the summer months spent in the eastern foothills and occasionally carried pots with them to the coast during seasonal transhumance. Pottery was generally manufactured during the drier summer months in upland areas, where residual clays and firing fuels (oak and mesquite) were abundant (Rogers 1936:5). Based on a detailed trace-element and petrographic study of ceramics and clays from the San Diego coastal plain, Hildebrand et al. (2002) suggested an east-to-west movement of ceramics from desert inland areas to the coast, but not vice versa. This movement likely resulted from both seasonal transhumance and trade.

The low densities of sherds at Gabrielino sites also suggest that pottery was probably limited in its functional applications. Baskets likely fulfilled many storage and carrying functions (McLean 2001:26–36) and were a preferred medium for artistic expression and social identity. Heye (1919) suggested that ceramic containers among southern California hunter-gatherer groups were used for both mortuary ceremonies and domestic purposes. As explained below, though, it is unlikely that they were used for ritual-mortuary purposes in the Ballona, given that no vessel sherds were recovered from burial features in the Mission period burial ground at LAN-62 (although two ceramic effigies were recovered). Based on detailed analysis of a large archaeological ceramic collection in the Cahuilla territory, Schaefer (1995) concluded that ceramic containers were used for cooking, water storage, and dry storage of grains, fruits, seeds, and meat (see Barrows 1967:40). Given the low densities of sherds at Gabrielino sites compared to Cahuilla sites, it appears that Gabrielino peoples infrequently used pottery for dry storage or other functions for which baskets could be readily substituted. Ethnographic accounts have also indicated that some desert groups used large jars (ollas) as cache vessels for long-term storage (DuBois 1908; see Griset 1990:181, 184), but archaeologists have uncovered no evidence for this practice in the Gabrielino territory.

More likely, ceramic containers were used for a limited number of domestic tasks, especially cooking, for which basket containers were not suitable. The evidence presented below supports this interpretation. Vessel sherds from LAN-211 appear to be fragments of cooking vessels; all of the vessel sherds from LAN-211 were recovered near hearth features. Unfortunately, the very low frequencies of indigenous sherds in the project area (and at Gabrielino sites in general), coupled with the generally very small sherd sizes, undermine any effort to infer a full range of pottery-vessel forms and functions.

Analytical Methods for Ceramics

Recorded Variables

Dating back to Rogers (1936), indigenous-ceramic typologies for southern California have been predicated on several key attributes, including paste color, wall thickness, surface treatment, and the types and amounts of paste inclusions (e.g., Dobyns and Euler 1958; May 1978; Waters 1982a, 1982b). Considering the weight given to these attributes, a data-recording system focused on paste, formal, and surface-treatment attributes was employed.

Recorded paste attributes include various characteristics of nonplastic paste inclusions (primary- and secondary-inclusion types, particle size, sorting, and angularity) and paste color (including core color, if present). A low-powered hand lens was used to inspect the paste matrices. Identifications of rock and mineral inclusions are only rudimentary and were based on macroscopically visible characteristics of inclusions, such as color and translucence. (Precise identifications of particle inclusions would require a detailed petrographic study.) Particle sizes of nonplastic inclusions were coded as very fine/fine sand (less than 0.5 mm), medium sand (0.5–1 mm), coarse sand (1–2 mm), and gravel (greater than 2 mm). The angularity of inclusions was coded on an ordinal scale from one to nine, with one indicating maximum angularity and nine indicating maximum roundness. In general, residual clays are expected to include highly angular particles, and sedimentary and alluvial clays are characterized by relatively rounded sand particles. Surface and paste colors were recorded using the Munsell color-coding system (Munsell Color Company 2000).

Wall thickness (for vessel sherds only) for most sherds was recorded, unless one or both exterior surfaces were obliterated. Additional attributes were recorded for the eight rim sherds recovered in the project area, including rim-tip shape (e.g., rounded, tapered, or squared), orifice diameter, and direction of the upper vessel wall (e.g., inflaring or outflaring). Unfortunately, evaluation of form class was possible for only five of the eight rims. Identified form classes included bowls, jars with necks, and neckless jars.

Surface-treatment attributes were recorded for all artifacts with visible surfaces, including interior- and exterior-surface colors and the presence/absence of slip. Most sherds generally exhibited well-smoothed, matte surfaces, although a few exceptions exhibited well-polished surfaces. Potters likely used a paddle-and-anvil technique for the construction of indigenous pottery (Lyneis 1988), resulting in relatively uniformly smoothed surfaces.

Where present, additional surface attributes were recorded, such as the presence of sooting, blackening, or incising. For this analysis, *sooting* refers to generally spotty, probably unintentional, dark staining on the vessel surface as a result of exposure to heat or fire (mainly during cooking); *blackening* refers to uniform surface darkening that was intentionally applied during the manufacturing process. To achieve blackening, potters introduced some form of organic carbon to the surfaces of the vessels, usually while the vessels were still hot, thus cutting off the oxygen and depositing carbon on the surface and in the pores, resulting in a consistent darkening of the surface. (Fire-clouding may also have been intentional and may have been achieved in the same way, but coverage was spotty rather than uniform. Fire-clouding is usually produced when portions of the vessel are exposed directly to the flame.) Incising refers to lines cut into the surface while the vessel clay is still soft and plastic; incisions are generally shallow (less than 1 mm).

Ceramic Typology

Most Native American ceramic artifacts from southern California are classified into one of two ware categories: Tizon Brown Ware and Lower Colorado Buff Ware. Malcolm J. Rogers (1936, 1945), working in the 1920s–1940s, attributed both wares to ancestral Yuman-speaking peoples in Arizona, California, Nevada, and northern Mexico (Waters 1982a:276–281). He argued that Tizon Brown Ware was manufactured from granitic, residual clays with mainly quartz and feldspar (and occasionally hornblende) inclusions that fire to a brown, brownish gray, dark-gray, or reddish color under oxidizing conditions. Lower Colorado Buff Ware pottery, he proposed, was manufactured from sedimentary clays that fire to a buff, gray, or pinkish color under oxidizing conditions. These wares are usually ascribed to geologically distinct source areas in southern California: the cismontane highlands of southwestern California for Tizon Brown Ware and the lowland deserts for Colorado Buff Ware. However, as Schaefer (1995:IX.9–IX.10) has pointed out, residual clays from granitic sources also are available in the lowland deserts and the Great Basin (his Salton Brown type), which complicates efforts to ascribe brown wares to approximate production loci (see also Hildebrand et al. 2002).

None of the ceramic artifacts from the Ballona conforms to the ware definition for Lower Colorado Buff Ware; therefore, the focus of the study was on brown wares. Many scholars have attempted to subdivide Tizon Brown Ware into refined type categories based on paste color and the size and texture of paste inclusions, but most distinctions appear unsustainable in light of the continuous variability observed in paste and texture attributes (see Lyneis 1988; McLean 2001:94;

Schaefer 1995:IX.9). The term "Tizon Brown" is employed with the understanding that it is a very broad, catchall category that encompasses a broad range of variability in paste and surface attributes (see Griset 1990:180). Ideally, detailed attribute analyses, in conjunction with geochemical- or petrographic-compositional studies, would provide useful means of establishing meaningful types, as Hildebrand et al. (2002) have done for the San Diego coastal plain, but such analyses would require a larger data set than is available for this study.

Another point of confusion concerns whether the term "Tizon Brown" should be used to describe brown ware ceramic artifacts recovered from Mission period sites and components (Griset 1990; Kealhofer 1991; Love and Resnick 1983). Love and Resnick (1983) analyzed 18 Mission period sherds from the Chumash site of Muwu in Ventura County. They suggested that the brown wares from Muwu were distinctive enough from traditional Tizon Brown to warrant a new ware category: mission pottery or Missionware. They defined Missionware as crudely made, hand-modeled vessels with thick walls and dark, carbon cores—distinct from the generally better-made, thinner-walled brown ware vessels manufactured using traditional paddle-and-anvil forming techniques. Love and Resnick (1983) maintained that mission neophytes produced crude Missionware vessels under the direction of Spanish priests affiliated with the nearby Mission Santa Buenaventura.

This study does not adhere to the type distinctions made by Love and Resnick (1983). First, as stated above, Tizon Brown encompasses a tremendous diversity of attributes and is not meaningful as a ware category associated with a specific group or period. Second, Griset (1990:184–190) documented considerable continuity in traditional pottery-production methods and use during the Historical period and suggested a long, relatively gradual process of change in which native potters retained many traditional pottery-making practices but also gradually integrated European-derived processing and forming techniques. Rather than designate a new ceramic type, therefore, it seems more prudent to "problematize" the issue and closely inspect a variety of paste, formal, and surface attributes to detect those that would have been potentially "sensitive" to changing practices and shifting socioeconomic conditions during the early Historical period. This approach yields a more rigorous means of inferring introduced vs. traditional aspects of pottery-making practices.

Finally, it is unclear whether observations made by Love and Resnick (1983) are broadly applicable throughout southern California. As shown in the following sections, the sherds recovered in the Ballona do not adhere to their defining criteria for Missionware. These are hardly sufficient grounds for inferring that they were manufactured outside the mission system (or within it, for that matter). Native potters at the various missions might have employed distinct manufacturing canons and procedures. Far more evidence than is available (and from a number of regions of California) will be needed to reconstruct the range of pottery-making practices among indigenous potters at the various California missions.

Analytical Results for Ceramic Artifacts

This section reports the results of all ceramic analyses for the PVAHP. The first part of the section reports results based on inspection of surface, paste, and formal attributes in the entire project collection. The second part reports results separately for each of the five sites from which ceramic artifacts were recovered.

Counts were used, instead of weights, to quantify the ceramic results. Cameron (1999:99–101) espoused using weights instead of counts to quantify sherd data, to provide better grounds for inferring the minimum number of vessels (or items) in a given collection. The sherd weights subsequently can be compared with "known" weights of various kinds of complete vessels (e.g., small bowls or large jars) to infer the number of vessels represented in a collection. Her recommendation, although well founded, assumed that the sherds in a given collection would be broken pieces from a limited number of vessels. But many broken pieces from a single vessel may have been recycled as worked-sherd tools, a common practice among indigenous peoples in southern California (Griset 1990:184). In such cases, the approach that uses weights potentially underestimates the number of vessels. Few of the sherds recovered from the PVAHP project area can be definitively said to derive from the same vessel.

This study does not rely on raw artifact counts. The results below are quantified as both raw counts and estimates of the minimum number of discrete ceramic items, hereafter abbreviated as MNI.[1] Many ceramic artifacts come from the same provenience and possess very similar attributes; these artifacts are very likely from the same vessel, figurine, or other ceramic item. Given this, ceramic fragments from the same provenience that possess similar attribute characteristics (color and paste texture) were combined to estimate MNI counts. Calculations based on MNI counts provide a more accurate reflection of past ceramic use and behavior; indeed, in many cases, percentages or other summary calculations vary considerably, depending on whether raw artifact counts or MNI counts are used.

[1] For ceramics, this calculation is usually phrased as the minimum number of vessels (or MNV). However, many of the ceramic pieces from this collection are probably not from pottery vessels. Consequently, I instead use a more neutral term: "item."

General Results

Ceramic Artifacts

Table 147 lists the distribution of ceramic artifacts per site. All but eight were from LAN-211. Two-thirds are body sherds (87 sherds) from pottery vessels. Eight rim sherds accounted for another 6 percent of the collection total. Together, pottery-vessel sherds (i.e., body and rim sherds) accounted for roughly three-quarters of all ceramic artifacts. Notably, of the eight ceramic artifacts recovered from sites *other than* LAN-211, only one is from a pottery vessel (a body sherd from LAN-2676). Vessel sherds were dominant in the LAN-211 collection but not in the other four site collections, which mainly included nonvessel artifacts.

Four modeled artifacts, possibly figurines, accounted for 3 percent of the collection, only one of which was from LAN-211. Three indeterminate artifacts were very small, broken, cylindrical pieces with coarse, unfinished exteriors and smooth, polished, rounded interiors; their function is uncertain. Nineteen additional ceramic artifacts were unidentifiable as to form or function. These latter cases were mostly tiny pieces with no visible surfaces. It is impossible to determine whether these tiny fragments are from pottery vessels or are modeled artifacts, small daub fragments, or other clay artifacts.

The estimated MNI per site is listed in Table 148. Of the 120 ceramic artifacts from the project area, an MNI of 80 was estimated. For LAN-211, from which most of the ceramic artifacts were collected (115 sherds), the MNI is 75. The actual number of discrete ceramic items could be lower, if fragments or sherds from the same item or vessel were recovered in different proveniences. For example, fragments from a single broken vessel or artifact may potentially spread over an area of several square meters as a result of systematic depositional processes (dumping or tossing) or postdepositional processes (e.g., bioturbation). However, in this study, the effects of these processes were not controlled for; therefore, it has been assumed that ceramic pieces recovered from different proveniences derived from different "parent" vessels or other ceramic items.

Surface Treatment

Surface attributes were recorded for 101 artifacts representing an MNI of 76 items. As mentioned above, many of the ceramic artifacts recovered in the project area were heavily obliterated, with no visible exterior or interior surfaces. In a few other cases, either the interior or the exterior surface (but not both) was obliterated, and in these cases, surface attributes were recorded for only one visible surface.

At least 19 ceramic artifacts (MNI = 15)—18 vessel sherds and 1 modeled artifact—appeared to have been slipped. Most of these pieces revealed spotty areas with a thin, very fugitive slip; only 6 exhibited what could be characterized as a thick, well-adhering slip. Observed slip colors included white, fugitive red, gray, and tan; 3 sherds possessed a thick, well-adhering, reddish brown slip. It is very likely that additional sherds also were slipped but that the slip eroded over time and was no longer visible (especially given the small size of most sherds). In addition, some sherds coded as having slips may actually have had misidentified surface residues or stains. Given this ambiguity, inference about patterning in the data set based on the presence or absence of slips is limited.

One sherd with a well-adhering, reddish brown slip also exhibited very fugitive painted decoration on the exterior surface of an incurving bowl rim. Only a faint outline of design was visible; the original color of the paint had eroded from the surface and was no longer visible. The pattern of decoration was indeterminate and had been truncated by the break.

In total, 18 vessel sherds (MNI = 16), all from LAN-211, exhibited exterior surface sooting due to postmanufacture exposure to fire, most likely from cooking. In addition, 21 sherds (MNI = 15), all from LAN-211, exhibited evidence of intentional blackening of their interior surfaces; as mentioned above, blackening probably resulted from deliberate exposure of the vessel surface to carbon (black smoke) while the vessel was still hot. It is unclear whether the blackening was meant to be ornamental, resulted as a firing accident, or was intended for some perceived functional advantage or decorative effect. One additional sherd from LAN-211 showed evidence of faint, red staining (probably from iron inclusions).

Sherd surfaces were mostly well smoothed and had even surface topographies. Only three vessel sherds were coded as having bumpy, uneven surfaces. The presence of consistently even surfaces is likely attributable to the use of a paddle-and-anvil forming technique. The vessel sherds from the project area thus do not conform to the type definition of Love and Resnick (1983) for Missionware, which they characterized as having bumpy and uneven surfaces. Three artifacts, including four indeterminate fragments (see below) and one body sherd, exhibited at least one well-polished and lustrous surface. The latter body sherd exhibited a polished, smudged (blackened) interior surface.

Paste Attributes

Minute rock and mineral fragments were identified in the paste matrices of 113 of the 120 ceramic artifacts (MNI = 75), with the exceptions of 5 fine-paste sherds with very small, nonplastic inclusions that were difficult to identity with only a low-powered lens. Paste attributes for 2 small, intact modeled artifacts from LAN-62 were not recorded; the item would have to be broken to expose the paste interior.

All but 1 of the 113 ceramic artifacts included quartz, feldspar, and small mica particles (likely muscovite) as primary inclusions; 1 sherd had granite particles as a primary inclusion. Mafic inclusions, likely hornblende, were present as secondary inclusions in 17 ceramic pastes (MNI = 12). This

Table 147. Ceramic Artifacts from the PVAHP, by Site

Feature No.	EU	Stratum/ Horizon	Body Sherd	Rim Sherd	Modeled Artifact	Cylindrical Piece	Indeterminate Artifact	Total
				LAN-62				
285[a]		IV	—	—	1	—	—	1
443[a]		IV	—	—	1	—	—	1
				LAN-193				
9[b]	106		—	—	1	—	—	1
				LAN-211				
1[c, d]		2Ab1	—	—	—	—	12	12
1[d]	103	A	1	—	—	—	—	1
1[d]	104	A	—	1	—	—	—	1
1[d]	105	A	2	—	—	—	—	2
1[d]	106	A	3	—	—	—	—	3
1[d]	107	A	1	—	—	—	—	1
1[d]	109	A	1	—	—	—	—	1
1[d]	125	A	8	—	—	—	—	8
1[d]	126	A	3	—	—	—	—	3
1[d]	128	A	—	1	—	—	—	1
1[d]	183	A	—	—	1	—	—	1
1[d]	186	A	—	—	—	1	—	1
1[d]	199	A	—	—	—	1	—	1
1[d]	203	A	2	—	—	—	—	2
1[d]	385	A	2	—	—	—	—	2
1[d]	390	A	4	—	—	—	—	4
1[d]	391	A	6	—	—	—	1	7
1[d]	397	A	2	—	—	—	—	2
1[d]	398	A	9	—	—	—	—	9
1[d]	399	A	1	—	—	—	—	1
1[d]	401	A	2	—	—	—	—	2
1[d]	403	A	2	1	—	—	—	3
1[d]	404	A	2	—	—	—	—	2
1[d]	409	A	1	—	—	—	—	1
1[d]	411	A	3	—	—	—	—	3
1[d]	413	A	3	—	—	—	—	3
1[d]	415	A	2	1	—	—	—	3
1[d]	416	A	1	1	—	—	—	2
1[d]	420	A	1	—	—	—	—	1
1[d]	421	A	3	—	—	—	—	3
1[d]	422	A	1	—	—	—	—	1
1[d]	423	A	4	—	—	—	—	4
1[d]	424	A	5	—	—	—	—	5
1[d]	425	A	4	—	—	—	—	4
1[d]	427	A	2	—	—	—	—	2
1[d]	438	A	2	—	—	—	—	2
1[d]	441	A	1	1	—	—	—	2
1[d]	449	A	—	—	—	—	1	1
46[e]		A	—	—	—	—	5	5
	557	2Ab1	—	1	—	—	—	1
	163	Bk	2	—	—	—	—	2

Feature No.	EU	Stratum/ Horizon	Body Sherd	Rim Sherd	Modeled Artifact	Cylindrical Piece	Indeterminate Artifact	Total
				LAN-2676				
	216		1	—	—	—	—	1
				LAN-2768				
	9		—	—	—	1	—	1
Total			87	7	4	3	19	120

[a] Human burial.
[b] Activity area.
[c] Subfeature 11 (pit).
[d] Activity area, FB 1.
[e] Rock cluster.

Table 148. Artifact and MNI Counts, by Site

Site	Artifact Count (n)	MNI	MNI (%)
LAN-62	2	2	2.5
LAN-193	1	1	1.3
LAN-211	115	75	93.8
LAN-2676	1	1	1.3
LAN-2768	1	1	1.3
Total	120	80	100.0

result may be misleading, though, because many sherds had very-dark-colored pastes in which mafic inclusions would be difficult to detect; it is likely that additional sherds had mafic inclusions that were not detected during analysis. Overall, the inclusions were poorly sorted and angular in shape. These observations are consistent with published paste descriptions for Tizon Brown from southern California (Dobyns and Euler 1958; May 1978; Rogers 1936, 1945).

Paste texture was assessed for all but two ceramic artifacts from the PVAHP collection (MNI = 80). As shown in Table 149, although the inclusion categories appear to be relatively consistent, the sizes and textures of the inclusions were not. Overall, more than half of the ceramic pieces (60 percent) were coded as having medium paste texture; 18 percent and 20 percent, respectively, were coded as having fine and coarse textures. Most ceramic artifacts from LAN-211 exhibited medium-textured (63 percent, based on MNI counts) or coarse-textured (21 percent) paste; few exhibited fine paste texture (16 percent). This mix of paste textures and particle sizes might indicate distinct clay sources or, alternatively, different practices of preparing ceramic clays (e.g., sifting or levigating). Ethnographic sources of Cahuilla pottery production have suggested that indigenous potters did not typically add tempering materials (Schumacher 1976:33; see also Rogers 1936:4–15; Koerper et al. 1978:51–52); thus, texture variability more likely indicates distinct clay sources and not different clay-preparation procedures. Unsurprisingly, fine-paste sherds also tend to have denser pastes. These differences probably indicate that different potters used distinct paste recipes and production techniques for making ceramic artifacts.

Paste colors (recorded for an MNI of 75 items) were almost uniformly brown, dark brown, grayish brown, or dark gray. Munsell hue scores mostly ranged from 7.5YR to 2.5Y, with generally low chroma and value scores (all below 5), indicating generally dark and relatively pale, gray-toned shades. Three sherds were the exceptions, exhibiting reddish brown pastes with hue scores in the 5YR–7.5YR range and higher chroma scores (5 or 7), indicating lighter and brighter (i.e., less gray-toned) colors. Love and Resnick (1983) reported relatively bright, red colors (2.5YR–7.5YR, with chroma scores between 5 and 6) for the sherds they interpreted as Missionware from Muwu; these color results are very different from the results of the present study, suggesting distinct pottery-provisioning sources. Again, though, this difference does not preclude the possibility of production under the auspices of one of the nearby missions.

Many factors contribute to color formation in fired clays (e.g., texture, porosity, atmosphere, and iron content). It is impossible to control for all of these differences, but the residual clays likely used to manufacture brown wares were probably rich in iron (see Hildebrand et al. 2002). Assuming that the sherds were made from comparable iron-rich clays, the darker, paler pastes might indicate lower firing temperatures at which iron compounds were not fully oxidized. Conversely, the redder pastes may have been fired at higher temperatures at which the iron compounds were more fully oxidized (see Rice 1987:333–335; Shepard 1956:16–17).

Dark paste cores or very dark pastes were prevalent in the collection, implying the presence of organic inclusions in the source clays used to manufacture the sherds. Admittedly, the distinction between a carbon core and an overall dark paste matrix is largely arbitrary and depends on how much of the paste matrix is dark vis-á-vis the lighter, better-oxidized portion of the matrix surrounding the carbon core. In total, 24 ceramic artifacts (MNI = 18) exhibited carbon cores. Another 51 artifacts (MNI = 37) exhibited completely black, very-dark-gray, or dark-gray paste matrices. Overall, dark or black pastes were

Table 149. Paste-Texture Categories, by Site

Site	Fine	Medium	Coarse	Indeterminate	Total
LAN-62					
Raw count	—	—	—	2	2
MNI	—	—	—	2	2
LAN-193					
Raw count	—	1	—	—	1
MNI	—	1	—	—	1
LAN-211					
Raw count	12	69	34	—	115
MNI	12	47	16	—	75
MNI (%)	16.0	62.7	21.3	—	100.0
LAN-2676					
Raw count	1	—	—	—	1
MNI	1	—	—	—	1
LAN-2768					
Raw count	1	—	—	—	1
MNI	1	—	—	—	1
Total raw count	14	73	37	2	126
Total MNI	14	48	16	2	80

present in 55 of 82 ceramic items (67 percent, using MNI counts). Carbon cores or dark pastes may result either from the incomplete removal of organic materials from the paste matrix during firing or from firing in a heavily reducing atmosphere (Rice 1987:334–335; Rye 1981:114–118). The high frequency of dark pastes and cores may suggest low firing temperatures and/or a poorly controlled and partially reducing atmosphere, although other criteria (e.g., the abundance of organics) factor into the color and presence of carbon cores.

Although the evidence allows for multiple interpretations, the sherds were very likely open-fired at low temperatures and not kiln-fired. Given the low frequency of sherd remains, it seems unlikely that Gabrielino peoples would have invested in kiln construction, especially if they retained a mobile hunter-gatherer subsistence strategy. Formal kilns generally expose clays to more-intensive heat (i.e., higher firing temperatures and longer durations of firing) than do open fires (see Tite 1999). Kiln-firing is a possibility if the pottery was manufactured under the auspices of mission personnel but is less likely among gentile or renegade indigenous populations that only intermittently made and used pottery. Accordingly, reconstruction of the firing technology used to manufacture the sherds recovered in the PVAHP potentially will shed light on the important question of affiliation between the indigenous populace of the Ballona and the nearby Spanish missions (Vargas et al. 2003). Refiring experiments provide one inexpensive means of inferring original firing conditions (temperature and atmosphere) and technology (see Rice 1987:428–429).

Formal Attributes

Vessel Sherds

Wall-thickness measurements were possible for 92 vessel sherds (body and rim sherds) representing an MNI of 68 items, excluding sherds with obliterated surfaces. Thickness measurements for intact rim and body sherds ranged from 4.6 to 12.9 mm, with a mean of 7.6 mm and a standard deviation of 1.9 mm. The quartile range extended from 6.3 to 8.7 mm, indicating that half of all vessel sherds fell within that range. This further shows the distinction between the sherds from the Ballona and those from Muwu that Love and Resnick (1983) identified as Missionware, which were considerably thicker (in the range of 10–15 mm). In the PVAHP collection, only 12 sherds (MNI = 10) had walls thicker than 10 mm, which accounts for less than 15 percent of the vessel sherds (using MNI counts).

Form classes were identified for five rim sherds and one body sherd (jar neck), all from LAN-211 (Table 150; Figure 164). Four other rims recovered from the project area were too small for form-class identification. Identified form classes included two bowls, two jars with necks, one neckless jar, and one indeterminate bowl or necked jar with an outflaring rim. The outflaring rim was from an unrestricted vessel form, but it was too small to determine whether it was from a jar or a bowl. The mean thickness for the two bowls was 6.1 mm; for the two jars with necks, the mean was 9.8 mm. This pattern is highly tentative, though, given the very small number of rims.

Table 150. Identified Form Classes (All Specimens Recovered from LAN-211)

Feature No.	Feature Type	EU	Stratum	Artifact Type	Form Class	Rim Form	Rim-Tip Shape	Rim Diameter (cm)	Thickness (mm)	Surface Attributes
1[a]	activity area	391	A	rim	jar with neck	direct rim	rounded	indeterminate	8.0	sooting on exterior
1[a]	activity area	403	A	rim	neckless jar	moderately upturned	beveled	15	7.1	sooting on exterior
1[a]	activity area	415	A	rim	bowl	direct rim	tapered	12	5.9	sooting on exterior
1[a]	activity area	422	A	body (neck)	jar with neck	direct rim	indeterminate	indeterminate	11.5	sooting on exterior
1[a]	activity area	441	A	rim	bowl or outflaring jar	direct rim	rounded	indeterminate	5.5	
		557	2Ab1	rim	incurving bowl	direct rim	tapered	16	6.2	blackened interior; fugitive painted decoration on exterior

[a] FB 1.

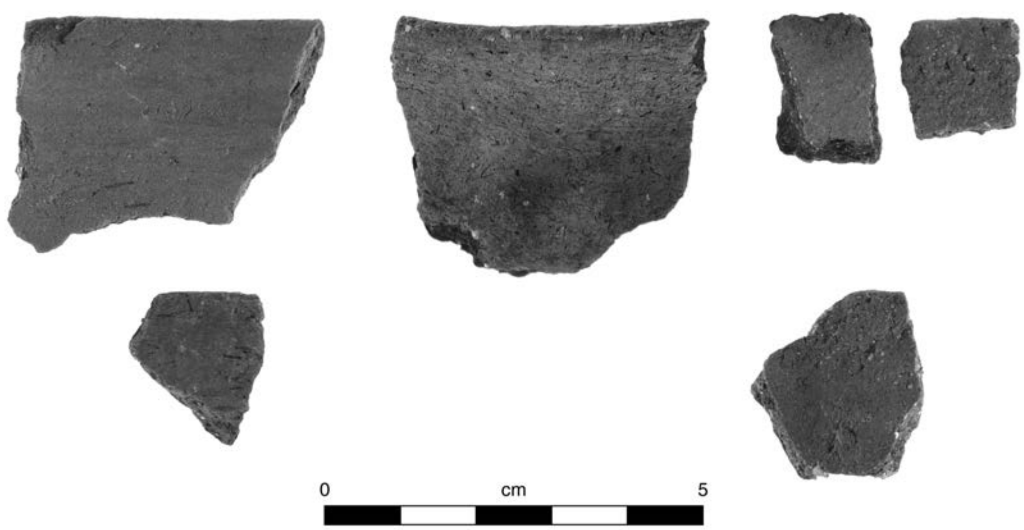

Figure 164. Rim sherds and a jar-neck fragment from LAN-211, PVAHP.

Little can be inferred from the rim-diameter results (see Table 150), because only three rims were large enough for measurement, but rim-tip styles may provide modest insights into the organization of pottery production. Three different rim-tip shapes were observed among the rims. The two bowls had tapered rim tips; one neckless jar had a beveled rim tip; and one jar with neck had a rounded rim tip. It is unclear whether rim-tip shapes are sensitive to functional requirements or stylistic choices on the part of manufacturers. Schaefer (1995:IX.23–IX.26) assumed rim-tip shape to be a "purely idiosyncratic trait . . . related to individual or household level pottery traditions" that could provide an appropriate line of evidence for monitoring social transmission of production techniques from (presumably) mother to daughter. If Schaefer was correct, then the diversity of rim-tip shapes may indicate that several different potters manufactured the vessels from FB 1 at LAN-211, each with her own distinct approaches and technological styles. This interpretation conforms to expectations based on ethnographic records (Schaefer 1995) and complements the paste evidence outlined above.

Importantly, four of the six identified form classes exhibited exterior sooting. Soot deposits may have formed because of postmanufacture exposure to fire, which typically suggests use as cooking vessels. However, fire-clouding or dark staining also may occur as a result of uneven or careless firing during the manufacturing process (i.e., if the vessel is placed too close to the fire) (Shepard 1956:92). As noted in Table 150, sooting was evident on the exterior surfaces of one bowl sherd, two jar-with-neck sherds, and one neckless-jar sherd. If the dark stains are related to fire exposure during cooking, then it may be significant that all three form classes may have been used as cooking vessels.

An alternative, but less likely, explanation for the presence of soot accumulation concerns native Gabrielino mortuary practices. Ethnographic accounts have indicated that indigenous groups in southern California routinely destroyed the possessions of deceased women: "Relatives of a deceased woman were expected to break all of her pots, including those cached away from the village" (Griset 1990:184). Immolation may have been one means of destroying the materials. If so, the exposure to fire may be a result of ritualized burning and destruction of domestic possessions of deceased individuals interred in the adjacent Mission period burial area at LAN-62. The very small sizes of the sherd fragments and the absence of whole or reconstructible vessels support this possibility (see above), but the sherds did not appear to have been subjected to *intense* burning, as would be expected if they were deliberately immolated. Moreover, the absence of mourning features in the vicinity does not support this interpretation. The modest accumulation of soot on the vessel surfaces, coupled with the presence of sooting on exterior surfaces only, is more consistent with interpretation of the vessels as cooking utensils.

Modeled Ceramic Artifacts

Four modeled artifacts were recovered in the PVAHP, including two small, intact specimens and two fragmentary pieces. The latter artifacts were tentatively interpreted as effigies or figurines, but the pieces were too small to be certain. The intact specimens were three-dimensional effigies or figurines. The two fragments were incised ceramic artifacts of indeterminate form.

Three-Dimensional Effigies or Figurines

One object (Figure 165, top) recovered from LAN-62 (Feature 443, burial with multiple individuals) was an intact three-dimensional effigy or figurine in the shape of a humanoid, which Henry Koerper (see Appendix G.1) has interpreted as a "Venus" effigy that may have functioned as a female fertility effigy. The object measured 2.8 cm in maximum length and 2.2 cm in maximum width and had a flat base. Its precise representation is indeterminate, but the small protrusions from an apparent torso may indicate limbs or breasts. The object

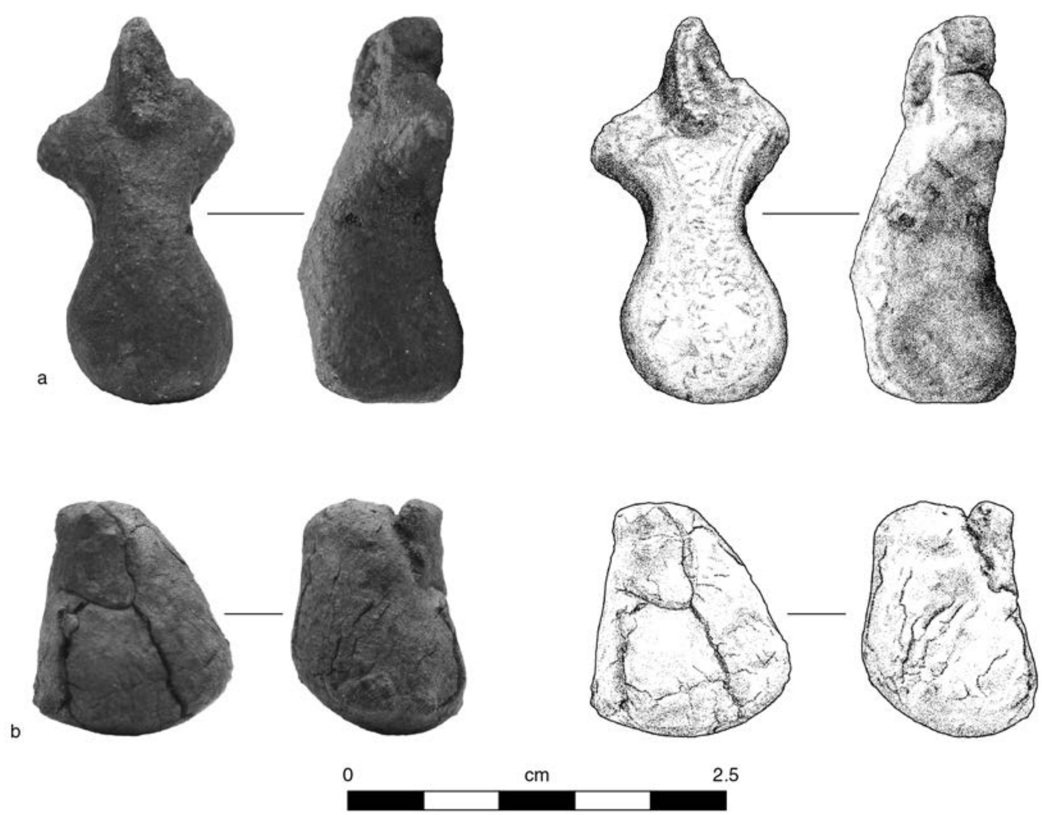

Figure 165. Three-dimensional effigies or figurines recovered from burial Feature 443 and nonburial Feature 285 at LAN-62.

was of single-piece construction, showed no evidence of multiple components or appliqué, and may have been molded to shape. No comparable objects have been reported from sites in the Los Angeles coastal area. Koerper provides a far more detailed discussion of this artifact in Appendix G.1.

A second intact three-dimensional ceramic artifact (see Figure 165, bottom) was recovered from a human burial (Feature 285) at LAN-62. This specimen exhibited no clear shape or formal representation. The item was conical in shape but truncated on the narrow end of the cone; the wider end was flat, forming a base. It included an appliqué piece. The artifact may have been part of a more complex, composite artifact, but no additional parts were recovered to support this interpretation. Notably, this object very closely resembled a number of similar ceramic "tapered cylinders" recovered from ORA-64 in upper Newport Bay, even though the specimens from that site have been dated to the Millingstone period, long predating the Mission period context at LAN-62 (Drover 1971; Drover et al. 1979; Drover et al. 1983:20–21; Macko 1998). In total, 52 such objects were recovered from ORA-64 during Macko's excavations in the 1990s (Macko 1998), many with punctate or shell-stamp decoration. No such decoration was evident on the object from LAN-62. Possibly, the Mission period object was found and curated and later buried with its owner in the LAN-62 burial ground.

Macko (1998:63) speculated that the objects could be composite doll or figurine parts (with twigs or sticks attached as appendages), ear plugs or labrets, or simple adornments. The composite figurines, he argued, may have been used in witchcraft or ritual incantations. Drover et al. (1979) suggested a possible "magico-religious" function. Another possibility is that they were used as gaming pieces. Indeed, historical documents have frequently mentioned a variety of games and gambling activities among California indigenous groups, many of which required gaming pieces (e.g., Castillo 1989; Librado and Harrington 1979:25–33). Ceramic objects from some Mission period sites have been interpreted as gaming pieces (Soto 1961:34–36).

Notably, both three-dimensional effigies/figurines were recovered exclusively from human burials; no other classes of ceramic artifacts were recovered from human-burial contexts. This association suggests a possible cosmological or sacred meaning or significance for these objects, supporting the speculations of Drover et al. (1979).

Incised Modeled Artifacts

Two modeled ceramic artifacts with incised decoration were recovered from LAN-193 and LAN-211. The specimen from LAN-193 appeared to be a two-dimensional figurine or effigy (Figure 166, top) with incised lines on a smoothed and well-finished front surface. The object was two-dimensional in the sense that it was constructed with a decorated front surface but an undecorated back surface; it clearly was meant to be viewed on the front surface only. The left and right edges were modeled to form a raised border, with incised lines running perpendicular to the outer edge. Additional incised lines were orientated at a roughly 45° angle to the edges of the artifact and appeared in the upper left portion, below the break. The back surface was flat, smoothed, and poorly finished and had a gritty texture and no apparent decoration.

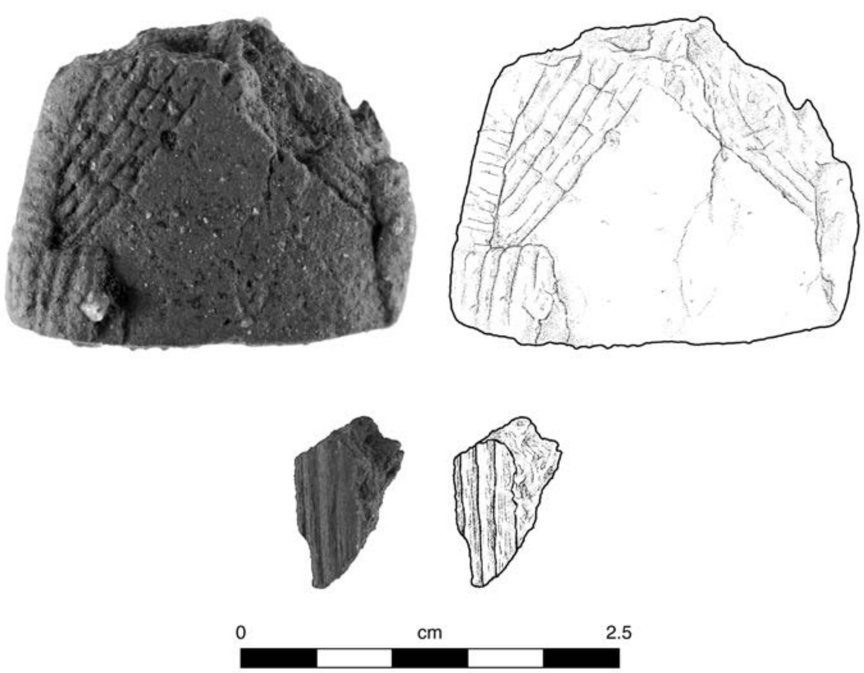

Figure 166. Incised modeled artifacts from PVAHP: (top) LAN-193, Feature 9 and (bottom) LAN-211, Feature 1.

The sides of the artifact had been smoothed and shaped, possibly using a mold, which gave it a "cookie-cutter" appearance. The LAN-211 specimen (see Figure 166, bottom) was a very small fragment from the edge of a larger artifact. It resembled the previous specimen but exhibited parallel lines along the intact edge.

Two-dimensional ceramic artifacts with incised and punctate decoration also were recovered at ORA-64 (Macko 1998:56–57), but unlike the two specimens from the Ballona, the photographed example from ORA-64 (Macko 1998:Figure 18, lower left) was incised on both the front and back surfaces. The LAN-193 specimen was from a feature dated to the late Intermediate period, postdating the specimens from ORA-64; the LAN-211 specimen was from a well-defined Mission period context, long postdating the specimens recovered from ORA-64 and LAN-193—in the former case, by several millennia. The object might have been found and curated by Mission period inhabitants.

Unlike the three-dimensional artifacts, these artifacts were not associated with burial features or any other feature class but activity areas, which suggests that they were prosaic rather than sacred objects. They probably did not convey the same religious potency or meaning as the three-dimensional figurines or effigies (see above). Use as gaming pieces is one possible interpretation. They also may have functioned as plaques or frames, given their flat, two-dimensional form.

Hollow, Cylindrical Artifacts

Three cylindrical fragments were recovered from the project area, two of which are depicted in Figure 167. These were hollow cylinders with very thin walls of 2, 2.4, and 3 mm; polished and smoothed interior surfaces; rough and coarse exteriors; and very fine paste textures.

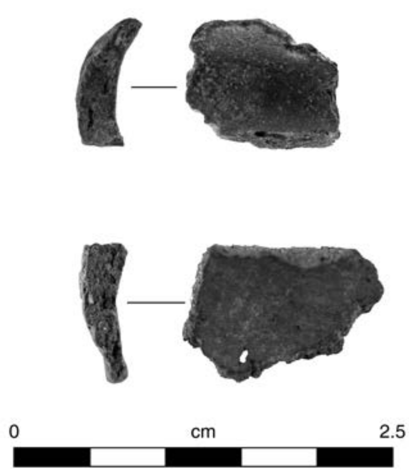

Figure 167. Hollow, cylindrical artifacts from PVAHP project area: (*top*) LAN-2768, Unit 9 and (*bottom*) LAN-211, Feature 1.

The form and function of these items are indeterminate. One possibility is that the items are daub fragments. The interior of each cylinder was smoothed and rounded and may be where the pole or support was pressed into the daub. Strudwick (2004) interpreted similar clay objects with smooth, cylindrical impressions as daub fragments at ORA-269 in the San Joaquin Hills of coastal Orange County. The illustrated pieces from ORA-269 (Strudwick 2004:Figures 7.14 and 7.15) somewhat resemble the cylindrical artifacts recovered from the PVAHP area. However, in FB 1 at LAN-211, these objects were spatially segregated from the various burned fragments interpreted as possible daub remains (see below). A second interpretation is that these are pipe fragments, but the center hole is likely too wide for this function. Another possibility is that they were used as decorative appendages or appliqué pieces originally attached to vessels, figurines, or other ceramic items.

Macko (1998:61) described similar objects from ORA-64 that he tentatively interpreted as mold impressions formed from clay that were "wrapped around a large-diameter plant material and fired." He speculated that they were deliberately produced in this manner to create large-diameter tube beads. At ORA-64 and in the Ballona, the only fragments recovered were small, making them very difficult to interpret. Additional study will be needed to infer the function of these artifacts.

Finally, it is possible that these may have been hollow sucking tubes (Patricia Martz, personal communication 2011).

Indeterminate Burned Soil Fragments

In total, 188.4 g (632 fragments) of small burned soil fragments were recovered from LAN-211 and LAN-2768 (Table 151; Figure 168). The overwhelming majority of burned soil fragments were recovered from LAN-211 (629 fragments); 3 were from LAN-2768. The soil fragments were burned to a black or dark-gray color, suggesting exposure to smoke from an open flame. They were initially classified as daub fragments, but they were composed of moderately clayey soils that would not have been ideal for daubing. The soils likely derived from local sources. It is possible that this poor-quality soil was used as an expedient daubing agent, if better-quality clays were unavailable in the local area or were inaccessible farther away. Another possibility is that the burned soil fragments were associated with the nearby hearth features at LAN-211. As explained below, both interpretations are problematic.

If interpreted as daub fragments, they may mark the approximate locations of wattle-and-daub structures. "Wattle-and-daub" refers to a construction technique in which wattle (closely packed, small sticks or reeds) is overlain on a framework of wooden sticks and poles. Clay (daub) is then pressed into the wooden sticks and poles to protect the structure from rain, wind, and insect damage. Kroeber (1925:628) and other early observers did not mention daubing of residential dwellings among the Gabrielino, but Kroeber did observe mud covering on the walls and floors of sweat lodges (see Gamble 1995:58). Daub fragments have been recovered from

Table 151. Burned Soil Fragments from the PVAHP, by Site

Feature	Subfeature	Subfeature Type	EU	Stratum/Horizon	Count	Weight (g)
LAN-211						
1[a]			112	A	7	1.3
1[a]			116	A	2	0.9
1[a]			141	A	4	2.4
1[a]			145	A	6	0.6
1[a]			147	A	3	2.2
1[a]			152	A	12	2.6
1[a]			154	A	10	2.0
1[a]			176	A	6	1.6
1[a]	42	hearth	373	A	2	1.4
1[a]			377	A	1	3.1
1[a]	14	hearth	377	A	3[b]	0.3
1[a]			380	A	4	3.8
1[a]			381	A	7	3.0
1[a]			383	A	5	1.4
1[a]			387	A	1	1.3
1[a]			391	A	424	51.6
1[a]			394	A	34	18.3
1[a]			399	A	—	8.0
1[a]			404	A	4	0.5
1[a]			404	A	3[b]	4.6
1[a]			407	A	2	0.6
1[a]	21	hearth concentration	415	A	3	0.8
1[a]			420	A	8	1.7
1[a]	28	hearth	420	A	3	0.8
1[a]	26	hearth concentration	421	A	41	13.0
1[a]	42	hearth	429	A	5	0.7
1[a]			429	A	3	0.4
1[a]	42	hearth	431	A	31	12.8
1[a]			443	A	9	2.9
1[a]			446	A	—	6.4
1[a]			447	A	22	12.2
1[a]			451	A	4	0.4
1[a]			453	A	3	0.8
1[a]			455	A	5	2.1
1[a]			459	A	4	2.3
1[a]			461	A	7	8.7
1[a]			464	A	3	10.3
LAN-2768						
			8		2[b]	0.5
			42		1[b]	0.1
Total					632	188.4

[a] FB 1.
[b] Originally identified as ceramic fragments.

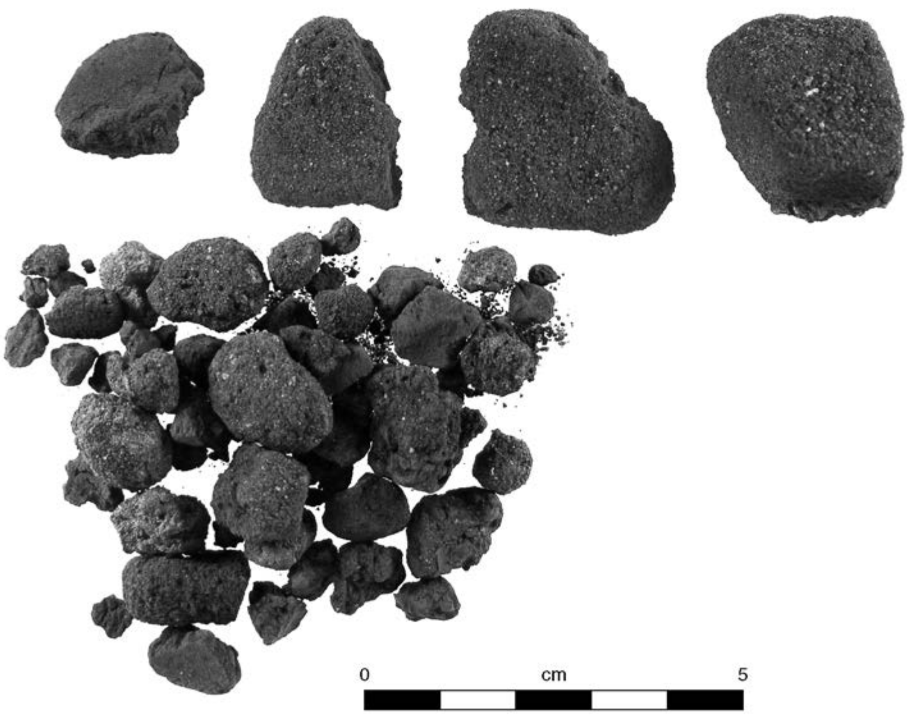

Figure 168. Burned soil fragments from FB 1 at LAN-211, EU 391.

a number of prehistoric sites in the Gabrielino territory, and Strudwick (2004) interpreted these as evidence for wattle-and-daub construction. At most sites, only a small handful of burned daub fragments were recovered. One exception was at ORA-269, where archaeologists recovered a substantial amount of burned daub (790 g) (see Strudwick 2004:19). These previous projects showed a precedent for burned daub remains at indigenous sites in the Los Angeles Basin.

Archaeologically recovered daub fragments are almost always burned. Exposure to intense heat from fire hardens and sinters the daub, rendering it more durable and, accordingly, more likely to preserve in the archaeological record (as is the case with ceramic artifacts). Unfired daub, conversely, is likely to dissolve over time and, therefore, is far less likely to preserve in the archaeological record. Hence, the presence and quantity of daub at a site essentially is a function of the amount of daub on a daub-coated structure that was subjected to intense heat. This presents a challenge for archaeologists attempting to infer the amount of daub originally present at a site or locus from the amount of burned (and preserved) daub recovered.

Based on a series of controlled burning experiments on wattle-and-daub structures in Calabria, Italy, Shaffer (1993:60–61) found that short-term, low-intensity blazes (as would likely occur with accidental fires) generated very small amounts of burned daub. As part of his experiment, he burned a wattle-and-daub hut for a short duration (roughly 45 minutes) and found that only 3 percent of the daub had sintered. In a similar experiment in Serbia, Bankoff and Winter (1979:13–14) observed sintering of only 1 percent of the daub. A very short-term or quickly extinguished fire would likely generate even smaller percentages of burned daub, less than 1 percent. Shaffer's second experiment, in which the fire was well stoked and allowed to burn and smolder over many hours, resulted in nearly complete sintering of the daub, generating a large and dense deposit. Comparing the archaeological record to his experimental results, Shaffer (1993:62, 72) concluded that Neolithic peoples in Italy deliberately burned dilapidated wattle-and-daub structures and reused the hardened daub remnants as voluminous filler for later construction. Stockpiling the burned daub meant that the inhabitants did not need to mine and haul large amounts of clay for each new construction (Shaffer 1993:62).

Shaffer's study may provide grounds for better understanding the burned soil fragments recovered in the Ballona. The 187.8 g of burned soil fragments recovered from scattered loci at LAN-211 would have provided a miniscule amount of daub. To put this amount into perspective, Cameron (1999:100) stated that a single small ceramic bowl measuring 6.3 cm in height and 13.3 cm in diameter weighs 189.9 g, roughly equal to the total weight of *all* of the burned soil fragments recovered from LAN-211. If the burned soil remains are in fact daub fragments, the amount recovered from FB 1 would be sufficient to cover only a very small part of a structure. Even the 790 g of burned daub recovered from ORA-269 (scattered over a large area) amounts to about four small bowls and would have been insufficient to cover an entire structure.

For the sake of argument, if the burned fragments from LAN-211 are in fact daub remains, then several hypotheses can be formulated to account for the small quantity. Perhaps only a small portion of a structure (or structures) was burned accidentally, in a fire-related mishap. Recalling the experiments conducted by Shaffer (1993) and Bankoff and Winter (1979), this may represent only 1–3 percent (or less) of the daub originally present, depending on the duration and intensity of the heat exposure. Another possibility is that the inhabitants of LAN-211 deliberately burned one or more structures but collected the burned fragments (likely larger pieces) for use in later construction efforts, as Shaffer (1993) suggested for Neolithic Italy. But if this were true, then many more fragments would have been recovered; complete immolation of a structure would probably generate thousands of daub fragments. A third possibility is that daub was used very modestly to cover only a small area of a structure (e.g., part of a floor).

In all, the low quantity of burned soil fragments, coupled with their low suitability as a daubing agent, suggests that they may not have been associated with wattle-and-daub structures. As explained below, though, other hypotheses appear to be equally untenable, given the spatial distribution of ceramic artifacts in FB 1 at LAN-211.

Site Results

LAN-193

One small fragment of an indeterminate modeled ceramic artifact with incised decoration, a possible effigy or figurine (see above), was recovered from LAN-193 (see Table 147; Figure 166a). The item was recovered from Feature 9, an activity area that encompasses a roughly 6-by-16-m area. The artifact was visually distinct from the ceramic artifacts recovered elsewhere in the PVAHP area. It possessed a dense paste with a distinct reddish color (5YR 4/4) that was quite different from the generally gray and brown sherds with relatively porous pastes recovered elsewhere in the Ballona. It also included incised decoration, but no pattern was evident because of the small size of the fragment.

The activity area encompasses a number of rock clusters and cached ground stone deposits and has been assigned to the late Intermediate period (mid- to late first millennium A.D.). This is surprising, because no comparable indigenous ceramic artifacts have been recovered from unambiguous early prehistoric deposits in the Los Angeles coastal area. The artifact, therefore, may have been intrusive in the feature. The field crew observed evidence of bioturbation (rodent burrows) within the feature matrix, which frequently generates downward movement of artifacts and other remains (see Waters 1992:309–316). Also, portions of the site were subjected to modern mechanical disturbance.

Even so, we cannot categorically rule out the possibility that the artifact was recovered from a primary deposit and, hence, legitimately dates to the late Intermediate period. Ceramic artifacts are known to have been used in inland desert and mountain regions at that time, and possibly along the coast to the south (Griset 1996); thus, it is plausible that an individual in the area procured the object through trade or gifting with one of the neighboring ceramic-making groups. The item's distinct paste, color, and decorative attributes are different from the mostly Mission period ceramic artifacts recovered elsewhere in the project area, which suggests different production methods and materials, possibly indicating a prehistoric ceramic-making tradition distinct from the Mission period tradition.

LAN-2768

One very small, cylindrical artifact (see Figure 167) was recovered from CU 9 at LAN-2768 (see Table 147). CU 9 was situated adjacent to and immediately south of Feature 17, an artifact concentration (mostly bone, lithics, and FAR) probably formed during a hearth cleanout. Several possible daub fragments also were recovered in the vicinity (see below), which supports the possibility that the object is a daub fragment with a stick or pole impression. No additional evidence of structures has been recovered in the vicinity. Calibrated radiocarbon dates from shell fragments (*Chione*) in adjacent CU 8 suggest occupation during the middle Intermediate period. These artifacts may have been intrusive items from later (Historical period) deposits. Shell beads dated to the nineteenth century (Rancho period) indicate a Historical period occupation at the site, but the possibility of primary deposition of the ceramic fragment cannot be ruled out.

The burned soil fragments from LAN-2768 were from CUs 8 (0.5 g, two fragments) and 42 (0.1 g, one fragment). CU 8 is adjacent to Feature 17, a probable hearth cleanout (mostly bone, lithics, and FAR). As stated above, calibrated radiocarbon dates from shell fragments (*Chione*) in CU 8 suggest a middle Intermediate period occupation. CU 42 at LAN-2768 was excavated into Feature 5, a large artifact concentration consisting mostly of unworked stone and FAR. It is unclear whether these small pieces were from primary deposits or moved downward into the feature matrix from later, overlying deposits as a result of bioturbation. Very small artifacts such as these are highly susceptible to the effects of bioturbation (see Waters 1992:306–316).

LAN-62

Two three-dimensional effigy or figurine fragments were recovered from Mission period human burials at LAN-62 (see Figure 165). The possible animal or humanoid effigy described above (see Figure 165, top) was recovered from Feature 443 (for burial descriptions, see Volume 4 of this series). Feature 443 appeared to be a multiple burial with disarticulated skeletal remains of at least two individuals (one adult and one juvenile of indeterminate sex). The feature was associated with nearly 100 shell beads and other shell artifacts. The effigy could have been an indicator of high social status or shamanic power. Because of the complex arrangements of skeletal remains, it was impossible to associate the artifacts directly with specific individuals. The conical artifact (see Figure 165, bottom) was recovered from Feature 285, a multiple burial containing at least eight individuals (four adults, one subadult, two juveniles, and a fetus, all of indeterminate sex). This burial feature also was associated with a large number shell beads, as well as glass beads, lithic artifacts, basketry and cordage, and other artifacts. The conical artifact was not clearly associated with a specific individual.

LAN-211

As mentioned above, most of the sherds from the PVAHP were recovered from LAN-211, including 86 body sherds, 7 rims, 1 modeled artifact (see Figure 166, bottom), 2 cylindrical artifacts (see Figure 167), and 19 indeterminate artifacts. Most of the sherds were recovered from the A horizon of FB 1, a large activity area associated with more than a dozen hearths, rock clusters, and hearth-cleanout features that dated to the Mission period occupation of the Ballona (see Volume 2 of this series). Two ceramic artifacts also were recovered from the Bk horizon of EU 163, roughly 5 m east of FB 1. One sherd was recovered from the more deeply buried II-Ab1 horizon of EU 559, located in a large excavation block roughly 15 m to the south of FB 1, along the southern boundary of the site. Finally, 5 tiny, unidentified ceramic pieces were recovered from the A horizon of rock-cluster Feature 14, EU 479, about 40 m northeast of FB 1. The scattered ceramic pieces from the Bk and II-Ab1 horizons (both Intermediate period formations) probably were Mission period deposits that moved downward within the subsurface matrix as a result of bioturbation or other post-depositional disturbances. In light of the very small sample sizes, little can be inferred about the various scattered ceramic artifacts outside FB 1. In the remainder of this section, therefore, the focus of the discussion is on the spatial distribution of ceramic artifacts in the A horizon of FB 1.

Ceramic Artifacts from FB 1

Most of the sherds (95 of 107, or 89 percent) recovered from FB 1 were excavated from the A horizon. Only 12 tiny, indeterminate pieces were recovered below the A horizon of FB 1, from the culture-bearing sediment forming the overlying fill of Feature 11, a nonthermal pit dated to the Intermediate period. These pieces probably were washed in from later Historical period deposits and shifted downward within the feature matrix as a result of bioturbation. Excluding these 12 small pieces, which were likely secondary deposits, the 95 ceramic artifacts from the A horizon of FB 1 represent an MNI of 71 items.

Figure 169 illustrates the spatial distribution of ceramic artifacts per 1-by-1-m control unit in FB 1. The ceramic remains were largely concentrated in the central portion of FB 1, primarily in the vicinity of several linear arrangements of hearth and cleanout features. Although ceramic artifacts were generally concentrated in a discrete portion of FB 1, they were not *continuously* distributed over this area. Rather, as Figure 169 makes clear, denser concentrations suggest three relatively segregated clusters. These concentrations are explored in more detail below.

To highlight the distinct spatial patterns for different artifact categories, Figures 170–172 show the artifact frequencies per control unit for vessel sherds (rim and body sherds), nonvessel ceramic artifacts (cylindrical artifacts, modeled artifacts, and indeterminate pieces), and burned soil fragments, respectively. These figures provide a more refined perspective on the spatial patterning within FB 1. The distributions of vessel sherds, nonvessel/indeterminate artifacts, and burned soil fragments are discussed separately in the following subsections.

Vessel Sherds

As illustrated in Figure 170, the vessel sherds were more tightly concentrated in the eastern portion of FB 1 than were ceramic artifacts from the other categories (see Figure 169). The vessel sherds appeared to be closely associated with a number of hearth and probable hearth-cleanout features. None of the vessel sherds was more than about 3 m from a hearth feature. The pottery vessels were probably used in association with the hearths for cooking food or other heating tasks (see above). If so, FB 1 probably functioned as a food-preparation and cooking locus, perhaps related to domestic food preparation or ritual feasts linked to the nearby burial area at LAN-62.

All of the vessel sherds in FB 1 were recovered from control units surrounding the hearth features, and none was excavated from feature fill. As mentioned above, many of the sherds collected from FB 1 exhibited soot accumulations on their exterior surfaces, a probable result of having been used as cooking utensils. An alternative explanation for the soot accumulations mentioned above concerns ritual destruction and immolation of deceased individuals' domestic possessions. If this were the case, though, we would expect to recover the sherds *within* the matrices of the hearth features and not in the nonfeature areas surrounding the hearths. Also, it is very unlikely that features excavated at LAN-211 were mourning features (see Volume 2 of this series). The most parsimonious explanation is that the scattered sherds were from cooking vessels broken during use (a frequent result of repeated thermal stress) and discarded in "toss zones" surrounding the hearths.

The FB 1 ceramic collection exclusively included very small sherd fragments and nonreconstructible vessels. Several processes may have been responsible for the absence of larger sherds and whole/reconstructible vessels. One possibility is that the larger sherds were fragmented by recent and Historical period plowing, trampling, or mechanical disturbance (see Stoll et al. 2003), but a geoarchaeological inspection of the subsurface deposits suggested that the area

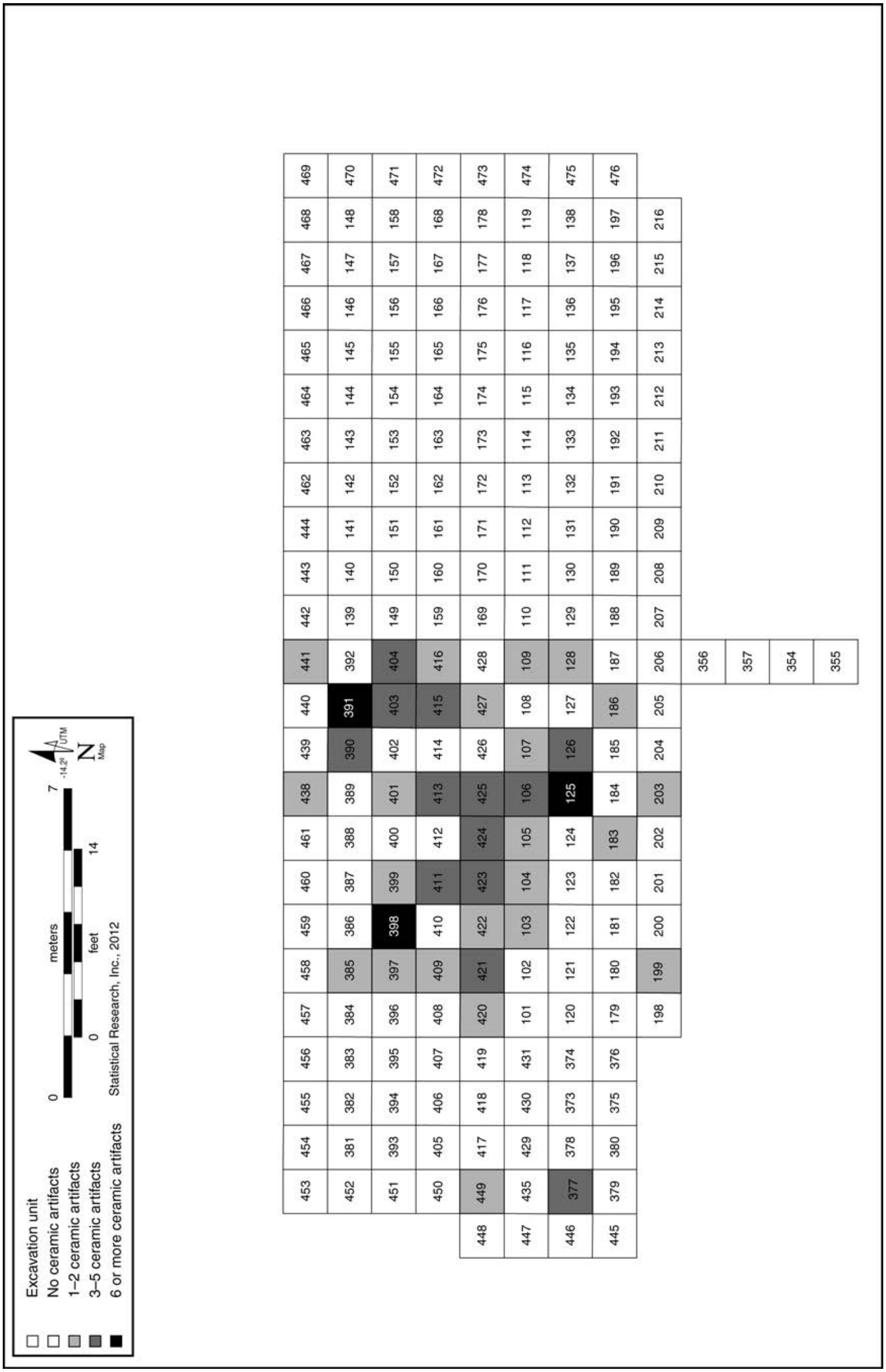

Figure 169. Ceramic-artifact frequencies (all categories) per excavation unit, FB 1, LAN-211.

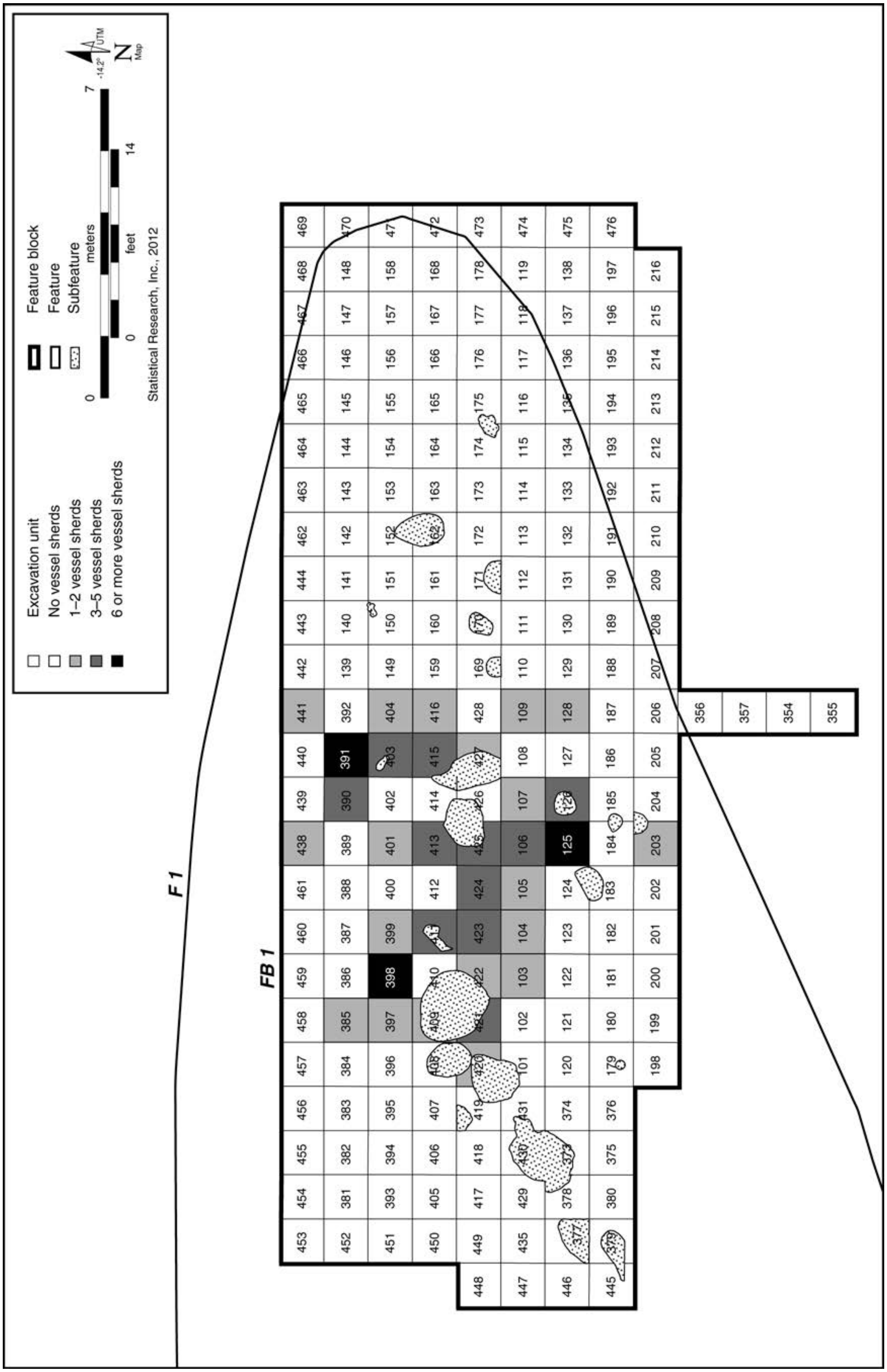

Figure 170. Vessel-sherd frequencies per excavation unit, FB 1, LAN-211.

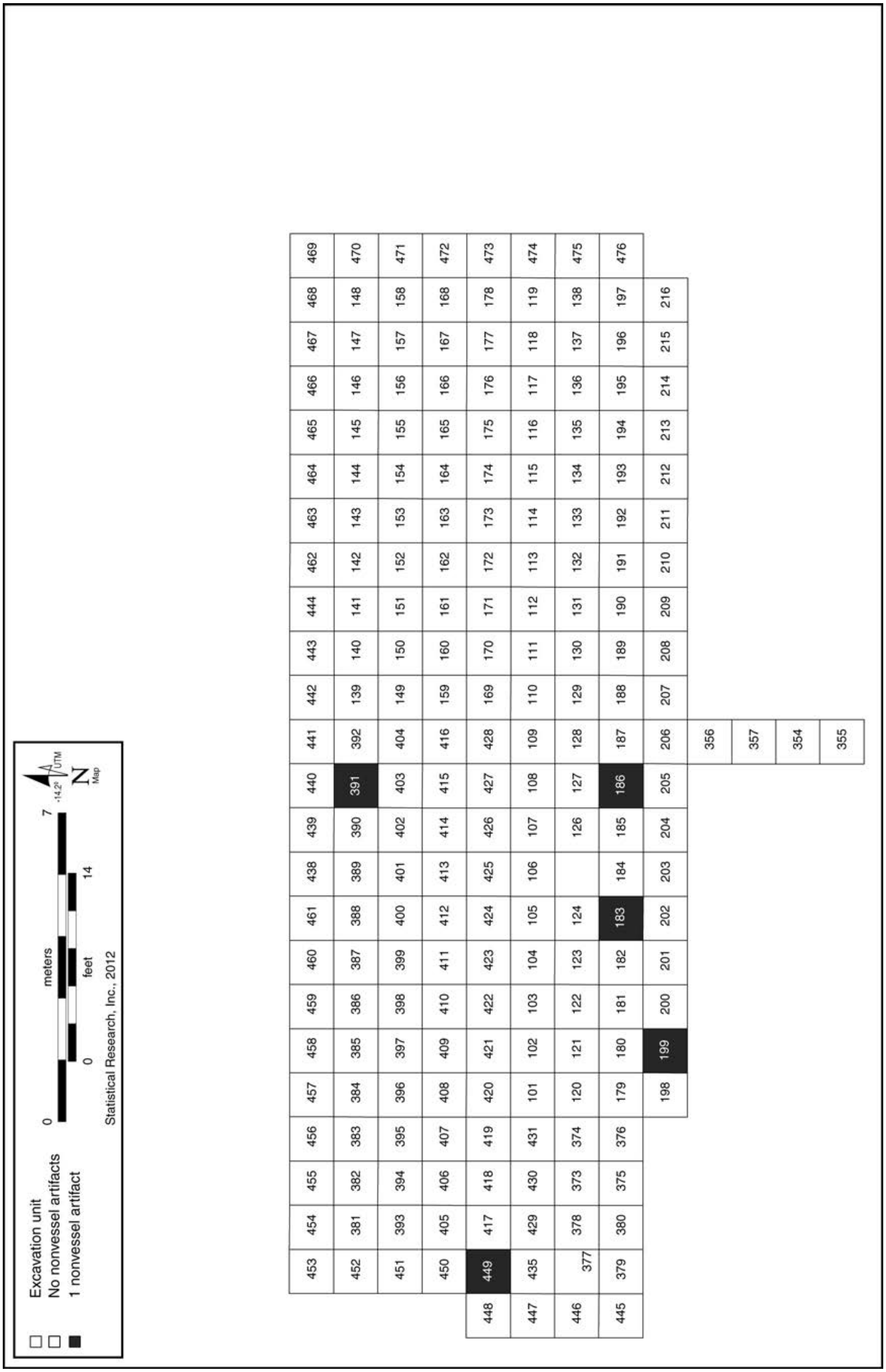

Figure 171. Locations of nonvessel artifacts in excavation units, FB 1, LAN-211.

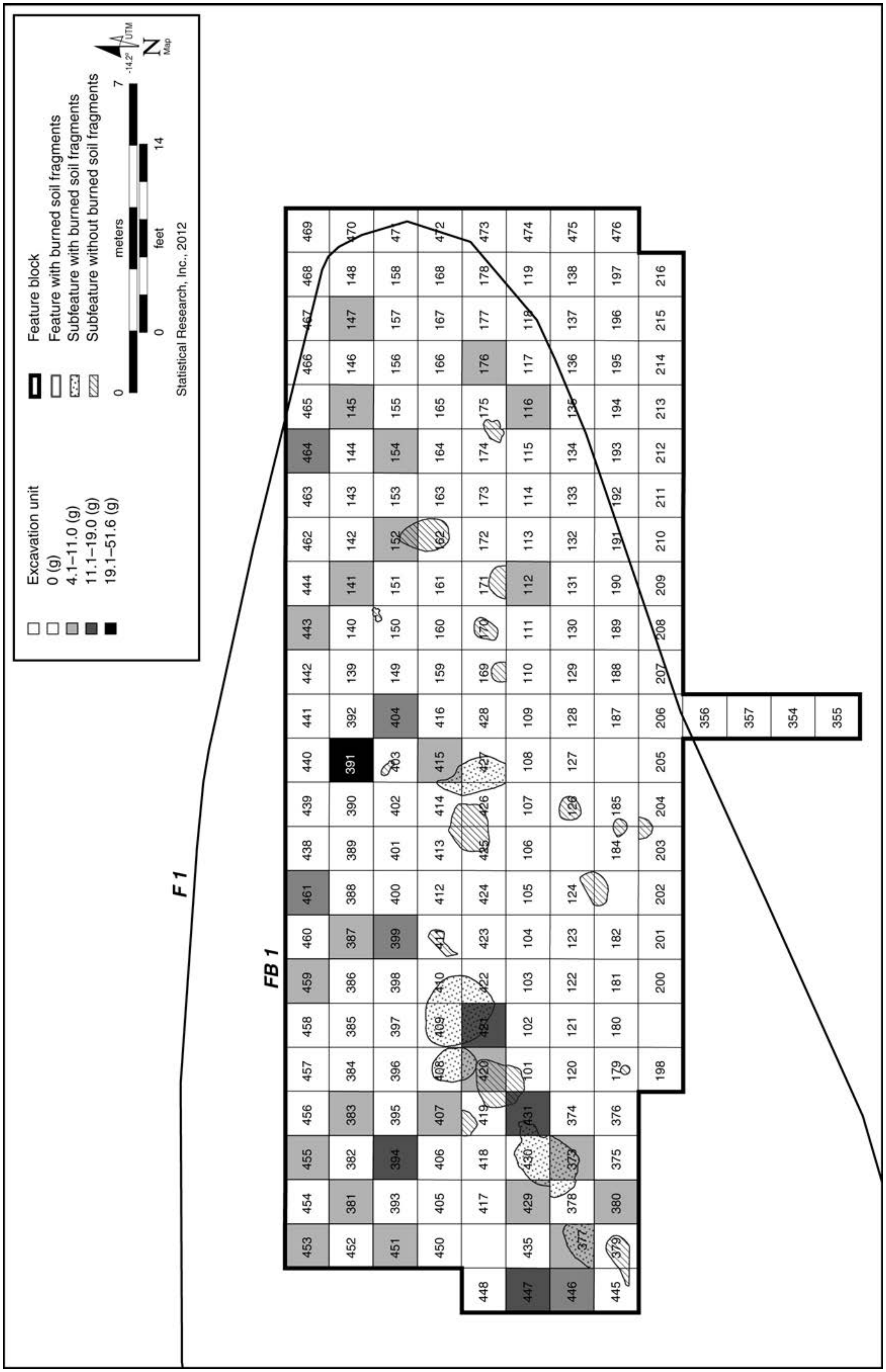

Figure 172. Frequencies of burned soil fragments (weights in grams) per excavation unit, FB 1, LAN-211.

around FB 1 was largely intact and did not appear to have been heavily disturbed by modern or Historical period processes, aside from bioturbation (see Volume 2 of this series). The prevalence of small and nonreconstructible sherds more probably relates to how pottery vessels were used and disposed of in the context than to postdepositional disturbance (see Schiffer 1972, 1987:13–15). Many broken-pottery fragments may have been trampled, especially if they remained in context after discard.

In addition, the occupants of LAN-211 might have regularly repaired and reused vessels with only minor breaks and/or recycled the larger sherds as smoothing or scraping tools (worked sherds), a common practice among indigenous groups in southern California (Griset 1990:184). If so, the sherd collection from FB 1 was composed of those vessel fragments that were too small to be removed and reused as worked sherds. Reuse would have been commonplace if pottery was manufactured elsewhere (i.e., procured from outside traders) and supplies were limited. However, note that none of the sherds recovered from LAN-211 exhibited clear evidence of having been recycled as smoothing or scraping tools.

A closer inspection of the spatial distribution of vessel sherds suggested denser concentrations of sherds in the vicinities of three specific clusters of hearths and associated cleanout features (Table 152). Cluster 1 includes Features 2, 4, 25, 28, and 41; Cluster 2 includes Feature 5, 6, 8, and 12; and Cluster 3 includes Features 21, 22, and 23 (nearby Feature 27, a human burial, was intrusive from a later occupation). The ceramic artifacts surrounding these clusters overlapped; thus, the cluster assignments were arbitrary for some control units. The clusters may indicate discrete, successive time spans of use for the hearth features. Surprisingly, no vessel sherds were recovered from clusters of hearth and associated cleanout features further to the west (Features 14, 42, and 50) and east (Features 16, 17, 18, and 19). The reason for this disparity is unclear at present, but analysis of the spatial distributions of other artifact categories (e.g., lithics and shell) may shed light on this matter. The latter hearths may have been used for specialized cooking or heating tasks that did not require the use of pottery vessels.

Table 152 lists the ceramic counts and attribute information for the three proposed clusters of hearths. For the most part, the sherds from the three clusters possessed similar attributes (paste colors, thickness, temper types, and textures). Cluster 3 includes a larger estimated number of vessels, which may indicate that hearth Features 21, 22, and 23 were used more intensively and/or over a longer span of time than the other clusters of hearths. Another difference in Cluster 3 is the larger proportion of sherds with evidence of sooting. In Cluster 3, 36 percent of the vessels (based on MNI counts) exhibited exterior sooting, compared to 11 and 8 percent for Clusters 1 and 2, respectively. The implication of this pattern is unclear. One possibility is that cooking vessels tended to be discarded in the vicinity of Cluster 3, whereas noncooking vessels, such as food-preparation or serving wares, were more frequently discarded in the vicinities of Clusters 1 and 2. If so, it may be possible to distinguish separate work areas for different food-preparation tasks within the FB 1 activity area. The small overall sample of rims and identifiable form classes precludes testing of this interpretation, but testing may be feasible if we include other artifact classes, such as flaked stone, faunal bone, and shell.

Nonvessel Artifacts

The nonvessel artifacts and indeterminate ceramic fragments tended to concentrate along the periphery of the ceramic-artifact concentration in the central portion of FB 1 (see Figure 171). However, no concentrations or spatial patterning were evident, except for a minor concentration of indeterminate ceramic fragments on the western edge of Excavation Block A (CUs 311 and 449). Two hollow, cylindrical artifacts were recovered along the southern edge of the excavation block in CUs 186 and 199. As explained above, the function of these artifacts is indeterminate.

Most striking in the comparison of Figures 170 and 171 is the nonoverlapping spatial distributions of vessel sherds and nonvessel/indeterminate artifacts. Only CUs 391 and 404 included both vessel sherds and indeterminate ceramic artifacts, which may be heavily fragmented vessel debris. The sherds were concentrated in the eastern portion of FB 1, whereas the nonvessel and indeterminate ceramic pieces were distributed along the peripheries of the ceramic concentration.

Burned Soil Fragments

Despite their functional ambiguity, the burned soil fragments showed a distinct spatial patterning within FB 1, as shown in

Table 152. Attributes of Vessel Sherds from Three Proposed Hearth Clusters, FB 1 at LAN-211

Cluster	No. of Sherds	MNI	Average Thickness (mm)	Identified Form Classes	MNI Sooted	EUs Included in Cluster
1	24	18	7.8	1 jar with neck	2	103, 104, 385, 397, 398, 399, 420, 421, 422, 423
2	21	13	7.0	none	1	105, 106, 107, 109, 125, 126, 128, 203
3	33	22	7.6	1 jar with neck, 1 neckless jar, 1 bowl	8	390, 391, 401, 403, 404, 413, 415, 424, 425, 427

Figure 172. Most striking is that the fragments were primarily concentrated in the western, northern, and northeastern portions of Excavation Block A. The scattered fragments formed a discontinuous arc across the western and northern portion of the block, with denser concentrations in some areas. One concentration was located in the southwestern portion of the excavation block, in CUs 446 and 447. A second was located roughly 3–4 m to the northeast of the first concentration, in the direct vicinity of Features 4, 28, and 41 (CUs 394, 421, and 431; the concentration in CU 394 may indicate a separate area of accumulation). By far, the largest accumulation was in CU 391 (51.6 g), in the north-central portion of the excavation block. A less-dense accumulation to the west of CU 391 (in CUs 399 and 461) may have been part of the same overall concentration. A generally continuous, low-density scatter covered the northeastern and east-central portions of the excavation block. The area did not appear to have been subjected to Historical period or modern plowing or other forms of disturbance that would have caused extensive horizontal movement of artifacts within the excavation block; hence, these concentrations probably were not caused by postdepositional disturbances.

Notably, the burned soil fragments were largely segregated from the vessel sherds. Figure 173 shows the larger concentrations of vessel sherds and burned soil fragments within the excavation block, including units with more than three vessel sherds and more than 6 g of burned soil fragments. The major concentration of vessel sherds, probable debris from broken cooking pots, was in the central portion of the excavation block; the major concentrations of burned soil fragments were scattered along a linear stretch from the southwestern portion of the block to the northeastern portion, generally to the north and west of the sherd concentration. Only two control units (CUs 391 and 421) possessed *both* more than three vessel sherds and more than 6 g of burned soil fragments, out of a total of 21 control units coded as meeting one or both of these criteria, indicating a 9.5 percent overlap. This low level of overlap underscores the spatial segregation of the sherd and burned soil remains.

Overall, the spatial distribution of the burned soil fragments is perplexing. To interpret these fragments as burned soil pieces formed as a result of exposure of the ground surface to heat during cooking or other activities, it would be necessary for the fragments to be closely associated with the hearth and cleanout features that cross-cut the activity area, but that was not the case. The fragments were generally distributed along the western, northern, and northeastern boundaries of the activity area, away from the alignment of hearths and cleanout features. Perhaps heating or cooking activities unrelated to the hearths were responsible for the modest accumulations of burned soil fragments in these areas.

Conversely, if they are interpreted as burned daub fragments, the distribution could indicate the approximate locations of one or several partially burned wattle-and-daub structures. Assuming that denser concentrations of burned daub accumulate in the immediate vicinities of burned or partially burned structures, the discrete concentrations may indicate approximate locations of structures, possibly domestic residences, nonresidential structures related to food preparation (outdoor kitchens?), or nonenclosed structures, such as windbreaks (see Strudwick 2004). Three to seven structures may have been present in the excavation block, depending on how one distinguishes the concentrations. The spatial arrangement suggests a possibly linear or circular arrangement of structures along the western and northern edges of Excavation Block A. Adjacent to this proposed swath of structures to the south is a line of hearth and heart-cleanout features that were spatially associated with the distribution of probable cooking-vessel sherds. If this interpretation is valid, then the hearths in FB 1 may have functioned as domestic cooking hearths associated with wattle-and-daub structures.

But this interpretation also is problematic. First, as explained above, the marginally clayey fragments would have provided poor daubing material. Second, the sparse accumulations of burned fragments in any one of the abovementioned concentrations would not have been sufficient to cover even a small portion of a structure—although, as explained above, if the daubed structures were only minimally exposed to heat, such modest accumulations would be expected. Finally, the presence of scattered daub fragments is inconsistent with the ethnographic record. Kroeber (1925) indicated that Gabrielino peoples used daub to coat the walls and floors of sweatlodges but not residential dwellings or other structures. The widespread spatial distribution and discrete concentrations of the burned soil fragments argue against the possibility of a single sweat lodge, and it is unlikely that more than one would have been constructed in the area, unless they were built successively, in slightly different locations, over the course of many years. However, it is possible that daubing practices changed over time from the Mission period to the early twentieth century, when Kroeber made his observation. Perhaps various types of structures, and not just sweat lodges, were completely or partially coated with daub during the Mission period (see Strudwick 2004).

LAN-2676

One body sherd was recovered from LAN-2676. The sherd was a fine-paste brown ware with a deeply incised decoration on the exterior surface. It was too small to detect patterning in the incised design. Although interpreted as a vessel sherd, it is also possible that it was part of a modeled artifact comparable to the incised figurine or effigies described above. Unfortunately, the remains from LAN-2676 were likely from redeposited fill from LAN-62 associated with the construction of a runway in the 1950s by the Hughes Aircrfat Company (Stoll et al. 2003). The sherd was recovered in secondary context.

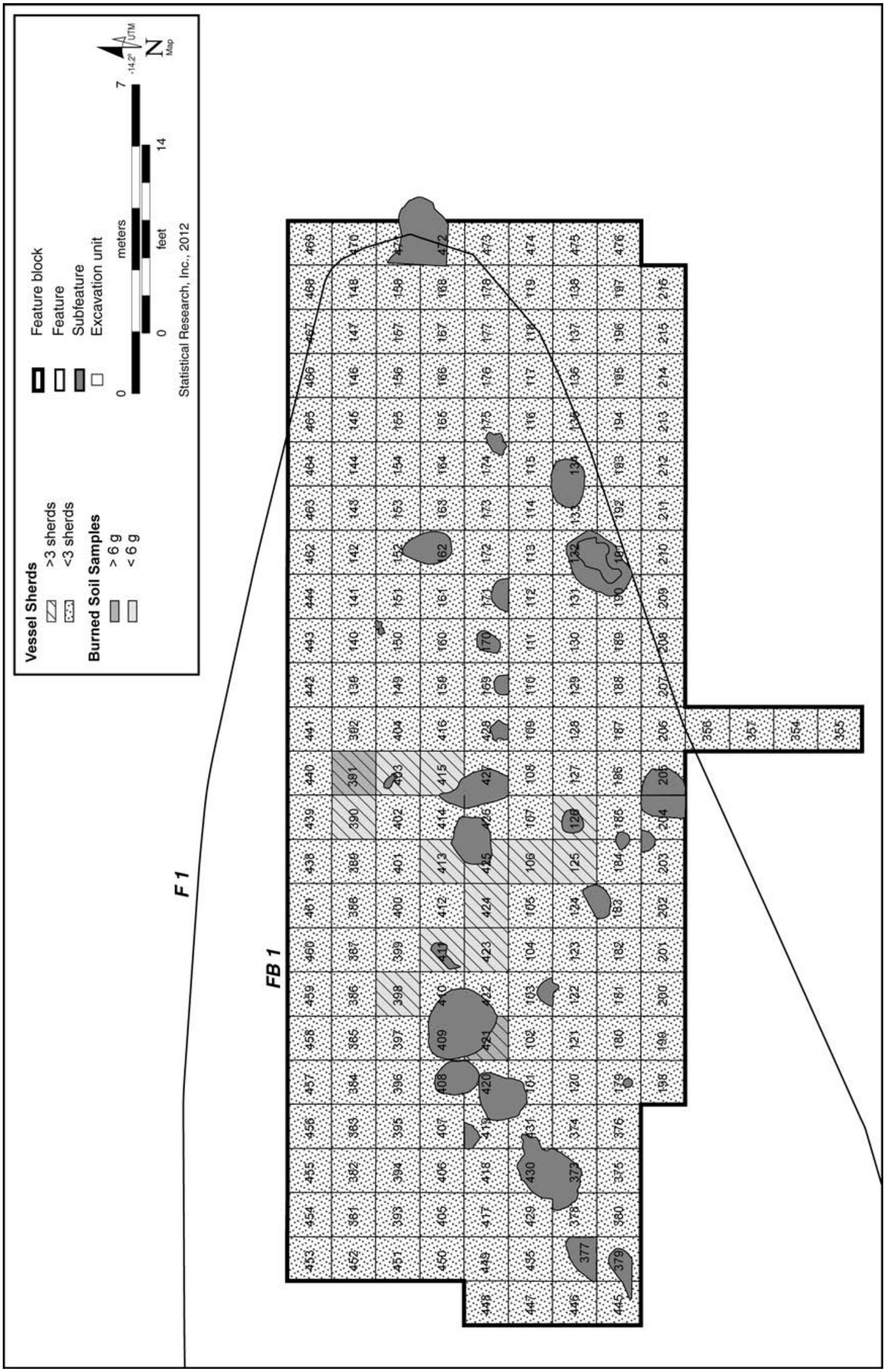

Figure 173. Larger concentrations of vessel sherds and burned soil fragments per excavation unit, FB 1, LAN-211.

Provenance Study of Ceramic Artifacts and Clays from the Ballona

Gena Granger, Adrian Abella, and Hector Neff conducted a compositional-provenance study of ceramic specimens and two raw-clay samples from the PVAHP, primarily LAN-211. To characterize the ceramic artifacts from the Ballona, they used the geochemical-compositional technique of LA-ICP-MS. Granger and Abella undertook the analysis under the direction of Dr. Neff at the IIRMES, California State University, Long Beach. A brief summary of their findings is presented here; for additional details, please refer to Appendix G.2.

The purpose of the research conducted by Granger, Abella, and Neff was to determine the provenance of the clays used to make the ceramic artifacts recovered in the Ballona. In total, 41 sherds and 2 clay samples were submitted for LA-ICP-MS analysis (excluding 2 submitted specimens that were later determined to be nonindigenous sherds). The majority of the sherds (n = 39) were recovered from LAN-211, and most of them derived from cooking and food-preparation vessels. One cylindrical artifact from LAN-2768 also was included in the study. Granger and Abella characterized the elemental composition of the sherds and clay materials using LA-ICP-MS, which was processed using a time-of-flight (TOF) detector (for technical details, see Appendix G.2). With the exception of some light elements, LA-ICP-MS can be used to detect concentrations of most chemical elements. The raw data received from the TOF detector were calibrated to parts per million for statistical analyses.

The aim of the statistical analysis was to compare the elemental composition of the sherd pastes in tandem with the raw clays to determine the level of elemental similarity between them. Similar geochemical properties between the sherds and clays may indicate that local clays were used in the production of ceramic artifacts. Granger and Abella first attempted to identify discrete compositional groups among the PVAHP geochemical assays using cluster analysis and other multidimensional analyses. Their initial analyses suggested that the sherds and raw clays formed a continuum of elemental compositions; distinct compositional groups within the data set could not be detected. The PVAHP sherd and clay samples, therefore, are better defined as members of a single compositional group encompassing a continuous range of geochemical variability.

Importantly, the continuum incorporated both the raw clays and the sherd pastes, which suggests the possibility that the sherds derived from ceramic vessels that were made using locally available clays. Based on these results, the ceramic artifacts from the Ballona were probably made from raw materials procured within or near the Ballona. This cannot be determined with certainty, though. It is possible, for example, that clays from a large area of the coastal plain south of the Santa Monica Mountains have chemically similar clays to those in the PVAHP. If so, ceramic vessels may have been imported from nearby areas in the greater Los Angeles Basin with geochemically similar clays. Additional studies will be needed to understand how the chemical composition of ceramic raw materials varies in different areas of the Los Angeles Basin.

Discussion

Site Function

LAN-211

As explained above, only FB 1 at LAN-211 contained sufficient frequencies of ceramic artifacts and daub fragments to permit a relatively comprehensive evaluation of site function. The data suggest that the eastern portion of FB 1 was a probable locus of cooking and food preparation. Pottery vessels—including jars with necks, bowls, and neckless jars—appeared to have been used as cooking utensils, perhaps in association with residential food preparation or ceremonial feasting (possibly related to the burial area at nearby LAN-62). The low-density accumulations of vessel sherds in FB 1 may have been a consequence of occasional discarding of broken cooking vessels in “toss zones” surrounding the hearths. The prevalence of cooking vessels, as indicated by the high frequency of sherds with exterior sooting, may have resulted in frequent vessel breakage from heat-related stress. Some of the sherds recovered in the area may have been used as food-processing (e.g., mixing) and serving vessels, but the existing sherd data are insufficient to infer the full range of vessel functions.

Surrounding this cooking area to the west and north was what appeared to be a linear or semilinear arrangement of burned soil remains with three or four distinct concentrations that *might* mark locations of wattle-and-daub structures (see Figure 172). These dwellings may have encircled a central, communal cooking area, as evidenced by the various hearth and cleanout features and vessel sherds and the copious remains of lithic and faunal-bone debris in the vicinity. A second possibility is that the burned soil remains mark the locations of outdoor kitchen structures, perhaps ramada-like shelters under which food-preparation tasks could be carried out. The latter accommodates the possibilities of domestic cooking or preparation of foods for ritual feasts or ceremonies connected to the nearby burial area. However, as explained above, the interpretation of these fragments as daub remains is problematic.

Notable also is the absence of vessel sherds outside FB 1 at LAN-211. Most of the ceramic artifacts collected from other areas of the Ballona were modeled artifacts, cylindrical artifacts, and tiny ceramic fragments with no visible surfaces. FB 1 at LAN-211 appears to be the only investigated locus in the project area in which pottery was used.

The vessel sherds from LAN-211 did not resemble the Missionware described by Love and Resnick (1983), which tentatively suggests that the inhabitants of the Ballona did not receive pottery vessels from the missions. Archaeologists should not assume that all of the pottery vessels made at the various missions looked the same or adhered to a narrowly defined manufacturing template. Even so, the vessel sherds from LAN-211 more closely resembled the indigenous-made Tizon brown wares recovered from inland deserts to the east. No attributes of the sherds indicated the adoption of European technologies or manufacturing canons. In addition, the LA-ICP-MS results suggest that pottery vessels were made using local clays, possibly from sources within or near the Ballona. These lines of evidence suggest a continuation of pre-contact practices and technologies and a weak economic connection to the missions and European settlements.

LAN-62

The three-dimensional effigies or figurines recovered from two human-burial features in Locus A at LAN-62 may indicate a ceremonial or religious function. A ceramic pipe fragment recovered from Locus A reinforces this interpretation (see Appendix G.3). Also notable is the *absence* of sherds or vessels from the extensive burial area at LAN-62. Many of the burial goods that early ethnographers observed placed inside ceramic vessels and interred with the deceased among the Diegueño were also recovered from burial features in the Ballona, but without any accompanying evidence of ceramic vessels (Heye 1919). The contact period Gabrielino inhabitants of the Ballona likely used baskets or stone (ground stone and steatite) bowls in place of pottery as containers for burial goods.

Ceramics and Subsistence in the Ballona

The very low frequency of ceramic containers in the project area (and at other indigenous sites in the Los Angeles coastal area) might indicate a mobile hunter-gatherer subsistence economy, given that mobile groups tended to make and use pottery less frequently than sedentary groups (see Arnold 1985:109–125). This evidence is hardly conclusive, though. As Eerkens (2003) explained, ceramic densities do not *directly* correlate with degree of mobility. Although "fully nomadic groups" rarely produced or used pottery (Arnold 1985:120), mobile groups that made "consistent and predictable use of specific areas" were very likely to manufacture and use pottery (Eerkens 2003:736), especially if it could be readily cached at those locations for future visits. Hence, high or low frequencies or densities of ceramic sherds do not unambiguously correlate to mobile or sedentary settlement and subsistence strategies.

Caching permitted mobile groups to maintain potentially large inventories of pottery without having to carry them during seasonal moves. Griset (1990:181–184) explained that indigenous peoples in southern California stored and cached food supplies in large ceramic vessels hidden away from the main settlements: "Large basketry acorn granaries placed near houses were open to public scrutiny. The location of cached pottery vessels was maintained as a family secret" (Griset 1990:184). Hence, the Gabrielino occupants of the Ballona might have possessed large inventories of pottery vessels in cached locations away from the habitations, which might explain the dearth of evidence of noncooking vessels in the project area. However, had this been a widespread practice, archaeologists working in the Los Angeles coastal area likely would have uncovered a number of vessel caches by now, and no such caches have been observed in the Los Angeles coastal area.

A detailed evaluation of vessel size and function would provide a far more comprehensive basis for interpreting subsistence and settlement strategies. For example, the presence or absence of large storage vessels may shed light on the duration of occupation, because seasonal or temporary occupations are unlikely to include large numbers of heavy-duty storage vessels. Unfortunately, the number of identifiable rims was far too small for such a comprehensive study. No obvious long-term-storage vessels were observed in the project collection, although the recovery of several thick-walled sherds from LAN-211 suggests this possibility. Even so, the presence of one or several large, thick-walled vessels does not preclude mobility—again, hunter-forager groups may have cached large, durable vessels between seasonal moves.

Ethnographic accounts have indicated that indigenous peoples developed large, wicker granaries for long-term food storage and other sophisticated, woven containers to serve many of the functions ascribed to ceramic technology in other ancient societies (Harrington 1942; Kroeber 1973; summarized in Elsasser 1978). The Gabrielino likely maintained a cultural preference for basketry and similar material media to explore and develop technological innovations and solutions to technical needs. Consequently, they may not have perceived ceramic technology as a viable medium for technological solutions to storage and preservation needs (see van der Leeuw and Torrance 1989). If so, the presence or absence of ceramic remains may be entirely unrelated to the question of whether the contact period occupants of the Ballona practiced a sedentary or mobile settlement strategy.

In all, the sherd data are largely mute on the question of whether the contact period inhabitants of the Ballona practiced a mobile hunter-forager subsistence strategy. It is at least plausible that the indigenous peoples occupied the Ballona year-round but saw little need to invest in or use ceramic-container technology, given the availability of (and preference for) other material media, such as basketry and stone vessels. Any interpretation of subsistence practices during the contact period, therefore, must consider additional and more-directly relevant lines of evidence (e.g., evidence for seasonal resource exploitation).

Origins of Pottery in the Los Angeles Coastal Area

Mack (2003) recently elucidated a coherent research agenda for indigenous ceramic studies in California. One important line of study, she suggested, concerns the context for the initial adoption of ceramic technology in different times and places in California: "Rather than focus on the ceramic objects we should shift our focus to include reconstructing the ecological and social conditions that fostered innovation and adoption of ceramic vessels" (Mack 2003:31). Indigenous peoples in the Los Angeles coastal area appear to have *fully* adopted ceramic-container technology very late in time, likely during the Mission period (see above). Most late-prehistoric inhabitants of the area probably were aware of ceramic technology and its potential benefits related to cooking and storage/preservation. Pottery vessels probably occasionally entered the Gabrielino territory through trade or gift exchange well before European arrival. Overall, though, the area inhabitants appear to have avoided large-scale adoption of this technology before the Mission period.

Following Mack's suggestion, it is pertinent to consider the social conditions that led to the adoption of ceramic-container technology in the Los Angeles coastal area at that specific point in time. What social and ecological conditions during the contact period fomented such a fundamental shift in technological choices and subsistence practices? If the indigenous of the Ballona did not receive pottery from the missions, as argued above, why would they have resisted the adoption of ceramic-container technology until after European arrival? Some connection between pottery adoption and the establishment of European settlements is likely. The Mission period remains from FB 1 at LAN-211 represent the early stages of pottery use following the initial adoption of ceramic technology and, therefore, shed light on the earliest uses of ceramic-container technology at that time.

To put this technological shift into a broader context, the Mission period in southern California was a time of severe indigenous depopulation as a result of European-introduced epidemics (Jackson 1994). Pre-contact communities, social patterns, and economic relationships likely became unsustainable, resulting in realignments of social boundaries and shifting patterns of interaction and communication. These conditions may have stimulated population movements and aggregation of formerly socially distant groups, all of whom brought with them their own cultural practices and technological preconceptions. Contact among formerly distant groups frequently provides an ideal context for adoption and spread of new practices and technologies (van der Leeuw and Torrance 1989). In this context, the adoption of pottery in the Ballona may have been a result of the resettlement of individuals or families from traditional pottery-making groups (e.g., Cahuilla or Luiseño peoples) in the Ballona or increasing contact with Ballona residents as a result of disruption and depletion of native communities or to avoid meddling European missionaries and census takers.

The European presence also likely disrupted traditional subsistence practices in other ways. European settlement likely circumscribed pre-contact resource-catchment areas, which in turn may have forced a change in dietary practices and food resources. Many groups may have had to make do with less-desirable or secondary food resources, possibly limiting themselves to resources available locally or within a short distance. The probable use of local clays to manufacture pottery (as suggested by the LA-ICP-MS results) supports this possibility. The circumscription of catchment territories might have forced Ballona peoples to accommodate new dietary staples for which ceramic cooking technology was needed. Ceramic containers are better suited than baskets or other implements for cooking "marginal and second-choice plant and animal products" (Mack 2003:31) that require long heating times or soaking periods.

An analogy for this change comes from the western Great Basin. Eerkens (2004) made a convincing case that the prehistoric inhabitants of the western Great Basin initially adopted ceramic-container technology to cook and process seed products. He observed increased frequencies of cooking pots around 600 years ago at several sites in eastern California and western Nevada that correlated with a dietary shift that placed greater emphasis on seeds. Most pottery from that time span consisted of rock-tempered vessels with thin walls and nonrestricted orifices, which would have been ideal for boiling ground seeds; many of the sherds also showed surface sooting and blackening from exposure to fire (Eerkens 2004:657–658). Pottery with these formal characteristics, according to Eerkens (2004:658), would have been "particularly conducive to the preparation of gruels of oily and carbohydrate-rich food, such as ground seeds." Boiling facilitates digestibility and augments the nutritional uptake of ground seeds (Eerkens 2004:660). Moreover, pot-boiling is generally less labor intensive and time consuming than boiling in baskets or other organic containers (Arnold 1985:128; Crown and Wills 1995).

As in the western Great Basin, the sherd remains from LAN-211 suggest the initial use of ceramic containers as cooking vessels. Surface sooting was prevalent, and most sherds possessed relatively thin walls and abundant rock temper. Too few rim sherds were recovered to evaluate ratios of restricted and nonrestricted orifices. There was no evidence of storage vessels or serving vessels, although we cannot preclude the possibility that the inhabitants of LAN-211 used storage and serving vessels that were undetected during the PVAHP data recovery. Even so, the parallels with Eerkens' (2004) observations in the western Great Basin are striking. In both cases, a shift in diet and subsistence practices likely prompted the adoption of ceramic-container technology. Perhaps spatial circumscription resulting from European settlement forced the Ballona peoples to adopt new subsistence practices and to include new food sources in their diets. Increased use of seeds need not have been the impetus for the adoption of pottery, as was the case in the western Great Basin; perhaps pot-boiling and the viability of long-term simmering (made possible with ceramic technology) facilitated the processing, digestibility, palatability, or detoxification of various second-choice plant and animal foods (Mack 2003; see also Arnold 1985).

By the same token, an argument could be made that the presence of ceramic artifacts indicates an acceptance of European and mission practices rather than indigenous strategies to cope with European presence in the region, but that does not appear to have been the case in the Ballona. The archaeological evidence from LAN-211 does not support robust social linkage to the missions or to European pueblos and ranchos; European-derived artifacts were rare in Mission period contexts in the project area. As explained above, none of the sherds was similar to previous descriptions of Missionware (Love and Resnick 1983). Hence, the adoption of pottery technology at LAN-211 more probably related to perceived adaptive strategies and technological choices on the part of indigenous inhabitants rather than a "top-down" introduction from European sources.

In sum, the arrival of European settlers may have *indirectly* encouraged widespread use of pottery in the early Historical period in at least two ways. First, indigenous demographic decline in response to European-introduced epidemics likely generated substantial changes in social interaction, habitation practices, and group identity. Inevitably, such realignment of social relationships generated new "vectors" of technological innovation and the spread of ideas, which may have prompted an increased usage of pottery in the Ballona after the conquest. Second, European settlement probably circumscribed traditional indigenous catchment areas and dietary practices. The need for long-term heating and pot-boiling may have been necessary to accommodate changes in the diet and to allow for exploitation of a wider range of food that likely included what were previously perceived as less-desirable plant and animal foods.

Summary and Conclusion

In total, 120 ceramic artifacts and 188.4 g of burned soil fragments were recovered from five sites in the PVAHP. Most of the ceramic artifacts probably were related to Mission period activities in the Ballona, with the possible exception of an incised, modeled artifact from a late Intermediate feature at LAN-193. Given the absence of diagnostic types or forms, the ceramic data provide no direct insight into site chronology or period of occupation.

The majority of ceramic artifacts were vessel sherds recovered from FB 1 at LAN-211, most of which appeared to be from cooking vessels used in connection with a series of hearths recovered from that intensively used occupation surface. Several spatial concentrations of burned soil fragments within FB 1 may be daub fragments and, if so, suggest *possible* locations of wattle-and-daub structures. The relatively segregated spatial distributions of sherds and burned soil fragments in FB 1 suggest a cooking locus adjacent to a residential or food-preparation locus. Little can be inferred from the scattered ceramic pieces—mostly nonvessel sherds—recovered outside FB 1 at LAN-211, with the exceptions of two three-dimensional effigies recovered from human-burial features at LAN-62; these artifacts may have been ceremonial or religious paraphernalia interred with deceased individuals, possibly shamans or ritual specialists.

In the treatment plan for data recovery at LAN-211, Vargas et al. (2003) proposed various scenarios for characterizing the relationships between indigenous inhabitants of the Ballona and European settlers during the Mission period. They developed test expectations based on the extent to which settlement patterns and material technologies reflect Hispanic influence. The ceramic data provide a limited window on this question but support a scenario of gentile occupation "by independent natives who never entered the mission system" (Vargas et al. 2003:258). As emphasized above, the ceramic sherds did not closely resemble the Missionware described by Love and Resnick (1983). Rather, the pottery appeared to have been manufactured using traditional indigenous manufacturing techniques and locally available raw materials. Thus, although the widespread adoption of pottery appears to have occurred during the Mission period, it does not appear to have resulted from direct contact with or influence from European settlers in the area.

The above model explores the conditions under which indigenous peoples in the Los Angeles coastal area may have adopted ceramic-container technology during the Mission period independently of direct Hispanic influence. Large-scale depopulation, social instability, and circumscription of traditional catchment territories may have forced changes in longstanding indigenous social patterns and subsistence practices. Consequently, pottery vessels were adopted to accommodate exploitation of different food resources, many of which required longer cooking times for which baskets and organic containers would have been poorly suited (after Eerkens 2004). Ceramic cooking utensils would have been necessary to process many foodstuffs that had been traditionally regarded as undesirable or inferior. This model requires additional testing using ceramic data from other sites in the Los Angeles coastal area.

Playa Vista Historical-Period Artifacts

Karen K. Swope and John G. Douglass

Historical-period artifacts of nonindigenous manufacture offer a unique vantage point for understanding the economy, behavior, and events of the Historical period. Historical period artifacts from the PVAHP range in date from the late eighteenth century to the early twentieth century and are from distinct contexts. Late-eighteenth- and early-nineteenth-century artifacts hail from aboriginal contexts at two archaeological sites in the project area, LAN-62 and LAN-211. Artifacts dating to this period from LAN-62 were recovered from a large, dense Native American burial area containing hundreds of interments. These Historical period artifacts were, in many cases, recovered alongside aboriginal artifacts in burial contexts, nonburial features, or the surrounding three-dimensional burial area. Historical period artifacts in the contemporaneous component of LAN-211 were found on an occupation surface in a primarily domestic context. In addition to these early Historical period artifacts, SRI also analyzed specific early-twentieth-century contexts at three sites: LAN-54, LAN-62, and LAN-193. All of these contexts are secondary trash deposits associated with the agricultural use of the project area prior to Hughes Aircraft Company. Further discussion of specific contexts is presented below, within each site discussion. It is important to note that these two broad time periods—the late eighteenth and early nineteenth centuries and the early twentieth century—are distinct from each other and represent two specific time periods in the history of occupation in the project area: aboriginal and early Hispanic occupation and use during the Mission period and early development during the American period, prior to project area use by Howard Hughes. Additional early Historical period artifacts (glass beads), primarily from the Mission period, with a few from the subsequent Rancho and American periods, are described and discussed by Lester Ross in Chapter 6 of this volume.

The Historical period artifacts collected from LAN-193, LAN-54, LAN-62, and LAN-211 were analyzed by Greg Johnson and Marlesa A. Gray at SRI's offices in Tucson, Arizona, and the Playa Vista field laboratory. Anne Q. Stoll previously had accomplished preliminary analysis on the materials from LAN-54 and LAN-193 in the SRI Redlands, California, office. The analysts employed standard historical-archaeological methods to identify 3,402 artifacts: 853 glass artifacts, 1,206 Historical period ceramics, 1,237 pieces of metal, and 106 "other" Historical period objects (Table 153 shows the distribution of artifacts by site). Historical period artifacts were categorized based on material and function. Diagnostic attributes of each artifact were noted, particularly temporally diagnostic characteristics. Indications of modification or use wear were documented.

Glass and ceramic artifacts were described as to vessel types, methods of manufacture, decorative techniques and motifs, and makers' marks. Terminology employed for bottle analysis follows Putnam (1965), Herskovitz (1978:4–5), Jones and Sullivan (1985:71–123), and Fike (1987:8, 10). Bottle-makers' marks were identified in reference to Toulouse (1971), Wilson and Wilson (1971), and Peterson (1992).

Metal artifacts were recorded based on metal type, morphology, function, and diagnostic attributes. Other material categories were identified and described according to function as appropriate.

Historical period artifact descriptions appearing in this report take the form of direct transcriptions of wording found on the artifacts. Glass and ceramic embossments, makers' marks, and other identifiers appear here enclosed in quotation marks to indicate that the wording is reproduced exactly as it appears on the artifact, without regard to rules of punctuation. Where a word is known but only a portion of it is preserved, the missing portions are shown in brackets. Brackets also contain descriptions of figural embossments. Where missing letters remain unknown, the break in text is indicated with ellipses. Separate lines of wording are divided by a single slash, and lines of wording appearing on different parts of an artifact (such as bottle body and base) are divided by a double slash. Italics are used to indicate wording that originally appeared in cursive lettering.

In addition to the Historical period artifacts of nonindigenous manufacture reported in this section, other artifacts produced and used during the Historical period (including faunal remains, shell, and glass beads) are discussed separately in other chapters of this volume.

Table 153. Analyzed Historical Period Nonindigenous Artifacts, by Site

Site	Glass	Ceramic	Metal	Other	Total
LAN-193	241	587	738	64	1,630
LAN-54	467	576	232	25	1,300
LAN-62	100	40	185	17	342
LAN-211	45	3	82	—	130
Total	853	1,206	1,237	106	3,402

LAN-193

In total, 1,630 Historical period artifacts were recovered from three test units at LAN-193. These artifacts are summarized by category and context in Table 154. Diagnostic or otherwise notable artifacts are discussed by context and material category in the section below. All Historical period artifacts, including those that are only identifiable to material category, are summarized in Tables 155–164.

All analyzed contexts were from Feature 600, a large Historical period (early-twentieth-century) refuse deposit. Originally identified during archaeological monitoring of the V-Ditch (a drainage ditch) constructed in November 2000, this large feature subsequently underwent data recovery prior to the construction of the Riparian Corridor in 2005. During excavation, Feature 600 was determined to contain burned, in situ deposits. Test units were mechanically excavated alongside data recovery trenches to investigate these deposits. Two strata, containing cultural deposits representing discrete dumping episodes, were separated by sterile sand. In excavating the units, each stratum was removed separately. Based partially on analysis of Historical period photographs of LAN-193, Feature 600 is possibly a by-product of the Kitahata Hog Ranch, located at LAN-193 during the 1920s; it is certainly a pre-Hughes-era deposit, based on the analysis discussed below. The context and history of the Kitahata Hog Ranch is discussed in Volume 2 of this series as well as Chapter 12 of this volume, which details the faunal remains from Feature 600, among other contexts. As discussed below, this dump may be related to the by-products of feeding the hogs with restaurant castoffs.

Test Unit 3004

Glass

One unembossed fragment of a milk-glass canning-jar-lid liner was recovered from Test Unit 3004. Glass liners were used with threaded zinc caps beginning in 1869 (Toulouse 1969:429–430), with the intent of solving problems resulting from contact between foods and unlined metal caps.

A clear cottage-cheese-jar fragment is marked “LOS ANGELES CREAM[ERY CO.]/LA/BRAND/[Co]ttage Chees[e]”. The Los Angeles Creamery was in operation at least as early as 1906 (Guinn 1915) and had become the largest dairy in southern California by the time of its merger with the Golden State Milk Products Company in 1928 (California Creameries 1928).

Several condiment jars are represented in the collection from Test Unit 3004. One specimen has 10 vertical panels and bears the mark “CAL. PACK CORP”. The California Packing Corporation was incorporated in 1916 and operated under this name until it became the Del Monte Corporation in 1967 (Del Monte Corporation 2007). The maker’s mark on part of one condiment jar indicates manufacture between 1902 and 1930 (Toulouse 1971:268). Another condiment-jar fragment is marked “Premier” on its shoulder, and a maker’s mark by the Owens Bottle Company on the base of this container indicates that it was produced between 1911 and 1929 (Toulouse 1971:393). A complete food jar bears a base embossment indicating manufacture by the Illinois Pacific Glass Company between ca. 1901 and 1930 (Toulouse 1971:269–270). A complete, clear jar bears a base embossment from the Hazel-Atlas Glass Company dating it to between 1920 and 1964 (Toulouse 1971:239). A complete condiment jar bears an unidentified maker’s mark, and portions of another condiment jar were recovered. An unmarked, fragmentary, clear-glass bottle probably held a soft drink.

One pressed-glass tumbler base is marked “H” and remains unidentified. Other tumbler fragments are hexagonal, fluted, or nondiagnostic. Portions of four pressed-glass stemware vessels were recovered. A clear-glass, handled-cup fragment exhibits eight vertical flutes with hobnails around the rim. Fragmentary pressed-glass bowls bear a pressed floral design, molded diamonds, and vertical flutes. Portions of a pressed-glass bowl and lid were recovered. The peak of pressed-glass production in America was between 1840 and 1900 (Drepperd 1944:105).

Medicine containers are represented in the Test Unit 3004 collection by both bottles and ampoules. Medicine containers include fragments of a cobalt-blue bottle bearing the embossment “[BROM]O-SELTZER/EM[ERSON]/DRU[G CO.]/BALTIMORE, MD.”. The Bromo-Seltzer Company sold this product beginning in 1888 (Wilson and Wilson 1971:107). A complete, aqua medicine bottle with a packer

Table 154. Analyzed Historical Period Artifacts from LAN-193

Context	Glass	Ceramic	Metal	Other	Total
EU 3004	175	537	724	40	1,476
EU 3005	60	48	14	23	145
EU 4006	6	2	—	1	9
Total	241	587	738	64	1,630

Table 155. Glass Artifacts, by Site and Form

Form	LAN-193	LAN-211	LAN-54	LAN-62	Total
Bottle	102	14	334	47	497
Bottle/jar	48	—	3	2	53
Indeterminate	1	11	1	10	23
Jar	37	—	13	8	58
"Jewel"	—	—	—	1	1
Lamp part	1	—	—	—	1
Lightbulb	—	—	1	1	2
Other	3	—	1	5	9
Projectile point	—	1	—	1	2
Tableware	25	—	28	1	54
Unidentified	22	19	58	24	123
Window	2	—	28	—	30
Total	241	45	467	100	853

Table 156. Glass Artifacts, by Site and Content

Content	LAN-193	LAN-211	LAN-54	LAN-62	Total
Beverage	1	—	—	—	1
Bitters	—	—	12	—	12
(Bitters)	—	—	2	—	2
Chili powder	—	—	—	1	1
Cleaning solution	1	—	—	—	1
Condiment/sauce	7	—	12	3	22
Cosmetics	—	—	—	1	1
Food	1	—	—	—	1
Liquor	—	—	8	—	8
Medicine	19	—	5	4	28
Milk	1	—	9	—	10
Other	—	—	—	1	1
Perfume	1	—	2	—	3
Preserves	—	—	8	—	8
Salt/pepper	—	—	4	—	4
Shaving cream	—	—	—	1	1
Soft drink	2	—	12	4	18
Unknown	207	44	383	83	717
Wine/champagne	1	1	10	2	14
Total	241	45	467	100	853

Table 157. Glass Artifacts, by Site and Function

Function	LAN-193	LAN-211	LAN-54	LAN-62	Total
Communication	—	—	1	—	1
Construction	2	—	28	—	30
Food preparation/consumption	22	—	24	1	47
Food/beverage storage	33	16	189	17	255
Food/beverage storage, personal	—	4	—	—	4
Food/beverage storage, weaponry	—	—	—	1	1
Household furnishings	1	—	—	—	1
Household maintenance	1	—	—	—	1
Leisure/recreation	1	—	—	4	5
Lighting	—	1	1	1	3
Medical and health	18	—	15	4	37
Personal	1	—	—	4	5
Unknown function	162	23	209	67	461
Weaponry	—	1	—	1	2
Total	241	45	467	100	853

Table 158. Ceramic Artifacts, by Site and Vessel Ware/Form

Vessel Form, by Ware	LAN-193	LAN-211	LAN-54	LAN-62	Total
			Nonvitreous		
Brown-bodied					
Bowl	—	—	1	—	1
Unidentified	4	—	—	—	4
Subtotal	4	—	1	—	5
Red-bodied					
Bottle	—	—	—	1	1
Crock	—	—	10	—	10
Flowerpot	1	—	1	—	2
Other	1	—	3	—	4
Saucer	2	—	—	—	2
Unidentified	7	—	5	—	12
Subtotal	11	—	19	1	31
White-bodied					
Bowl	50	—	2	3	55
Crock	2	—	35	1	38
Cup	13	—	12	1	26
Plate	10	3[a]	13	2	28
Saucer	3	—	—	—	3
Unidentified	65	—	100	5	170
Subtotal	143	3	162	13	320
Nonvitreous subtotal	158	3	182	14	355
			Semivitreous		
Stoneware					
Crock	1	—	17	2	20
Cup	2	—	4	1	7
Pitcher	—	—	1	—	1

Vessel Form, by Ware	LAN-193	LAN-211	LAN-54	LAN-62	Total
Unidentified	4	—	1	—	5
Subtotal	7	—	23	3	33
Indeterminate					
Bottle	—	—	1	—	1
Bowl	2	—	—	—	2
Unidentified	1	—	—	—	1
Subtotal	3	—	1	—	4
Semivitreous subtotal	10	—	24	3	37
			Vitreous		
Hotelware					
Bowl	35	—	15	9	59
Cup	11	—	14	1	26
Other	3	—	8	—	11
Pitcher	—	—	1	1	2
Plate	17	—	109	3	129
Saucer	4	—	12	1	17
Unidentified	56	—	197	1	254
Subtotal	126	—	356	16	498
Hard-paste porcelain					
Bowl	4	—	—	1	5
Cup	23	—	—	—	23
Doll	—	—	—	1	1
Insulator	—	—	2	—	2
Other	1	—	—	—	1
Plate	1	—	3	3	7
Saucer	2	—	1	—	3
Teapot	1	—	—	—	1
Unidentified	56	—	6	1	63
Subtotal	88	—	12	5	106
Soft-paste porcelain					
Other	2	—	—	—	2
Tile	1	—	—	—	1
Subtotal	3	—	—	—	3
Vitreous subtotal	217	—	368	21	607
			Unidentified		
Unidentified					
Button	1	—	—	—	1
Flowerpot	—	—	—	1	1
Marble	1	—	—	—	1
Other	—	—	2	—	2
Plate	—	—	—	1	1
Unidentified	200	—	—	—	200
Subtotal	202	—	2	2	206
Unidentified subtotal	202	—	2	2	206
Total	587	3	576	40	1,206

[a] Includes one majolica (tin-glazed) sherd.

Table 159. Ocean Park Ceramic Artifacts, by Site and Vessel Form

Form	LAN-193	LAN-54	Total
Bowl	—	14	14
Cup	4	24	28
Other	—	8	8
Pitcher	—	1	1
Plate	2	116	118
Saucer	—	12	12
Unidentified	1	224	225
Total	7	399	406

Table 160. Ceramic Artifacts, by Site and Function

Function	LAN-193	LAN-211	LAN-54	LAN-62	Total
Clothing/clothing maintenance	1	—	—	—	1
Commerce	—	—	—	1	1
Construction	2	—	5	—	7
Food preparation/consumption	559	3	485	35	1,082
Food/beverage storage	4	—	62	3	69
Heating/energy	2	—	—	—	2
Household furnishings	1	—	2	—	3
Leisure/recreation	1	—	—	—	1
Other function	1	—	1	1	3
Unknown function	16	—	21	—	37
Total	587	3	576	40	1,206

Table 161. Metal Artifacts, by Site and Description/Type

Description/Type	LAN-193	LAN-211	LAN-54	LAN-62	Total
Aluminum foil	6	—	—	—	6
Animal tack					
Buckle	—	—	1	4	5
Horseshoe	—	—	2	1	3
Subtotal	—	—	3	5	8
Automotive part	—	—	1	—	1
Awl	—	—	—	4	4
Bell	—	—	—	3	3
Bell clapper	—	—	—	2	2
Bottle top					
Cover	7	—	—	—	7
Crown cap	178	—	55	1	234
Screw-on	2	—	—	—	2
Unidentified	—	—	—	1	1
Subtotal	187	—	55	2	244
Canister					
Aspirin tin	1	—	—	—	1
Key-open can	3	—	—	—	3

Description/Type	LAN-193	LAN-211	LAN-54	LAN-62	Total
Sardine	3	—	—	—	3
Unidentified	185	—	3	1	189
Subtotal	192	—	3	1	196
Canister key, key-open can	1	—	—	—	1
Chain	1	—	—	—	1
Clothing fastener					
Buckle	—	—	—	2	2
Button	—	1	—	21	22
Safety pin	4	—	—	—	4
Subtotal	4	1	—	23	28
Coin (dime)	—	—	1	—	1
Construction fastener					
Bolt	1	—	—	1	2
Bolt or pin	—	—	1	—	1
Eye bolt	1	—	—	—	1
Grommet	—	—	12	—	12
Nut	4	—	—	—	4
Rivet	3	—	3	—	6
Square-head bolt	1	—	—	—	1
Washer	1	—	—	—	1
Welding rod	—	—	—	1	1
Wood screw	—	—	1	—	1
Subtotal	11	—	17	2	30
Container					
Chocolate pot	—	—	—	2	2
Enamelware	—	—	—	2	2
Unidentified	—	—	—	4	4
Subtotal	—	—	—	8	8
Electrical component	2	—	—	1	3
Fishing weight	—	—	—	1	1
Hardware					
Chain	2	—	—	—	2
Hinge	—	—	—	2	2
Hollow pin	—	—	1	—	1
Iron strap	—	—	1	5	6
Ring/grommet	—	—	—	1	1
Unidentified	1	—	—	—	1
Valve part	—	—	1	—	1
Washer	3	—	—	—	3
Wheel/machinery hub	—	—	1	—	1
Wire	34	—	12	4	50
Subtotal	40	—	16	12	68
Indeterminate	—	—	1	4	5
Jewelry/personal item					
Eyelet	—	—	—	2	2
Pendant	—	—	—	2	2
Rope-style chain	—	1	—	—	1
Subtotal	—	1	—	4	5

continued on next page

Description/Type	LAN-193	LAN-211	LAN-54	LAN-62	Total
Key	—	—	—	1	1
Machine part, nonautomotive	—	—	2	—	2
Nail					
Box	—	—	—	1	1
Brad	—	—	4	—	4
Common	205	22	51	13	291
Other	3	—	—	—	3
Roofing	—	—	1	—	1
Spike	—	—	2	—	2
Unidentified	3	35	12	27	77
Subtotal	211	57	70	41	379
Pipe	7	—	2	2	11
Point	—	—	—	2	2
Rod	—	—	—	1	1
Slag	—	—	—	7	7
Tool					
Hatchet/wedge	—	—	—	1	1
Hoe head	—	—	—	1	1
Pitchfork head	—	—	4	—	4
Scissors	—	—	—	1	1
Subtotal	—	—	4	3	7
Unidentified	70	23	51	48	192
Utensil					
Knife	2	—	—	—	2
Butter knife	1	—	—	—	1
Spoon	1	—	—	6	7
Fork	—	—	—	1	1
Pocketknife	1	—	1	—	2
Utensil handle	2	—	1	—	3
Subtotal	7	—	2	7	16
Weaponry					
Cartridge	—	—	1	—	1
Probable gun barrel	—	—	—	1	1
Probable shotgun shell	—	—	—	6	6
Shotgun shell	—	—	3	—	3
Subtotal	—	—	4	7	11
Total	738	82	232	191	1,243

Table 162. Nails, by Site and Type/Technology

Technology, by Type	LAN-193	LAN-211	LAN-54	LAN-62	Total
Box					
Wire	—	—	—	1	1
Subtotal	—	—	—	1	1
Brad					
Cut	—	—	1	—	1
Wire	—	—	3	—	3
Subtotal	—	—	4	—	4
Common					
Cut	—	—	3	—	3
Unidentified	148	20	14	2	184
Wire	57	2	34	—	93
Wrought and cut	—	—	—	11	11
Subtotal	205	22	51	13	291
Other					
Wire	3	—	—	—	3
Subtotal	3	—	—	—	3
Roofing					
Unidentified	—	—	1	—	1
Subtotal	—	—	1	—	1
Spike (over 6 inches)					
Unidentified	—	—	2	—	2
Subtotal	—	—	2	—	2
Unidentified					
Unidentified	3	35	12	27	77
Subtotal	3	35	12	27	77
Total	211	57	70	41	379

Table 163. Metal Artifacts, by Site and Function

Function	LAN-193	LAN-211	LAN-54	LAN-62	Total
Clothing/clothing maintenance	4	1	—	27	32
Commerce	—	—	1	—	1
Construction	211	57	70	41	379
Defense/hunting	—	—	4	9	13
Food preparation/consumption	7	—	2	15	24
Food/beverage storage	380	—	58	3	441
Heating/energy	2	—	—	1	3
Personal	—	1	—	9	10
Tools and hardware	50	—	37	19	106
Transportation	—	—	4	5	9
Unknown function	84	23	56	62	225
Total	738	82	232	191	1,243

Table 164. Other Historical Period Materials

Material Type	LAN-193	LAN-54	LAN-62	Total
Composite artifacts	5	—	—	5
Concrete	—	1	—	1
Fabric	13	—	—	13
Hard rubber	22	10	3	35
Leather	—	6	—	6
Mineral	11	—	—	11
Other	7	—	1	8
Paper	—	3	—	3
Plastic	1	1	—	2
Shell (modified)	—	—	1	1
Slag	—	—	1	1
Stone (modified)	—	—	1	1
Unidentified	2	4	1	7
Wood	—	—	1	1
Wood (modified)	3	—	8	11
Total	64	25	17	106

finish is embossed with a maker's mark of the Illinois Pacific Glass Company that was used 1902–1925 (Toulouse 1971:268–269). A complete, paneled patent-medicine bottle bears a maker's mark of the Illinois Glass Company of Alton, Illinois, employed between 1916 and 1929 (Toulouse 1971:264). Fragments of a milk-glass bottle bearing the otherwise unidentified embossment "BROMO" were recovered.

Two homeopathic vials or ampoules are represented by fragments; one is clear and measured 0.25 inches in diameter, and one is amber and measured 0.38 inches in diameter. The practice of homeopathy was widespread during the nineteenth century, and such vials have been commonly discovered in sites dating to this period. Tenets of the practice held that administration of a minute dose of a "remedy" that in a healthy person would cause the symptoms of the disease under treatment would affect a cure (Pastron 1981:315–316). A clear bottle that may have contained medicine is marked "O [in square]", a mark used by the Owens Bottle Company between 1911 and 1929 (Toulouse 1971:393). Other clear bottles that probably contained medicine bear unrecognized maker's marks: "LB [in diamond]" and "N".

One partial milk-glass jar possibly held cold cream or some other toiletry. By the late nineteenth century, many toiletries, cosmetics, ointments, and foodstuffs (such as cream cheese and mustard) were available in milk-glass jars. The period of greatest popularity for milk-glass containers has been estimated beginning in the 1870s (Welker and Welker 1985:7) or 1890s (White 1979:124), and the use of milk glass was common until about the turn of the twentieth century. Small, pressed-glass jars typically feature threaded closures, which were introduced about 1920 (Lief 1965:26–29).

Other amber bottles were assigned to the household-chemical category on the basis of their color. One has an octagonal body. This bottle and shards of another bear maker's marks used by the Illinois Glass Company between 1911 and 1929 (Toulouse 1971:264, 393).

A portion of a pointed, hexagonal lamp dangle was recovered. Similar dangles were used on both candlesticks (Hayward 1962:Plate 73) and oil lamps dating from the mid- to late nineteenth century (Hayward 1962:Plates 95–96, 99–100; Hebard 1964:65, 68, 74–75). One extremely thin shard of colorless glass likely is from a lamp chimney or lightbulb.

Shards of clear privacy glass bearing floral and starburst patterns were also recovered. Also included in the glass collection from LAN-193 is one glass marble. Regardless of material, most marbles used in the United States at the turn of the twentieth century were made in Germany (Smith 1991:93). Marbles were produced cheaply and thus were inexpensive; an 1895 catalogue (Montgomery Ward & Company 1895:225) advertised a bag of 100 assorted marbles at a price of only 20 cents.

One fragment of melted black glass was recovered from the site, along with melted shards from clear bottles (one fluted). Termed "black glass," this bottle material is actually very dark olive-green or greenish amber. Burned material is expected, given that portions of Feature 600 were burned in place. This burning event may have been intense, considering the high temperature necessary to melt glass.

Ceramics

Five sherds representing at least two hotelware vessels bear decorations and/or maker's marks indicating manufacture by John Maddock & Sons, Burslem, Staffordshire, for use by the Ocean Park Casino in nearby Venice (see Table 159). The ware features a green band bordered by maroon lines at the rim.

Included are at least one cup and one plate. The company used this mark from 1870 to 1896 (Kovel and Kovel 1986).

Another hotelware sherd from an unidentifiable vessel form bears a Syracuse China mark indicating that it was manufactured in June 1920 (Lehner 1988:454–455).

At least three stoneware vessels are represented by four sherds bearing marks of the Homer Laughlin China Company, Ohio, and indicating manufacture in 1920 and 1921 (Gates and Ormerod 1980:129).

One porcelain vessel base exhibits a maker's mark reading "NORITAKE/M [in wreath]/HAND PAIN[TED]/MADE IN [JAPAN]", probably indicating manufacture from 1904 to 1945 (Kovel and Kovel 1986:74), although the same mark was used from 1953 to the present. The base of an unidentified porcelain vessel is marked "[crown]/GERMANY/-10. . .". This mark was used by the Rosenthal Glass and Porcelain Company after 1953 (Kovel and Kovel 1986:96).

One earthenware sherd with a geometric, polychrome transfer pattern bears the maker's mark "O.P.CO./SYRACUSE/CHINA/C-8", indicating manufacture by the New York manufacturer in August 1922 (Kovel and Kovel 1986:195, 251). American consumers had no ready source for color-decorated ceramics prior to about 1885 (Berge 1980:169). Before that time, color-decorated ceramics had been hand-painted and costly. The first transfer prints were applied to American ceramics around 1825 and were monochrome. Production of polychrome wares began soon after that date but was not popular until about 1885 (Berge 1980:174). More than one ceramic manufacturer might have purchased and employed identical transfer patterns for application to their wares, rendering positive identification inconclusive in the absence of identifiable maker's marks.

A molded, decorative object is represented by one porcelain sherd with overglaze cloisonné decoration. Half of a ceramic doorknob exhibits a reddish-orange-clay body and brown slip glaze. Such doorknobs feature an Albany slip glaze and were known as "mineral" or "Bennington" knobs. Many of the mineral knobs were made in the East Liverpool, Ohio, potteries, in operation from 1840 to the present (Gates and Ormerod 1980:1). Unfortunately, the metal shank and the method of securing the shank to the spindle, more reliable chronometric indicators (Eastwood 1976:48, 94a, b), are absent. This context also yielded one white-clay marble. Common clay marbles were manufactured in Germany beginning in 1860; unfortunately, the production end date is speculative (Baumann 1970:32). Clay marbles were sometimes sold in sets of five, known as "five stones" (Hillier 1965:128).

A complete, white, hexagonal ceramic tile measuring 1 inch wide was recovered. One nail-through electrical fuse was recovered, and another fuse or insulator is represented by a fragment exhibiting an orange-clay body.

One gray, four-hole Prosser button measuring 22 lines was recovered. Prosser buttons are frequently mistaken for milk glass but actually are a type of ceramic produced since 1840 for use on underwear, work shirts, housedresses, and other utilitarian garments (Albert and Kent 1949:35; Storm 1976:118). Attempts have been made to determine clothing type from the button diameter (Carpenter 1980:6-2). In general, this button is larger than a standard shirt button and may have been used on a dress, a vest, or pants.

Metal

One sterling-silver butter knife with "PAT. 1895 [lion passant, anchor, winged uppercase "D"] STERLING" on the handle was recovered. The anchor part of the mark may indicate that the knife was manufactured in Birmingham, England. The letter "C" is monogrammed on the end of the handle. Five other metal utensils—two knives, one spoon, and two utensil handles—likewise were recovered from this unit.

In total, 178 crown-cap fragments, patented in 1892 (U.S. Patent No. 468,258), were recovered, along with 2 screw-cap fragments. Metal canister fragments included one canister key, at least three key-wind-can pieces, and one complete, hinged aspirin tin. Key-opened cans were first produced beginning in the mid-nineteenth century and most often contained canned meats, fish, and coffee (Fontana 1962:71).

In total, 208 nails or nail fragments were recovered from this unit, 57 of which were wire-cut. Wire-cut nails first appeared in the West after around 1900 (Fontana 1962:50).

Other

Forty artifacts representing "other" material categories were recovered from Test Unit 3004. Level 1 produced a single flat, perforated mica disk; 2 transparent mica disks; half of a four-hole wooden button with holes 0.85 inches in diameter; a battery interior 0.25 inches in diameter; a bone knife handle composed of two bone pieces attached by two rivets; and a mold-made figurine of a rabbit sitting upright. A piece of insulated, ferrous wire; a possible figurine base composed of plaster with traces of felt; a possible insulator composed of metal and ceramic; a stained piece of cancellous bone; and an indeterminate gray, roundish item were recovered from the same level. Thirteen clumps of decomposing cloth—4 gray, 1 brown, and 8 white—were found in both levels (the white cloth occurred only in Level 1), as were 7 fragments of red, blue, or black hard rubber. Both halves of a burned bottle cork were collected from Level 2.

Test Unit 3005

Glass

Milk-glass canning-jar-lid liners are represented by fragments embossed "[BO]YD'S GENUINE [PORCELAIN LINED CAP]" and "FOR MASON JARS". Fragments of one clear food jar from this unit exhibit a continuous-thread closure introduced in about 1920 (Lief 1965:26–29). The base of a colorless-glass condiment jar bears the embossment

"GELFAND'S/[indeterminate mark]/BALTIMORE"; the product and manufacturer remain unidentified. Another reads "BEST/FOODS/REG."; Best Foods mayonnaise was introduced in 1922 (Periodical Publishers Association 1934:16). Another condiment-bottle base is marked "H. J. HEINZ Co./221/3["O" IN SQUARE]5/PA . . .", a mark used by the Owens Bottle Company from 1911 to 1929 (Toulouse 1971:393). A fragmentary condiment bottle marked "Premier" on its shoulder likely dates between 1911 and 1929. The neck and finish of an aqua bottle appears to be a Coca-Cola bottle manufactured after 1915 (The Coca-Cola Company 1999). A complete, clear, cylindrical bottle appears to have held liquor.

A pressed-glass tumbler fragment exhibits a molded sunburst pattern; others have 12 vertical panels or are nondiagnostic. The handle of a bar-glass beer mug was recovered. One pressed-glass, lidded and footed bowl is represented by two shards.

Fragments of two other colorless bottles bear a mark used by the Owens Bottle Company between 1911 and 1929 (Toulouse 1971:393). A complete, clear, square bottle that may have held medicine was made by the Long Beach Glass Company between 1920 and 1933 (Toulouse 1971:318). A fragment of a small, rectangular bottle bears the maker's mark of the Illinois Glass Company of Alton, Illinois, dating 1916–1929 (Toulouse 1971:264). Fragments of a clear-glass medicine ampoule were recovered; the vessel measured 0.45 inches in diameter.

A clear, paneled bottle bears the embossment "A. S. Hind's/Co/[logo]/Portland/Maine USA" and retains its white metal cap. Although the product that this bottle contained cannot be identified, the Hind's company produced Honey and Almond Complexion Cream in a similar bottle beginning in 1875 (Fike 1987:92).

Amber bottle shards bear a maker's mark used by the Illinois Glass Company between 1911 and 1929 (Toulouse 1971:264) and may represent a household-chemical bottle. The thumb handle from a large-capacity, clear bottle was recovered.

Ceramics

Feature 3005 yielded two sherds of a cup made for the Ocean Park Casino by John Maddock & Sons, Burslem, Staffordshire.

Metal

Test Unit 3005 produced three wire-cut nails, all likely postdating 1900 (Fontana 1962:50). A four-tine fork decorated with stamped lines was also recovered from this unit.

Other

Twenty-three artifacts representing "other" material categories were recovered from Test Unit 3005: 2 flat, transparent disks (probably mica); the plastic mouthpiece of a smoking pipe; 2 wooden pencil fragments, split lengthwise; 15 fragments of red, hardened rubber, possibly from a ball; and 3 pieces of the Bakelite portion of a screw-in fuse. Bakelite, the first plastic composed of synthetic components, was patented in 1909 (U.S. Patent No. 942,809).

TR 4006

Glass

A complete, clear-glass bottle with partial metal cap is embossed "HORLICK'S/TRADE/m. m./MARK/MALTED MILK/RACINE-WIS-U.S.A.", with a base embossment of the Hazel-Atlas Glass Company dated 1920–1964 (Toulouse 1971:239). This milk-malt-wheat preparation fulfilled a need for easily transported and prepared food that did not require refrigeration. The product was marketed to the public largely through soda fountains and was also used extensively by military forces and exploratory groups (Zumwalt 1980:249). A complete condiment jar exhibits two concentric body ribs, is marked "Premier" on its shoulder and "K C" on its base, and likely dates between 1911 and 1929.

The base of a green champagne bottle is marked "V E"; the mark remains unrecognized. Maker's marks on one partial pressed-glass tumbler indicate manufacture between 1920 and 1964 (Toulouse 1971:239).

A complete, amber bottle is marked "Lysol" on its body in vertical script, with a base embossment of "LYSOL INCORPORATED/BOTTLE MADE/IN U S A/BLOOMFIELD, N.J.". The familiar Lysol product was introduced by the 1890s and continues in production today.

A complete, rectangular, clear bottle appears to have contained perfume.

Ceramics

Only one ceramic artifact was recovered from TR 4006. This hotelware-coffee-cup fragment bears the mark "QMC" for the U.S. Army Quartermaster's Corps.

Summary of Historical-Period Artifacts Recovered from LAN-193

Overall, most of the Historical period artifacts from LAN-193 relate to storage or consumption of foods and beverages, although significant numbers also were used for construction or medical purposes. The miscellaneous material culture was composed mostly of materials relating to energy/heating. All of the units likely postdate 1920, and most of the materials seem to date to the 1920s–1930s. The restaurant ware from the Ocean Park Casino was manufactured earlier than this period but appears to have been dumped at LAN-193 during the 1920s–1930s. The lack of alcohol bottles in the deposit also suggests this period, because prohibition was in place between 1919 and 1933. Finally, it is important to note that although there were a number of nails in the deposit, there was no evidence of construction debris. Nails may have been in boards that were burned in the deposit, but noncombustible construction material was absent, suggesting that the deposit may have originated from restaurants or other food-serving establishments. This possible conclusion will be discussed further at the end of this chapter.

LAN-54

In total, 1,300 Historical period artifacts were recovered from a single feature, Feature 33, at LAN-54. Feature 33 is a dense concentration of prehistoric and Historical period artifacts. It is likely that the prehistoric artifacts were from the surrounding archaeological site and were redeposited with the Historical period artifacts during the early twentieth century. The feature contained a mixture of Historical period items, primarily domestic in nature. There was a variety of intact glass bottles and ceramic vessels present, suggesting that the Historical period component of this feature was intact. The Historical period artifacts from Feature 33 include 467 pieces of glass, 576 ceramics, 232 pieces of metal, and 25 other artifacts. Diagnostic artifacts are discussed by context and material categories in the section below. The feature was excavated and cleared by hand, and all artifacts were recovered for analysis. All Historical period artifacts, including those that are only identifiable to material category, are summarized in Tables 155–164.

Glass

Level 1 contained an amber base shard from a bottle of Angostura Bitters manufactured by C. W. Abbott & Company, Baltimore, Maryland (Fike 1987:50). Angostura is a town in Venezuela where Siegert, its creator, was stationed as surgeon general of the military hospital. The product, said to cure stomach disorders, was marketed in the United States as early as 1850 (Fike 1987:50). It continues in production today and is used in cocktails and Caribbean cooking (Angostura Aromatic Bitters 2009). Part of another amber bottle from Level 1 is embossed “LASH’S/KIDNEY/AND/LIVER/BITTERS//THE BEST CATHARTIC/AND BLOOD PURIFIER”. This laxative preparation was produced from 1884 to 1905 (Fike 1987:37–38).

Two aqua bottles are represented by shards embossed “GIN/BITTERS”, which could be the mark of any of a number of distillers that marketed the product. Other marks that remain unidentified include “WICKSON”.

Shards of a light-green bottle are embossed “[RU]SSEL[’S]/[PEPSIN/CALI]SAYA [BITTERS]”; another shard of the same bottle was recovered from Level 4. The Dr. Russell Med. Co. was established in 1890. The name of this product was changed to Augauer Bitters. It contained 35 percent alcohol and was touted as a treatment for stomach disorders and multiple other complaints (Fike 1987:30).

A surprising number of the bottles from Feature 33, Level 1, once held ketchup, Worcestershire sauce, pepper sauce, or other condiments. Four are embossed “[CU]RTICE BROTHERS CO./PRESERVERS/[ROCHESTER, N.Y.]”. These sauce bottles date between 1867 and 1921 (Toulouse 1971:150–151). An identical bottle is unembossed. An aqua bottle fragment embossed “WORCESTERSHIRE SAUCE//LEA & PERRINS” remains undated because of the absence of its base and finish. The sauce has been sold in the United States since 1838, but only since 1849 has it been available west of the Mississippi River (Zumwalt 1980:269–271).

One fragment of a small, oblong bottle may have held tooth powder. Two clear-glass bottle bases are embossed “BB Co.”, indicating manufacture by the Berney-Bond Glass Company of Pennsylvania, ca. 1900 (Toulouse 1971:70).

One complete, aqua soda-water bottle is embossed “N” on its base, the meaning of which is unknown.

Glass tableware from Feature 33, Level 1, includes the stems of two wine glasses, one hexagonal in cross section, and a fragment of a candy or nut bowl.

Level 2 of this provenience yielded only 17 glass shards representing 10 vessels. Fragments of 2 clear-glass medicine bottles were embossed “THOMAS ECLECTRIC[sic] OIL//FOSTER MILBURN CO.//INTERNAL AND EXTERNAL”. Dr. S. N. Thomas of Canada claimed that his formulation was the “greatest household remedy for pain.” Advertisements claimed that “no household [was] safe without it for Sudden Attacks of Pain or Accidental Injuries.” Foster and Milburn were wholesalers who operated in Canada and the United States between 1860 until at least the 1890s (Wilson and Wilson 1971:90,141). A complete, clear medicine bottle is embossed “3iv” with graduated measurements. A milk-glass canning-jar-lid-liner shard is unembossed.

Feature 33, Level 3, yielded several diagnostic glass artifacts. A complete, sun-colored-amethyst jar is embossed “VASELINE/CHESEBROUGH/NEW YORK”. These jars were made in both clear and amber glass after 1908 (Fike 1987:56). The company sold a variety of preparations in the jars. Two aqua bottle finishes bear continuous-thread closures, first introduced about 1920 (Lief 1965:26–29). One olive-green wine-bottle fragment was recovered.

Clear canning-jar shards are embossed “PERFECT/MASON” and “Bal[l]” (in script). The company used this mark between 1915 and 1935 (Toulouse 1969:37–38). Level 3 also included one whole milk-glass canning-jar-lid liner. A body shard from a clear bottle measuring 2 inches in diameter bears graduated markings “5”, “6”, and “7” and may be a baby-nursing bottle.

Part of at least three clear-glass tumblers exhibit facets at the foot, and the stems of three wine glasses were recovered. The bases of two small bar glasses (probably shot glasses) are pressed into 10 facets. A fragmentary, pressed-glass salt or pepper shaker exhibits a floral pattern and rows of vertical hobnails at its corners. A fragmentary bottle stopper was identified. Fragments of at least two other pressed-glass objects are embossed with a floral pattern or bumps. Parts of one undecorated tumbler were recovered.

Also from this provenience was recovered a broken vacuum-tube base. Fragments of clear privacy glass were recovered. Four clear shards from this provenience are thermally altered.

Feature 33, Level 4, yielded an assortment of diagnostic glass artifacts. A complete, aqua soda-water bottle is embossed "LOS ANGELES ICE & COLD STORAGE CO/BOTTLE IS NOT SOLD LOS ANGELES CAL.". The company began operations in 1895 and continues today as the Los Angeles Cold Storage Company. Their ice business was discontinued after home refrigerators outpaced iceboxes (Los Angeles Cold Storage Company 2008). The bottle likely contained soda water. One complete soda-water bottle marked "OCEAN PARK ICE CO. SANTA MONICA CAL./BOTTLE IS NOT SOLD" remains undated; the Imperial Ice Company is known to have operated in the area, but no references to the name were found on this bottle. Another complete aqua bottle has a blob-top finish and likely held soda water. Amber bottle shards marked "RED RAVEN" are from a bottle of aperient water.

Two (one complete and one partial) clear sauce bottles are marked "CURTICE BROTHERS CO./PRESERVERS/ROCHESTER, N.Y." and date between 1867 and 1921 (Toulouse 1971:150–151). Portions of two clear-glass stoppers from Lea & Perrins Worcestershire Sauce bottles were recovered, as well as one complete and two fragmentary aqua bottles from the same manufacturer. The two colors of sauce bottles are not temporally distinct. One shard of another aqua bottle stopper was recovered. Part of a clear-glass milk bottle is embossed "SANTA MONICA DA[IRY]/H. MICHEL/SANT[A MONICA DAIRY]". In 1887, Herman Michel bought a dairy at Seventeenth Street and Santa Monica Boulevard. Forty-five cows were kept at that location. Later, the business expanded, and Michel purchased 1,000 acres in the Ballona area (Gabriel and the Santa Monica Historical Period Museum 2006:93). Another colorless bottle shard is from a milk bottle.

An unmarked sun-colored-amethyst milk-bottle finish was identified. One aqua and one amber bottle base are marked "A. B. Co.", indicating manufacture by the American Bottle Company; the vessels likely held beer. The base of a wine bottle was identified, as well as shards from at least one other wine bottle. An aqua bottle fragment is embossed "WELCH BROTHERS/BURLINGTON, VT.". This company is known to have bottled maple syrup in 1914, when their product was evaluated as "borderline" quality (Wiley and Pierce 1914).

A green, bitters-style-bottle fragment is marked "GERSTLEY/RYE/ROSSKAM, GERSTLY & CO. PHILA.". Old Saratoga rum was produced by this company after 1934 (Odell 1999).

This provenience yielded fragments of six wine glasses. Shards of at least two clear, pressed-glass tableware vessels were identified. One shard of an octagonal tumbler was recovered, along with shards of another faceted tumbler.

The threaded, metal base of a lightbulb was recovered. Fragments of privacy glass were identified in this level. Four shards from Level 4 were thermally altered.

Feature 33, Level 5, yielded only nine glass artifacts representing four vessels. These include one clear-glass milk-bottle finish and portions of two other food or beverage containers. One shard of privacy glass also was recovered.

Ceramics

Feature 33 contained 576 Historical period ceramic artifacts; ceramics were represented in all five excavation levels. Three hundred ninety-nine sherds representing numerous hotelware vessels bear decoration and/or maker's marks indicating manufacture by John Maddock & Sons, Burslem, Staffordshire, for use by the Ocean Park Casino in Venice (see Tables 158 and 159). Decorations on the ware are characterized by molded relief and green and maroon rim bands. The company used this mark from 1870 to 1896 (Kovel and Kovel 1986). Vessels represented by the sherds include plates, bowls, cups, saucers, and platters.

A molded-relief stoneware-plate sherd bears an impressed maker's mark "GREENWOOD . . .". Greenwood Pottery was in operation from 1868 to the present (Kovel and Kovel 1986:177). Frequently, plain, white ceramics of the nineteenth and early twentieth centuries were decorated by molded relief, with vessels bearing raised geometric or floral motifs. Such decorations typically are found around rims and handles. Molded-relief decorations could be applied to or molded with the vessel (Gusset 1980:84). Period catalogues offered molded-relief wares at moderate prices.

The ceramic collection from LAN-54 includes 55 sherds representing a number of household-crockery vessels. The vessels represented ranged from 3.5 to 10.5 inches in diameter. These medium-sized crock fragments include both red- and white-bodied wares; two crock fragments exhibit Albany slip.

A variation of the well-known "Blue Willow" pattern of cobalt blue on a white ceramic body is represented on one sherd of an unidentified vessel type. Such wares may represent any one of numerous British- or American-manufactured wares produced as imitations of eighteenth-century Chinese-export porcelains.

Asian ceramics in the collection include a fragment from a hand-painted porcelain saucer bearing a fine blue and red floral pattern. Two other porcelain sherds represent unidentified Asian exports.

Included in the ceramic collection from LAN-54 are kaolin toilet fragments, two nail-through electrical insulators, and a red brick fragment. Fragmentary fire bricks bear impressed maker's marks reading "L.A.P.B.CO/28" (the Los Angeles Pressed Brick Company 1887–1926 [Gurcke 1987; Kelly and Kelly 1977]) and "COR . . ." (which could represent a number of bricks manufactured between 1907 and 1942)

(Gurcke 1987:220–223). Terracotta-flowerpot fragments represent at least one vessel measuring 8 inches in diameter.

Metal

A dime dating to 1905 was recovered from Level 3 of Feature 33, indicating that the materials in Levels 1–3 were deposited no earlier than 1905. Fifty-five crown caps, patented in 1892 (U.S. Patent No. 468,258), were recovered from Levels 3 and 4. These caps were used to close pressurized containers, especially soda bottles. A .22-caliber Union Metallic Cartridge/Remington cartridge, first produced in 1867, was recovered from Level 1. This cartridge postdates 1911, when the Union Metallic Cartridge Company amalgamated with Remington (Hogg 1982:151). A 12-gauge shotgun shell, probably manufactured by Winchester, was recovered from Level 3.

Other

Twenty-five artifacts representing "other" material categories were recovered from Feature 33. Level 1 produced a single fragment of a concrete pipe. Six pieces of hard, black rubber, possibly from a bicycle tire, and a small, unidentified fragment of deep-red plastic were recovered from Level 2. The third and lowest level produced 4 white, curved fragments of hard rubber; 6 leather-shoe fragments, likely from a child's shoe; 3 pieces of thick paper; and 4 plaster fragments, some with grooves.

Summary of Historical-Period Artifacts Recovered from LAN-54

Overall, Feature 33 appears to have been dominated by materials relating to food/beverage storage and consumption, most of which were likely associated with the Ocean Park Casino. Most notable among these artifacts are the large numbers of Ocean Park Casino ceramic-tableware fragments, the numerous soda and condiment/sauce bottles, and the crown bottle caps. Other notable artifacts, such as medicine-bottle shards and child's-shoe fragments, may be associated with the casino or may reflect a different use of the site. Most of the diagnostic Historical period artifacts from LAN-54 date to between ca. 1875 and 1925, which overlaps with the operation of the Ocean Park Casino. The Ocean Park Casino and its historical context are discussed at the end of this chapter.

LAN-62

In total, 342 Historical period artifacts were recovered from various contexts, including Mission period burials, at LAN-62 and are summarized in Table 165. The contexts included two control units, burial features, burial-area excavation units, and

Table 165. Analyzed Historical Period Artifacts from LAN-62

Context	Glass	Ceramic	Metal	Other	Total
Control units					
CU 141	1	—	—	—	1
CU 316	—	—	5	—	5
Subtotal	1	—	5	—	6
Burial features	6	3	85[a]	13	107
Burial Feature 159 (sitewide)	—	—	11	—	11
Burial Feature 229 (sitewide)	41	31	3	—	75
Burial Feature 608 (sitewide)	13	1	1	1	16
Subtotal	54	32	4	1	91
Excavation units (sitewide)	17	—	12	—	29
TR 8371 (sitewide)	2	—	—	—	2
Subtotal	73	32	27	1	133
Excavation units (burial area)	18	4	63	3	88
Feature 29 (burial area)	—	—	2	—	2
Subtotal	18	4	65	3	90
FB 3 (excavation units)	2	1	3	—	6
Total	100	40	185	17	342

[a] Some pieces were too fragmented to count.

several nonburial features. Diagnostic artifacts are discussed by context and material categories in the section below. Notable or diagnostic artifacts recovered from burial contexts are discussed thematically, and all of the Historical period artifacts from these features are described in detail in Table 166. The complete collection of Historical period artifacts from LAN-62, including those that are only identifiable to material category, is summarized in Tables 155–164. From the control units, only 1 diagnostic artifact was identified: a copper hinge fragment (Figure 174) likely belonging to a box from CU 316.

Historical period artifacts from LAN-62 hail from two distinct, broad contexts: (1) the aboriginal-burial area dating to the late eighteenth and early nineteenth centuries and (2) late-nineteenth- and early-twentieth-century pre-Hughes-era contexts. A broad discussion of these finds and their larger social and anthropological contexts are presented at the end of this chapter.

Burials

Thirty-three burial features and 1 unit containing isolated human remains yielded Historical period artifacts that were submitted to the historical analyst. Table 166 provides a complete list of all of these materials, organized by feature or unit number. Figure 175 illustrates the locations of the 33 burials containing analyzed Historical period artifacts. Artifacts that are particularly diagnostic as to chronology or function are described in detail below.

Artifacts probably associated with defense or hunting were recovered from eight different burials. Burial Feature 6 and EU 183 (Level 58) produced a small shard of colorless glass fashioned into a flaked projectile point (Figure 176). Burial Feature 10 included an iron point that probably was modified from a wrought-iron spike. A complete iron hatchet/wedge, which may have functioned as a weapon and/or as a woodworking tool, was recovered from burial Feature 38 (Figure 177). This item measured 3 by 1.75 by 0.625 inches. A heavy iron point, 3.25 inches long and 0.56 inches in diameter and circular in cross section, was found in burial Feature 155. Fragments of iron knives were found in burial Features 223 (Figure 178), 438, and 565. These blades, which likely also served a culinary function, all retained at least a portion of their handle tangs, and none preserved the tip. Finally, one probable gun-barrel fragment and two pieces of iron tubing rusted together (also possibly parts of a gun barrel) were recovered from burial Feature 313.

Historical period artifacts that may reflect the occupations or interests of the interred individuals were recovered from eight burials. Burial Feature 5 produced a single piece of slag or melted metal, and six pieces of slag were recovered from burial Feature 33, suggesting that these individuals may have been involved in metalworking. Three fragments of what appears to be a single iron awl with a bone handle were recovered from burial Feature 32, and the tip of an iron awl was found in burial Feature 56, perhaps indicating that sewing was an important activity for these two individuals. A complete iron hoe head (Figure 179), probably cast as a single piece, was recovered from burial Feature 438 (which also produced the iron knife fragment described above). Finally, an iron skeleton key (Figure 180) to a door-type lock was found in burial Feature 112, which also included a copper bell clapper (discussed below).

Artifacts tentatively identified with horses were recovered from four of the burials. Burial Feature 222 produced one possible horseshoe and a possible cinch buckle of heavy iron adhering to two iron loops, one iron circle, and several strands of shell beads. Other evidence of horsemanship may be seen in artifacts initially identified as bells or bell clappers that may have functioned as parts of the trappings of a Spanish-style saddle. A copper bell clapper (Figure 181) was found in burial Feature 112, a copper bell with an iron clapper was found in burial Feature 280 (Figure 182), and a brass-plated-lead bell clapper (Figure 183) was found in burial Feature 539. Bickford (1982:Figure 2) identified several metal ornaments that are very similar in appearance to the "bell clappers" as "*higos.*" This term, a Spanish word meaning "figs," is used to refer to the small, forged-metal ornaments that hung from the *anquera*, a leather saddle skirt used by Spanish and Mexican colonists during the seventeenth and eighteenth centuries (Bickford 1982:15). These ornaments were most frequently produced of iron but occasionally were cast in bronze or brass.

Artifacts relating to dress and decoration were recovered from 10 of the burials. Burial Feature 33 produced a single animal tooth that perhaps served as decoration or costume. A copper or brass jewelry eyelet was found in burial Feature 155 (which also contained a metal point), and an iron jewelry eyelet was recovered from burial Feature 223, which also contained an iron knife fragment, an olive-green-glass-bottle shard, a bolt fragment, and a copper button (to be described later). A complete cobalt-blue solitaire-cut-glass jewel, most likely originally set into a piece of jewelry, was recovered from burial Feature 112, the same burial that produced a copper bell clapper and an iron skeleton key. A modified shell, most likely a Native-made shell button or bead, was found in burial Feature 170.

Two fused copper buckles (Figure 184), probably for clothing but possibly for horse tack, were recovered from burial Feature 50. Burial Feature 196 contained a whole, shank-style brass button with a cloth covering; burial Feature 227 held two fragments of a one-piece cast-copper button; and the fragmented remains of two complete metal buttons were found in burial Feature 461. Complete or fragmented specimens of cast-copper buttons whose shanks were each pierced with a single drilled hole were recovered from burial Features 313 (Figure 185), 223, 225, and 438. Historically, brass has been more commonly used in button manufacture than copper (Albert and Adams 1951:43–45). Drilled-eye cast buttons generally date between 1700 and 1850 (Hughes and Lester 1981:221). Buttons matching this description have been noted for civilian use in the colonies during the Revolutionary War era (Crummett 1939:93). Until the mid-1700s, buttons were not made

Table 166. Historical Period Artifacts in Burial Contexts at LAN-62

Context	Artifact Summary
Feature 5	1 piece of slag
Feature 6	1/2-inch shard of colorless glass modified to form a projectile point
Feature 10	1 iron point (probably a modified iron spike); 2 indeterminate metal fragments
Feature 32	3 metal/bone-awl fragments
Feature 33	1 animal tooth; 6 possible shotgun-shell fragments; 6 pieces of slag; 1 common nail
Feature 34	1 indeterminate metal fragment
Feature 38	1 metal hatchet/wedge; 2 indeterminate metal fragments
Feature 50	1 complete copper chocolate pot; 1 mostly complete tin(?) container; 2 fused-metal buckles
Feature 56	1 metal awl tip
Feature 110	1 indeterminate metal nail
Feature 112	1 cobalt-blue solitaire-cut-glass jewel; 1 copper bell clapper; 1 iron skeleton key (probably for a door)
Feature 155	1 iron dart point; 1 copper/brass eyelet (jewelry)
Feature 165	2 indeterminate metal fragments
Feature 170	1 modified shell (likely a Native-made shell button/bead)
Feature 178	1 indeterminate metal fragment
Feature 196	1 whole, shank-style brass button with cloth covering
Feature 222	1 possible horseshoe; 4 heavy metal fragments (likely from a cinch; strands of shell beads also are attached); 4 indeterminate iron hardware fragments; 4 indeterminate metal fragments
Feature 223	1 olive-green-glass-bottle shard; 1 complete cast-copper button (maybe tin plated); 1 iron knife fragment; 1 iron eyelet (jewelry); 1 copper/brass bolt fragment
Feature 225	1 whole cast-copper button (probably tin plated)
Feature 227	1 body sherd of a "Four Seasons" Chinese-porcelain rice bowl; 1 mostly complete salt-glazed-stoneware child/demitasse cup; 1 colorless-glass machine-made-bottle shard (with pontil scar); 1 olive-green-bottle shard (probably a wine bottle); 2 fragments of a one-piece cast-copper button
Feature 243	1 tiny green-glass shard (possible bead fragment)
Feature 265	1 complete copper chocolate pot (deformed base); 7 indeterminate metal fragments
Feature 278	1 charred and shaped wood fragment (no catalog number)
Feature 280	1 complete copper bell with an iron clapper
Feature 313	wood fragment (associated with textile, shell beads, and green-glass beads); wood fragment with a human-made drill hole; 1 cast-copper button; 2 heavy metal-pipe fragments rusted together (possible gun-barrel fragments); 1 probable gun-barrel fragment (glass and olivella beads inside the tube; wood fragments adhering to the outside); 1 indeterminate metal fragment
Feature 319	2 indeterminate metal fragments
Feature 376	2 indeterminate iron nail fragments
Feature 408	wood fragment (probably bark)
Feature 438	5 fragments of a cast-copper button; 2 indeterminate iron nail fragments; 1 iron knife fragment; 1 complete iron hoe head (probably cast as one piece)
Feature 461	2 complete metal buttons (fragmented)
Feature 477	1 body sherd of hard-paste-porcelain (Asian) vessel (indeterminate form) with blue starburst design on the exterior surface; 2 indeterminate metal fragments
Feature 539	1 brass and lead bell clapper
Feature 565	1 iron knife fragment
CU 163	6 wood fragments, likely modified

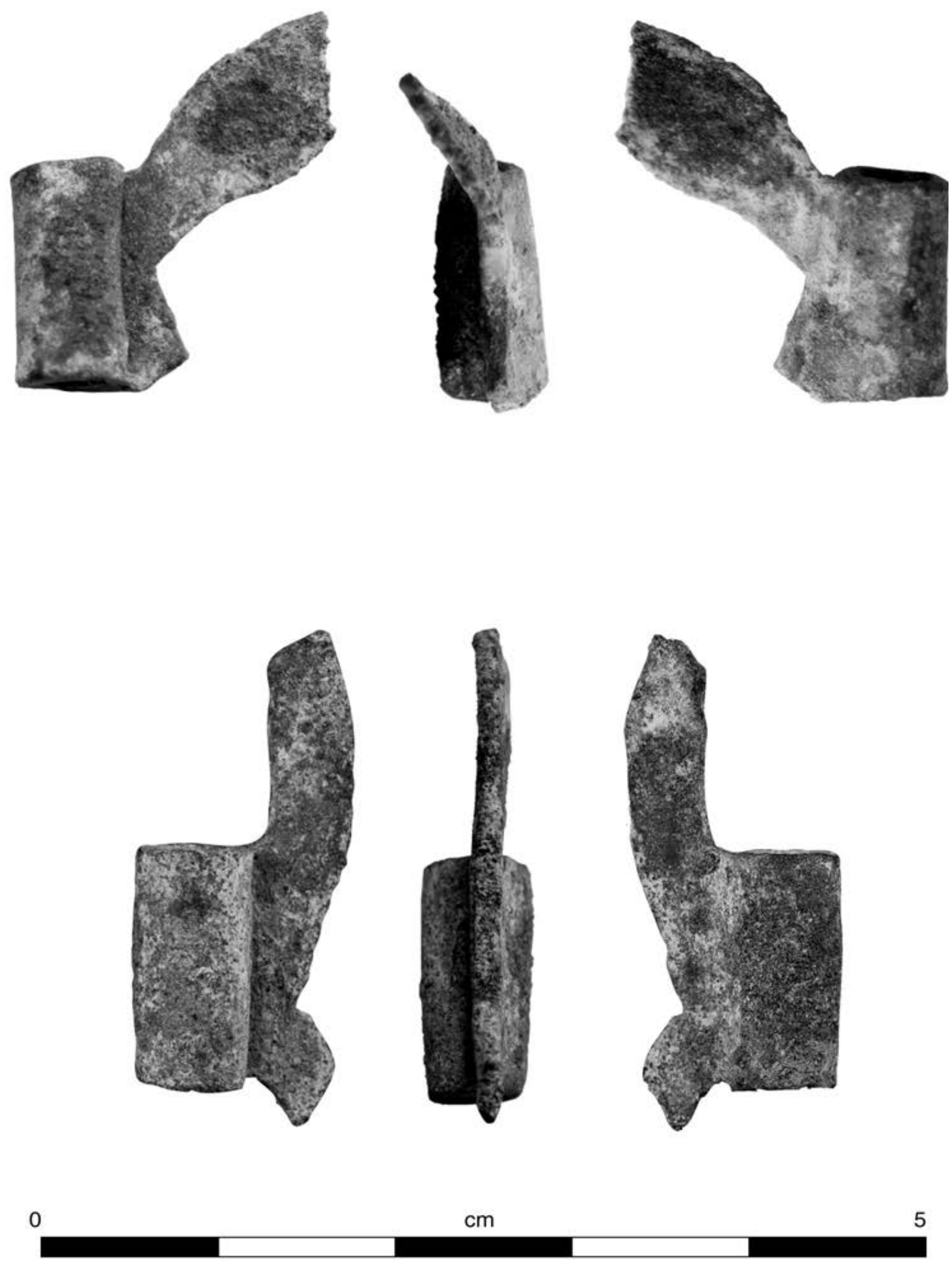

Figure 174. Copper hinge fragment from LAN-62, CU 316.

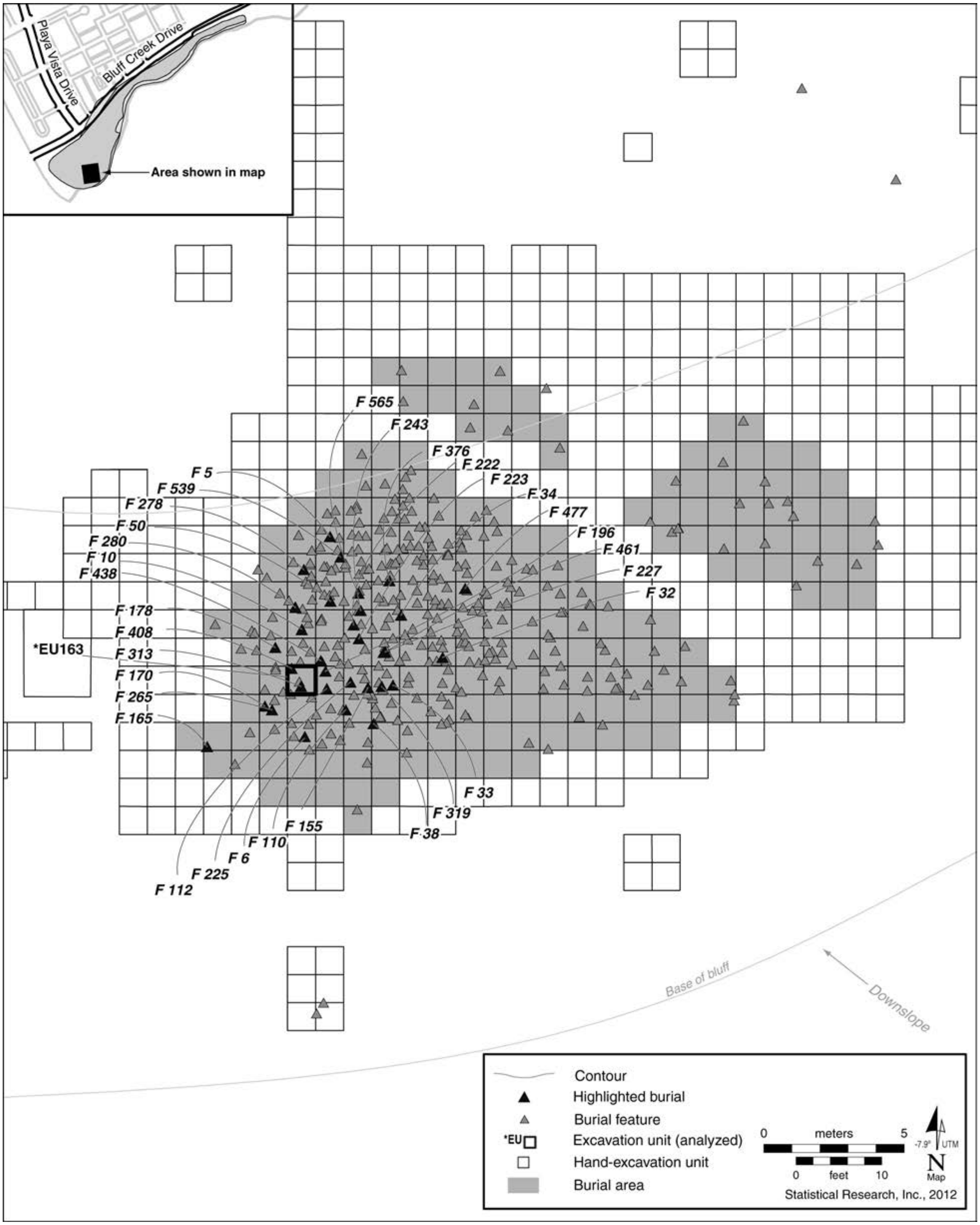

Figure 175. Map showing the locations of burials containing Historical period artifacts at LAN-62.

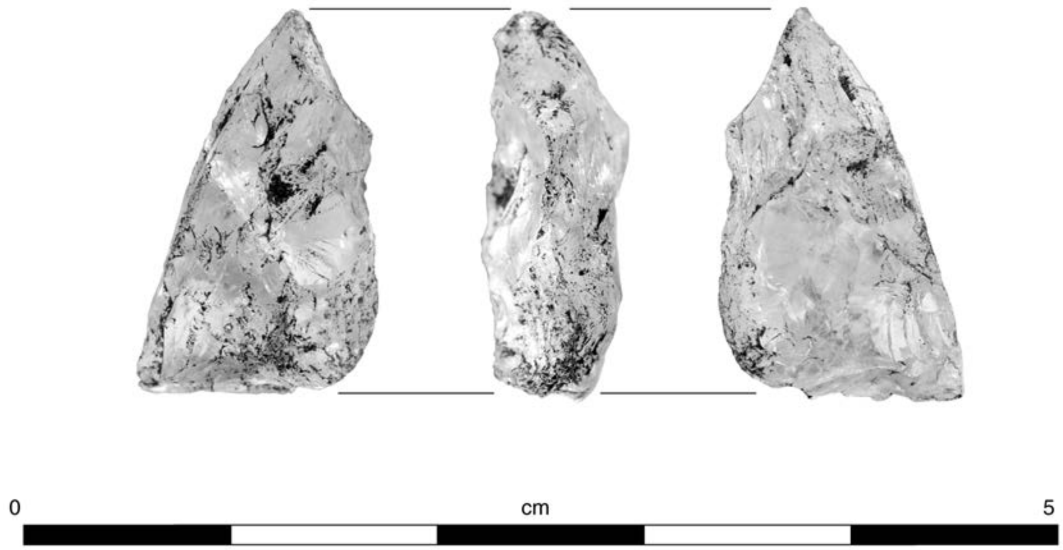

Figure 176. Glass projectile point from LAN-62, burial Feature 6.

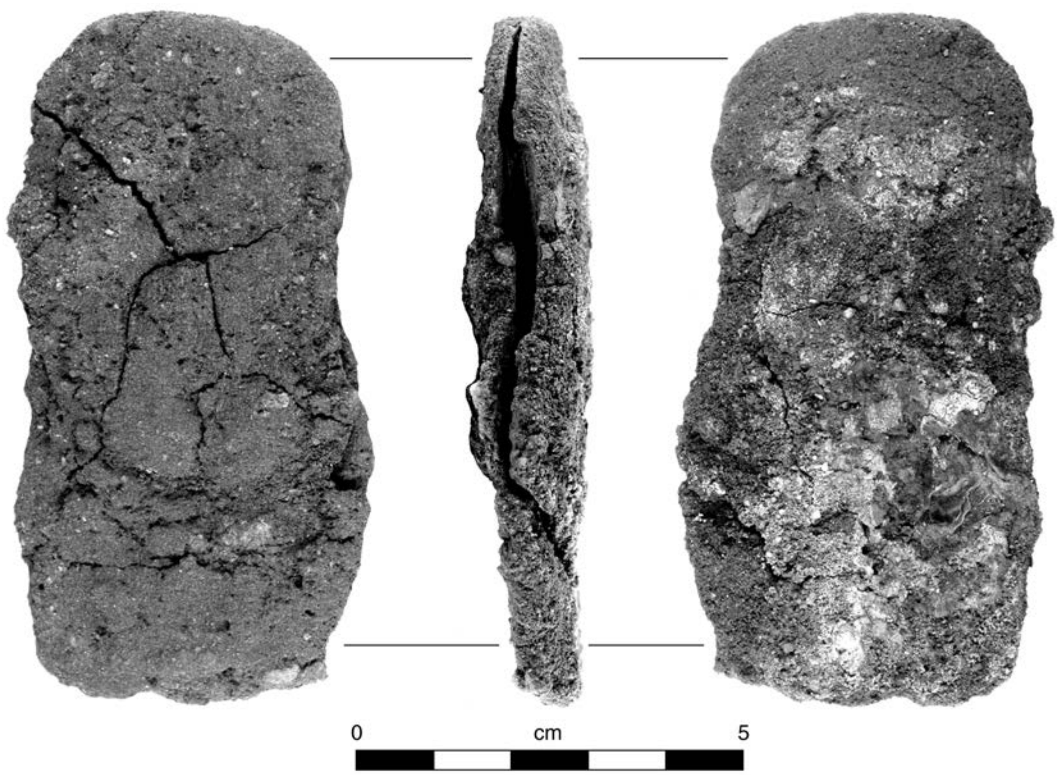

Figure 177. Iron wedge/hatchet from LAN-62, burial Feature 38.

Figure 178. Fragment of an iron knife blade (and tang) from LAN-62, burial Feature 223.

Figure 179. Iron hoe head from LAN-62, burial Feature 438.

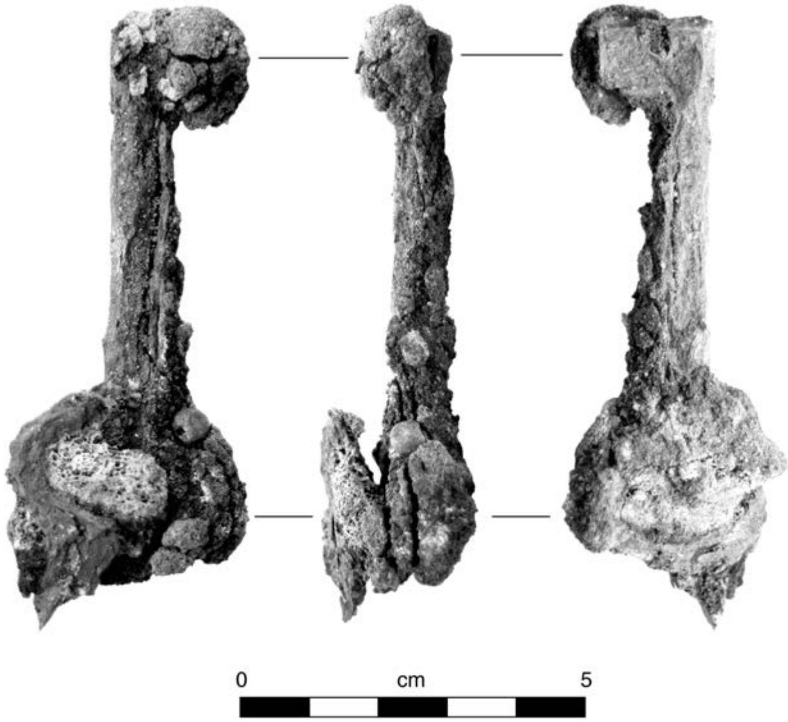

Figure 180. Iron skeleton key from LAN-62, burial Feature 112.

Figure 181. Copper *higo* or bell clapper from LAN-62, burial Feature 112.

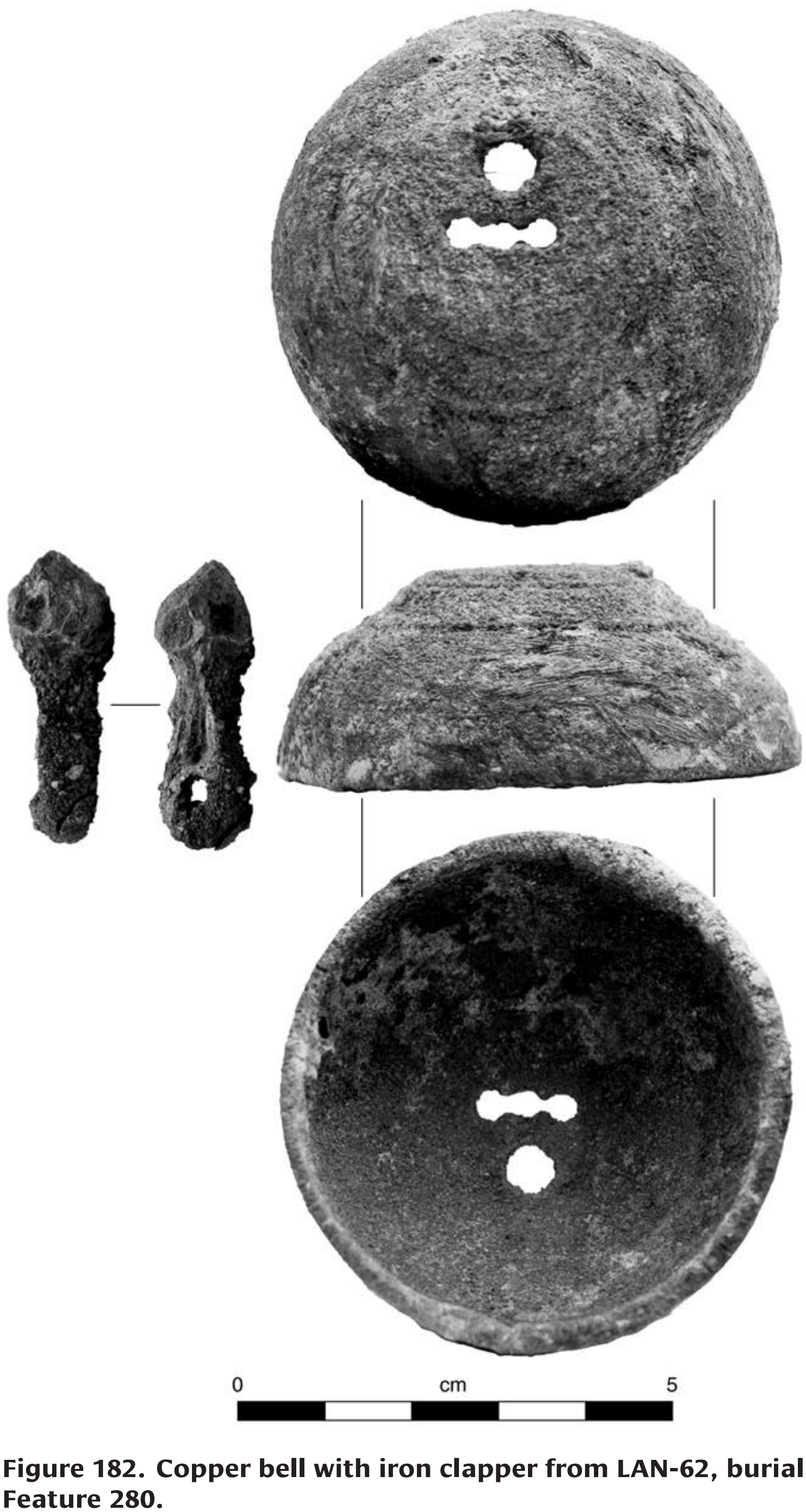

Figure 182. Copper bell with iron clapper from LAN-62, burial Feature 280.

Figure 183. Brass-plated-lead bell clapper from LAN-62, burial Feature 539.

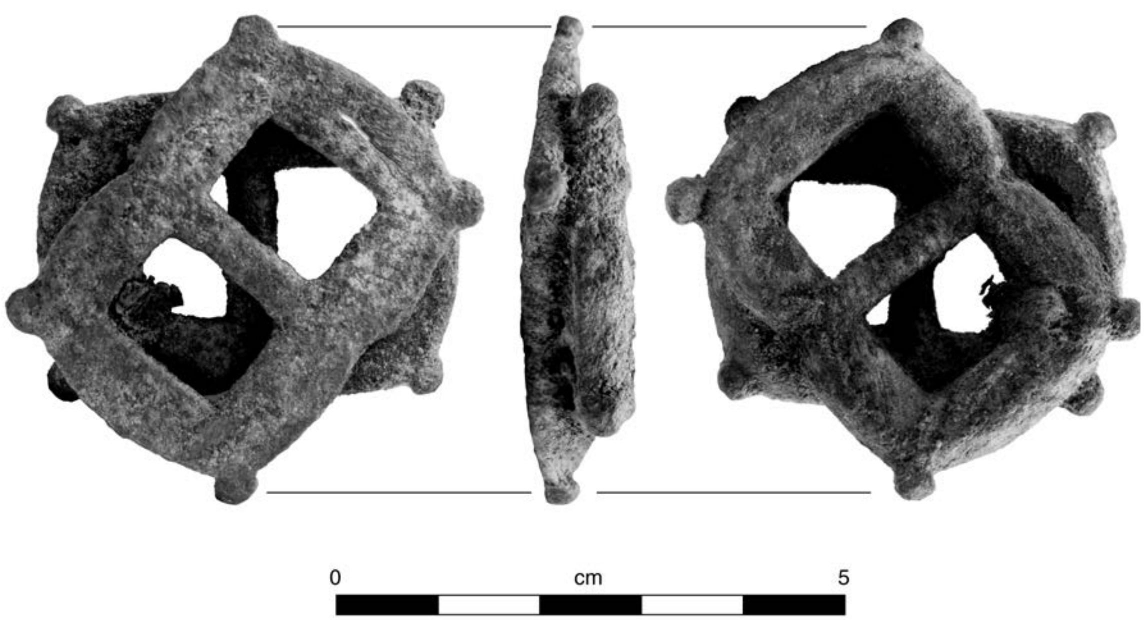

Figure 184. Two fused copper buckles from LAN-62, burial Feature 50.

Figure 185. One-piece cast-copper/brass button with drilled eye from LAN-62, burial Feature 313.

specifically for military use; between 1760 and 1770, British and French military uniforms began incorporating special buttons marked with regimental numbers or corps emblems (Albert and Adams 1951:46–47). Voss (2008a:278) observed that plain buttons were used on the uniforms of presidio soldiers at El Presidio de San Francisco (1778–1821).

Historical period containers of metal, ceramic, and glass were recovered from at least four of the burials, notable among which were two copper chocolate pots from burial Features 50 and 265. Burial Feature 50 contained a whole copper chocolate pot measuring 5.4 inches tall, 3 inches in diameter at the base, 4.8 inches in diameter at the widest point, and approximately 4.2 by 2.5 inches at the mouth (Figure 186). The pot was missing its handle but retained part of the copper rivet that would have held the handle in place. The vessel was coated with asphaltum just about the flange (approximately 2 inches above the base) and shows traces of impressed cordage marks. Another complete copper chocolate pot was found in burial Feature 265, this one approximately 5 inches in diameter and 4.8 inches tall (Figure 187). There is some semblance of a spout, but it is not as clearly defined as the spout on the chocolate pot from burial Feature 50. This pot is hand-formed and has a scrolled handle riveted to the cup at the lip. One of these was wrapped in traditional textiles and possibly placed in a basket; the bottom was smashed prior to placement in the burial, similar to the deliberate destruction of ceramic and stone vessels by Native Americans in ritual contexts. Burial Feature 50, which produced the more-intact copper chocolate pot, also contained a nearly complete, tin container, possibly a cup or pitcher, that had been purposefully smashed and rolled before placement in the burial (Figure 188).

Ceramic vessels or vessel fragments were recovered from burial Features 227 and 477. Burial Feature 477 yielded a single hard-paste-porcelain sherd decorated with a hand-painted blue starburst. This item likely was imported from Asia. Burial Feature 227 contained a large fragment of a Chinese rice bowl bearing the "Four Seasons" pattern, also known as "Four Flowers," "Flowers of the Four Seasons," "Enamelled Flower Ware," and "RoseVerte" (Mueller 1987:272; Wegars 1993:160–161) (Figure 189). Vessels of this ware depict flowers representing each of the four seasons: prunus for winter and beauty, peony for spring and wealth, lotus for summer and purity, and chrysanthemum for autumn and friendship (Mueller 1987:272). This ware was one of the most expensive of Chinese-export ceramics between 1871 and 1883, netting "6.5 to 8.7 cents per bowl" (Wegars 1993:153–163); it is common in nineteenth-century Chinese-American sites in Arizona and California (see Allen et al. 2002; Allen and Hylkema 2002; Felton et al. 1984; Mueller 1987; Padon and Swope 1997; Thiel 2006). The precise date of this Chinese rice bowl is unknown. The same feature also contained a nearly complete salt-glazed-stoneware cup with a small, applied handle (Figure 190). The cup, which measured only 2.4 inches in diameter, either is a

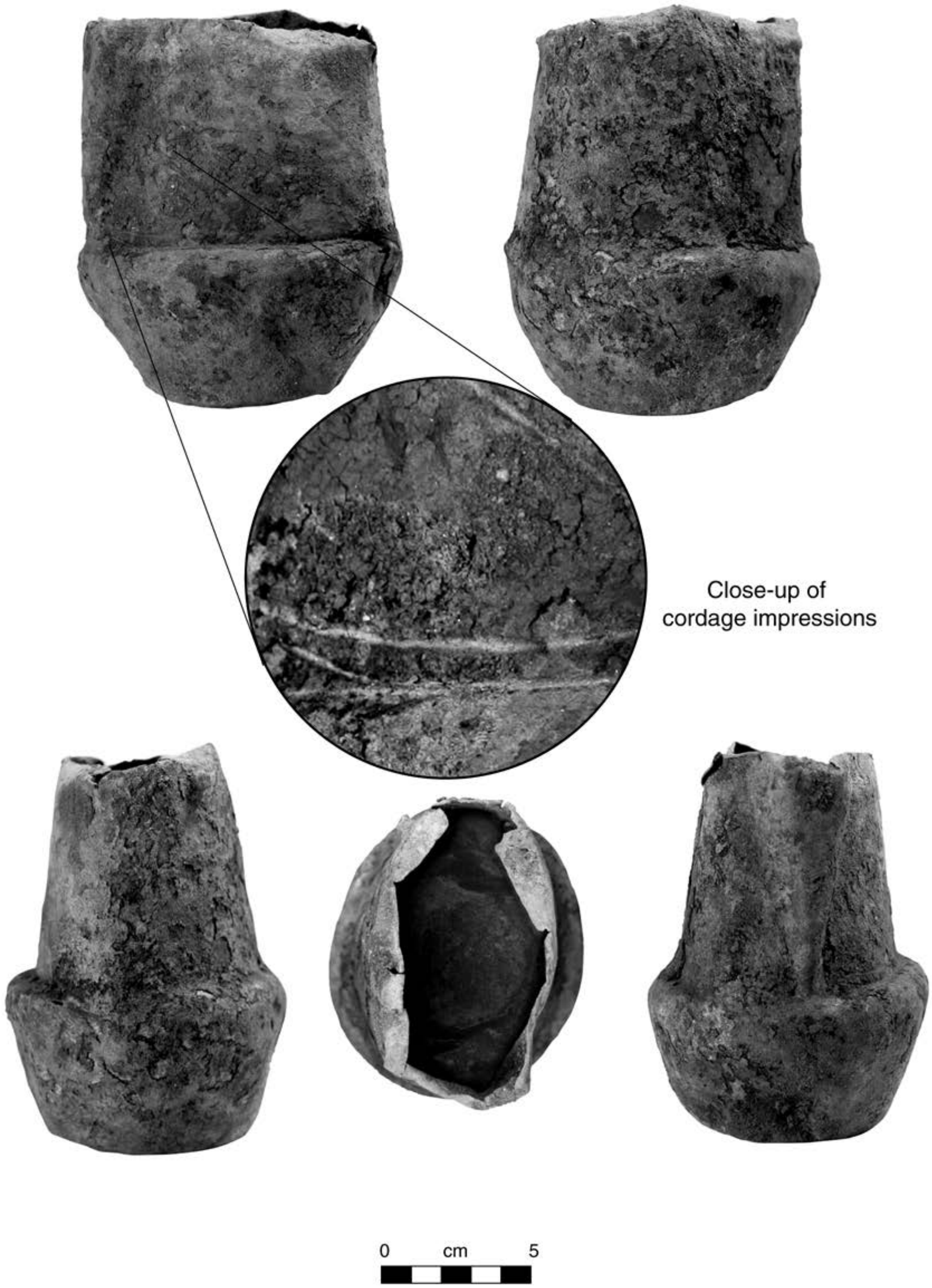

Figure 186. Deformed copper chocolate pot from LAN-62, burial Feature 50.

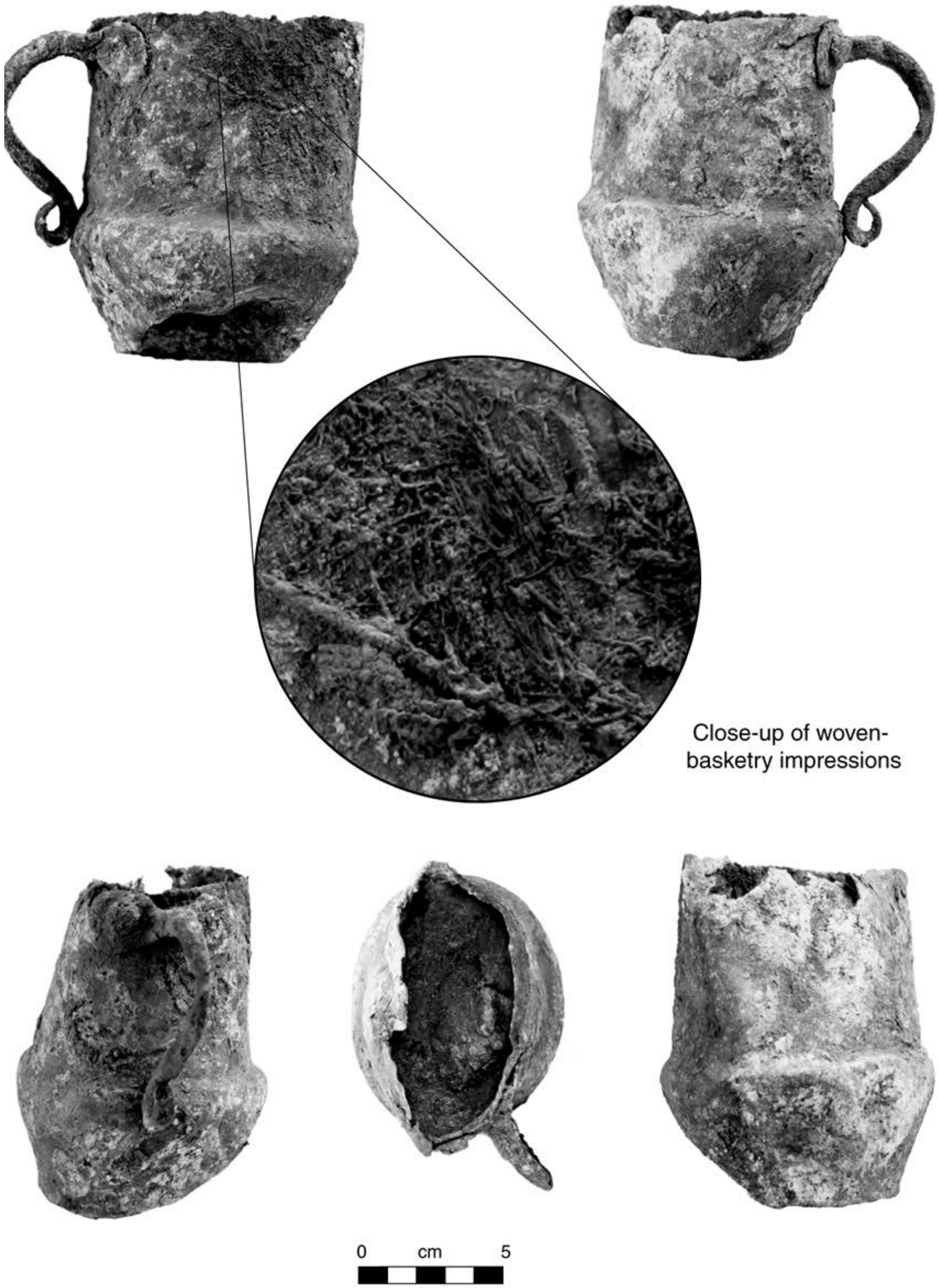

Figure 187. Copper chocolate pot from LAN-62, burial Feature 265.

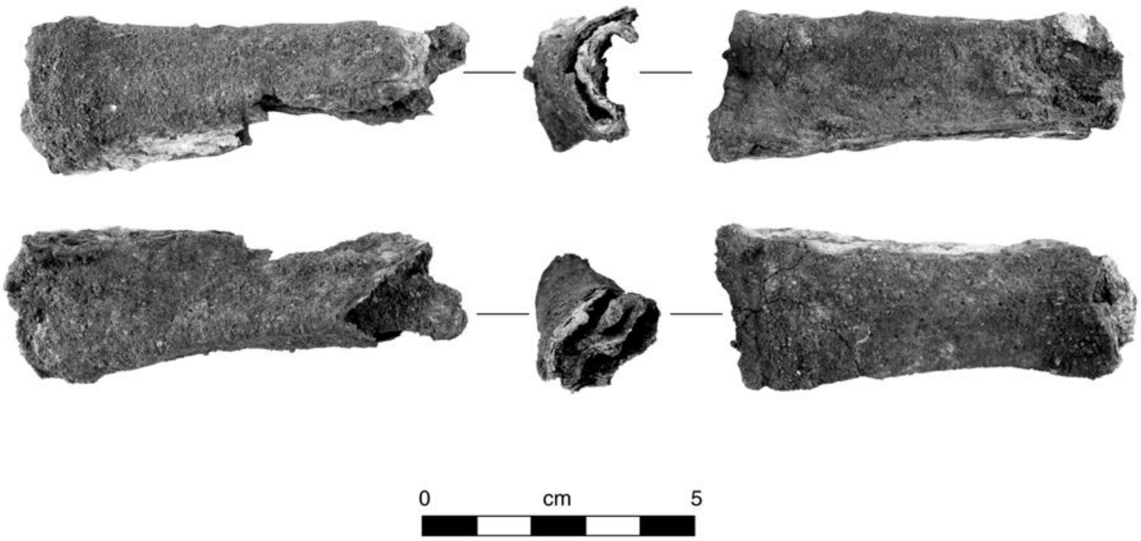

Figure 188. "Killed" tin container from LAN-62, burial Feature 50.

Figure 189. Chinese-porcelain rice-bowl fragment with "Four Seasons" decoration from LAN-62, burial Feature 227.

Figure 190. Salt-glazed-stoneware child's or demitasse cup from LAN-62, burial Feature 227.

demitasse cup or was designed for a child. White- (refined-) stoneware vessels were produced in England by the 1720s, and although English stoneware production tapered off by the late 1700s, American production of stoneware vessels continued for at least another century (Deetz 1996:72).

Burial-Area Excavation Units

Ceramics

Three white-bodied-earthenware-vessel fragments and 1 fragment of a red-bodied-earthenware vessel were recovered from the burial area. One white bowl rim exhibits molded-relief decoration. Fragments of 2 unidentifiable vessels were recovered; 1 fragment bears a blue transfer pattern, and the other 101 fragments bear no decoration.

Metal

A nearly complete piece of possible horse tack (Figure 191) measuring 3.5 by 2.75 inches was recovered from EU 143. Other notable metal artifacts include a floral-decorated pocketknife handle (Figure 192), a large knife blade, a piece of iron slag, and four metal buttons. Three of the buttons are copper, and one is a one-piece cast-brass button with a drilled shank (Figure 193) likely dating to between 1700 and 1850 (Hughes and Lester 1981:221).

A pair of iron scissors or shears (Figure 194) 5.5 inches long and 2 inches wide was recovered from EU 154. Other notable items from the burial area include an iron pendant; a portion of a riveted, circular bell of copper or brass (Figure 195); a possible iron fishing weight (Figure 196); and three buttons (two made of copper). Metal hardware includes nails, a partial welding rod, and a fragment of slag. A fragment of a blue and white, enameled pan and a portion of a threaded, zinc jar cap were recovered. Part of a copper box hinge, probably related to a similar item in EU 316, was identified.

Other

Three small fragments of hard, red rubber are the only “other” Historical period materials recovered from the burial area.

Burial-Area Feature 29 (Rock Cluster)

Metal

Feature 29, a rock cluster, contained at least one fragment of a crown bottle cap, first patented in 1892 (U.S. Patent No. 468,258). This artifact appeared to have been intrusive into the deposit.

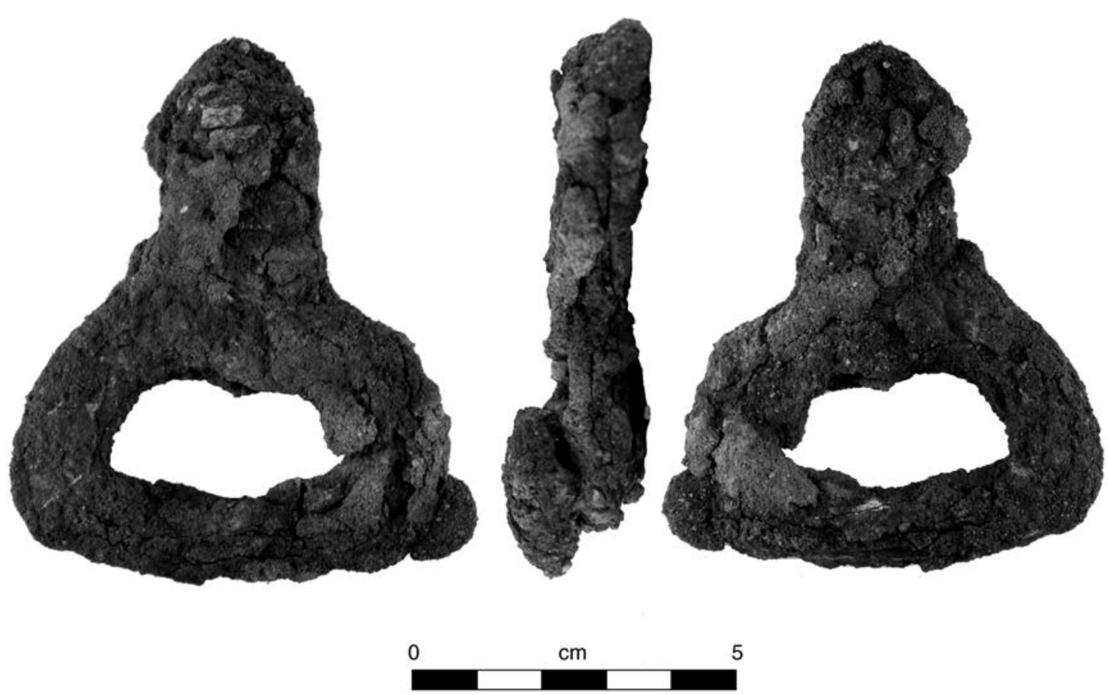

Figure 191. Possible iron horse-tack element from LAN-62, burial-area EU 143.

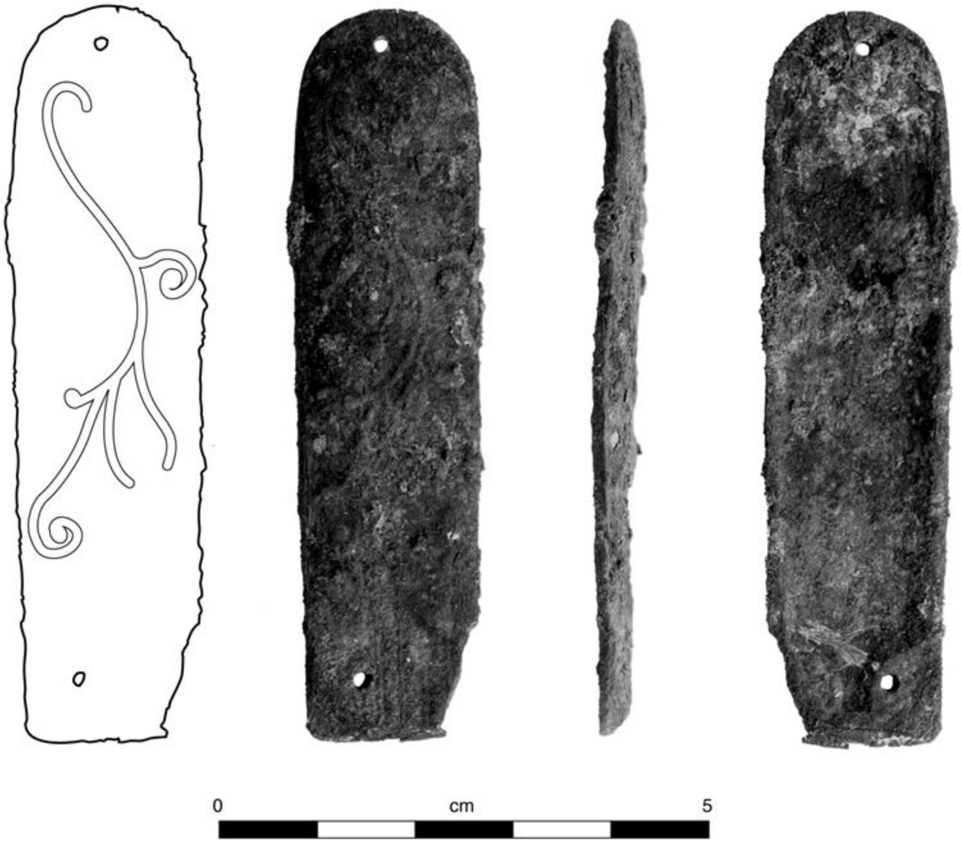

Figure 192. Pocketknife handle from LAN-62, burial-area EU 138.

Figure 193. One-piece cast-brass button with a drilled eye from LAN-62, burial-area EU 144.

Figure 194. Iron scissors/shears from the LAN-62 burial area, EU 154.

Figure 195. Copper or brass bell with riveted hinge from the LAN-62 burial area.

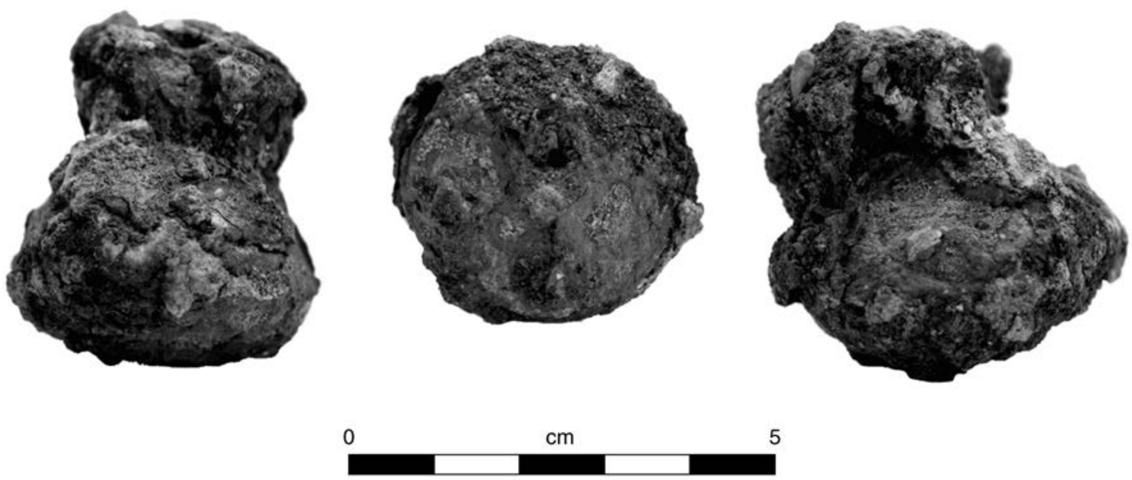

Figure 196. Iron fishing weight from the LAN-62 burial area.

FB 3

Ceramics

FB 3 yielded a single ceramic sherd: a small, unidentifiable, white-stoneware-vessel fragment. This artifact may have been intrusive.

Later Historical Period Deposits outside the Burial Area

In addition to the burial area, which contains an early Historical period component, SRI also analyzed other specific contexts outside the burial area for later Historical period artifacts. These include materials from several features and a trench. The Historical period materials from these contexts were collected for analysis and are discussed below.

Feature 229

Feature 229 is located outside the burial area and was found during mechanical stripping. The feature was interpreted as a pit and it represents a long linear deposit of historical-period refuse.

Ceramics

Feature 229, a pit, yielded 31 ceramic-vessel fragments representing perhaps four different vessels. Three fragments of a porcelain plate measuring 7.5 inches in diameter are identified by a maker's mark reading "[PAR]MELEE DOHRMAN COMPANY/LOS ANGELES"; this company operated from 1899 to at least 1915 (Guinn 1915:419). Molded-relief decoration is represented on 1 fragment each of a bowl, a plate, and a teacup.

One hotelware-saucer fragment bears two green bands around its rim. A hotelware plate measuring 7 inches diameter is represented by two sherds exhibiting a blue band, a gold band, and a blue stripe. Another hotelware plate represented by a single fragment and measuring 7.5 inches in diameter was decorated with a black floral transfer pattern. An unidentified hotelware-vessel sherd bears the maker's mark "D.P.CO./SYRACUSE/CHINA/F5". The Syracuse China Corporation used a coded dating system; the "F" mark denotes manufacture in 1925 (Kovel and Kovel 1986:251).

Seven bowls are represented by 10 sherds. Included is a complete, undecorated hotelware bowl measuring 3 inches in diameter and only 3/8 inch in depth. Two stoneware bowls are represented by 1 sherd each. Four hotelware bowls are represented by 7 sherds. A 3.5-inch-diameter stoneware bowl is characterized by a black floral transfer pattern.

A hotelware bowl measuring 3.75 inches in diameter is represented by one sherd exhibiting two green bands around its rim. Another hotelware bowl measuring 6.5 inches in diameter exhibits the same decoration and is represented by one sherd. A hotelware-bowl sherd representing a 6.5-inch-diameter bowl exhibits a gold band flanked by two blue bands at its rim.

Other undecorated vessel forms include one 7-inch-diameter plate, one hotelware-cup fragment, and one hotelware-pitcher fragment. An unidentifiable vessel is represented by a single sherd exhibiting a bit of a maker's mark, and another nondiagnostic sherd was recovered.

One fragment each of two stoneware crocks measuring 10 and 10.5 inches in diameter were recovered. Another fragment represents the rim and body of a terracotta flowerpot measuring 4.5 inches in diameter.

Metal

Feature 229 yielded a piece of a gray-and-white enamelware pot with a flaring rim and two attachments for a wire handle.

Feature 608

Feature 608 is an artifact concentration located in LAN-62, Locus C, of historical-period refuse discovered during mechanical stripping.

Glass

Two beverage bottles were recovered from Feature 608. One complete, green soda-water bottle is embossed "83 2347 [Greek letter Omega]". Part of a clear soft-drink bottle bears an applied-color label reading "BOTTLED BY QUALITY BOTTLERS EVERYWHERE/MISSION/BEVERAGES/Naturally Good/UNDER LICENSE OF MISSION DRY CORPORATION//Naturally/good/PROPERTY OF/MISSION ORANGE BOTTLING CO./FRESNO, CALIFORNIA"; the maker's mark is that of the Glass Containers Corporation and was used after 1945 (Toulouse 1971:220).

Two complete, clear bottles were recovered from Feature 608. One complete, round, clear-glass bottle exhibits the base embossment "TCW" used by the T. C. Wheaton Company since 1888 (Toulouse 1971:492). Throughout its history, the company has produced specialty glass, such as druggist's wares with ground stoppers, reproduction tablewares, and commemorative flasks (Toulouse 1971:527–528).

Three toiletry bottles were recovered from Feature 608. A complete, clear nail-polish bottle bears an embossed decorative motif. A nearly complete, cobalt-blue bottle is embossed "INGRAM'S SHAVING CREAM". Production details for this product were not identified, but the company is known to have marketed a complexion cream from 1895 to at least 1948 (Fike 1987:92–93). A complete, clear, round bottle is embossed "LISTERINE [below shoulder]" and "LAMBERT/PHARMACAL CO. [at heel]". The maker's mark indicates manufacture by the Alton, Illinois, plant of the Owens Illinois Glass Company in 1932, 1942, 1952, or 1962 (Toulouse 1971:395, 403).

Four glass marbles were recovered from Feature 608; two are multicolored, one is clear with green swirls, and one is honey-yellow colored.

Ceramics

Of particular interest is a Japanese-porcelain Maneki Neko, the only ceramic artifact recovered from Feature 608. These cat figurines were documented as early as the 1870s and continue in production today. The beckoning cat with upraised left paw represents prosperity in business, in terms of either customers or income.

Metal

Feature 608 yielded one electrical component: a switch marked "C-H/70-50/SWITCH//3A-250V/6A-125V".

Other

A single piece of modified stone with lengthwise grooves, possibly a piece of a slate/shale roof shingle, was the only "other" Historical period artifact recovered from Feature 608.

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Glass

One complete, colorless, machine-made glass bottle was embossed "GEBHARDT EAGLE" on one side and "CHILI POWDER" on the other. Mr. Gebhardt first registered Eagle Brand Chili Powder in 1896 (Texas Archival Resources Online 2009).

Summary of Historical Period Artifacts Recovered from LAN-62

Overall, the Historical period artifacts from LAN-62 reflect the various activities performed around the site at various times; the most significant of its uses is as a burial area during the Late and Mission periods. Most of the Historical period artifacts recovered from burial contexts (see Table 166) appear to date from the late eighteenth and early nineteenth centuries, during the Spanish Mission period; a few artifacts are from the later Mexican and early American periods. Furthermore, although none of these burial artifacts seems to reflect the religious influences of the Hispanic colonists, they do suggest significant involvement on the part of the deceased in the colonial economy. For example, the presence of copper chocolate pots, Spanish/Mexican copper/brass buttons, and ornaments from Spanish-style saddlecloths indicate that the individuals had adopted (and adapted) certain elements of colonial dress, transportation, and cuisine. The inclusion of a Chinese rice bowl and what was either an English or an American salt-glazed cup in one of the later burials (burial Feature 227) suggests that the native residents of the Ballona also had access to exotic goods manufactured much farther away than just other portions of the Spanish colonial empire. As discussed below, these goods may have been introduced to the local Hispanic economy either via regular annual shipments from San Blas or through black-market ships that traveled up and down the California coast during the early 1800s. Both of these types of shipments included items from China, and black-market-ship manifests included British and American goods.

Most of the Historical period materials from nonburial contexts at LAN-62 seem to date to the later American occupation and use of the site. Diagnostic artifacts from Features 229 and 608 mostly date from the late 1800s through the mid-1900s, and most of the artifacts from these proveniences are glass or ceramic containers/vessels relating to the storage or consumption of foods and liquids. These later deposits, although roughly contemporary with those found at LAN-54 and LAN-193, do not appear to be related to other deposits on-site and may simply represent isolated and random dumping events.

LAN-211

In total, 130 Historical period artifacts were recovered from several contexts at LAN-211, including a burial feature and FB 1, a large, dense activity surface dating partially to the Mission period. These artifacts are summarized by material category in Table 167. Diagnostic artifacts are discussed by context and material categories in the section below. All Historical period artifacts, including those that are only identifiable to material category, are summarized in Tables 155–164.

Burial Feature 33

Glass

Burial Feature 33 yielded a single shard of black glass from the burial context. It is unclear whether this glass was a grave good or was intrusive to the feature. A number of other artifacts were found during screening of a large amount of overburden. These intrusive artifacts, not from the burial context, included a fragment of flat windowpane, three fragments of at least one clear bottle, one tumbler-rim shard, and one bottle fragment of sun-colored amethyst. Fragments of two olive-green wine bottles were recovered. A single clear shard of a lamp chimney or lightbulb was found.

Table 167. Analyzed Historical Period Artifacts from LAN-211

Context	Glass	Ceramic	Metal	Total
Burial Feature 33	7	1	28	36
Subtotal	7	1	28	36
FB 1 (excavation units)	37	2	53	92
Feature 1	1	—	—	1
Subtotal	38	2	53	93
EU 583	—	—	1	1
Subtotal	—	—	1	1
Total	45	3	82	130

Ceramics

One plate-rim fragment exhibiting a bluish green slip glaze was recovered from this feature. This plate fragment is from the general overburden above the burial and is not related to the burial.

Metal

A 2.25-inch-long rope-style fragment of a gold chain was recovered from Feature 33. Twenty-seven nails, 20 of which were common nails, also were recovered. These metal artifacts are from the general overburden above the burial and are not related to the burial.

Feature-Block Excavation Units

Ceramics

EU 198 produced a single sherd of Puebla Blue-on-white majolica (Figure 197), most likely from a plate or soup dish. This tin-glazed blue-and-white ceramic was produced in Mexico, likely in Puebla, in an attempt to imitate the Chinese porcelain vessels obtained from the Philippines. This type is common at Spanish and Mexican colonial sites dating to A.D. 1700–1850 (Deagan 1987; Goggin 1968:194).

A body sherd from a white-bodied-earthenware plate decorated with molding on the interior and exterior and concentric

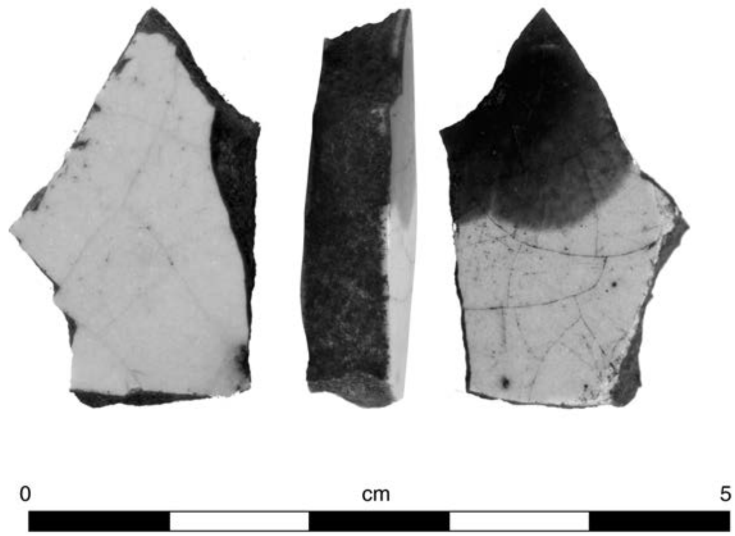

Figure 197. Puebla Blue-on-white majolica sherd from LAN-211, EU 198.

black and blue, painted lines on the interior was recovered from EU 381. The base and body sherd probably belonged to a 10-inch-diameter plate dating to the 1950s.

Metal

EU 583 produced part of an iron, one-piece, cast button with a shank.

Glass

One unidentifiable clear-glass shard was recovered from FB 1. In addition, one green-glass projectile point, probably produced from a shard of a broken alcohol bottle, was identified from EU 183.

Summary of Historical Period Artifacts Recovered from LAN-211

Overall, relatively few Historical period artifacts were recovered from LAN-211, and a significant percentage of these are not temporally diagnostic or identifiable beyond material category. The only notable artifacts include a single majolica sherd likely dating to the Spanish or Mexican period, a piece of a gold necklace chain, and a green-glass projectile point (also likely dating to the colonial or early American period). Most of the nondiagnostic glass and metal likely dates to the twentieth century and is not associated with Native American occupation of the site.

Discussion

There are two primary contexts for Historical period artifacts analyzed as part of the PVAHP in this chapter: late-eighteenth- and early-nineteenth-century Mission period artifacts within the burial area at LAN-62 and the domestic context of LAN-211 and late-nineteenth- and early-twentieth-century artifacts from the American period in the project area. In addition, in Chapter 6 of this volume, Lester Ross has identified a few ceramic beads that date to the Rancho period.

Late-Eighteenth- and Early-Nineteenth-Century Contexts

The analysis of late-eighteenth- and early-nineteenth-century contexts, located in the LAN-62 burial area and FB 1 at LAN-211, reveal a great deal of detail regarding Mission period aboriginal identity, possible activities undertaken by individuals buried at LAN-62, and aboriginal access to and use of nonindigenous material.

Clothing

The identification of Hispanic clothing-related items in the burial area at LAN-62—including several copper buttons from multiple burials and a set of likely shoe buckles—is interesting, in part because these items would not normally be expected to be in the possession of Native Americans during the Mission period. As Voss (2008a:252–286; 2008b) has pointed out, clothing fasteners (including buttons and buckles) were politically and socially important items, because they were readily visible on clothing. Hispanic society during the late eighteenth and early nineteenth centuries was very rigid in its caste system, and Spanish colonial sumptuary laws highly restricted both the upward and downward movement in this caste system by members of colonial society (Voss 2008b:413). Clothing was a conduit for expressing one's position within the caste system. For example, Voss (2008b:413–414) argued that people with African ancestry were expected to dress in Bourbon fashion and were disallowed from wearing luxury goods. Bourbon clothing for those with African ancestry was fastened with ties and laces rather than buttons or buckles (Voss 2008b:414). More-elite members of Spanish colonial society were permitted to have plain buttons and buckles on their clothing, but only the highest-status members of society were allowed filigreed and jeweled buttons and ornamental gold or silver buckles. Voss (2008b:414), citing Fisher (1992) and Loren (1999), argued that clothing fasteners "were especially potent objects in representations of racial differences." As a result, it is striking that, given the restricted access, these clothing fasteners—a variety of plain buttons and a pair of likely shoe buckles—would be found buried with the Gabrielino in a traditional burial area. Because these artifacts were identified in several different burials and no one burial contained large numbers, these may have been individual grave goods that were not attached to clothing.

Weapons and Knives

Weapons of Hispanic origin are another class of items that, in many ways, is striking to find in a Gabrielino burial area. Certainly, metal knives would have been in demand by Native Americans as an alternative to lithic tools for use in butchery and other domestic activities, as well as warfare. As pointed out by Lev-Tov in Chapter 11 of this volume, some faunal remains from LAN-211 contained butchery marks from metal tools. Burial Feature 313 at LAN-62, with one probable and two possible gun barrels, is unique in the burial area (see Table 166). The probable gun barrel contained glass and olivella-shell beads inside the barrel, indicating that the final use of this fragmentary gun was an indigenous function. Bickford (1982:18–22) identified portions of three weapons—a pistol, a flintlock rifle, and a sword—in the Mission period burial area at Humaliwo (LAN-264). In the case of Humaliwo, both the pistol and the rifle appeared to have been adapted by the Native American residents of the site for other purposes. In the case of the pistol, the gun butt was partially hollowed out and covered with asphaltum, suggesting that it may have been used as a receptacle. Daily (2008) has shown photographs of swords from Mission period aboriginal burials on Santa Catalina Island that are decorated with shell beads and asphaltum. In the case of the LAN-62 gun barrels, it is unclear whether they were attached to gun stocks at the time of placement in the burial feature. Silliman (2005, 2009) has argued that these types of examples of reuse of Hispanic items by Native peoples reflect clearly indigenous functions, whether domestic, ritual, or related to other aspects of daily life.

Marla Daily (2008) argued that the source for weapons in Mission period burials on Santa Catalina Island may have been a shipwreck, possibly the *San Jose*, the missing ship of the Portola expedition of 1769. Daily argued that it was possible that the *San Jose* had wrecked in a cove on the west side of the island, partially based on large quantities of Spanish weaponry excavated from several Mission period burials found there. No shipwreck of the *San Jose*, though, has been found to date. Given a connection between Humaliwo and Santa Catalina Island—the chief of Humaliwo, named Chapray or Saplay, was originally from the island (see Mission San Fernando Rey Baptismal No. 1379 and Mission San Buenaventura Baptismal No. 1869 for documentation of this; see also King [1994:77–78])—it is possible that the weapons found in Humaliwo burials may have originated from the possibly shipwrecked *San Jose*, as well.

Hispanic weapons, including pistols and rifles, were highly restricted items in colonial California. Mason (2004:30) argued that the Presidio Santa Barbara occasionally sold used weapons to specific colonists for protection when the presidio received new shipments of weapons. Even so, as late as 1816, over 40 years after the establishment of the Pueblo of Los Angeles, the total number of weapons for the entire pueblo area, including the pueblo itself, the surrounding ranchos, and the Mission San Fernando Rey, was a paltry 14 muskets, 4 pistols, 16 swords, and 4 lances (Mason 2004:51; see also Hardwick 2006:22–23). This list includes the weapons held by 4 sergeants, 1 corporal, 16 soldiers, and 73 residents of the Pueblo of Los Angeles and surrounding areas (Hardwick 2006:23). Given this small number of weapons in the greater pueblo area, it is curious that Native Americans would have access to complete weapons or parts of weapons to place in two separate burial areas along Santa Monica Bay (LAN-62 and LAN-264) unless they had been scavenged from a lost shipment, such as a shipwreck.

Chocolate and Chocolate Pots

The two chocolate pots recovered from burial features are similar to one found at the Chumash burial area at the Ojai site (VEN-132) (Phillip Walker, personal communication 2004) and several burials on Santa Catalina Island (Daily 2008). Unfortunately, the Ojai site, which contained hundreds of Chumash burials dating to the Mission period, was excavated in the late 1960s by amateur archaeologist Robert O. Brown, and details of these burials and their contexts were not collected in the field (Lopez 2002:9). The contents of the burials, though, have subsequently been recorded at the Repository for Archaeological and Ethnographic Collections of the Department of Anthropology at the University of California, Santa Barbara. Little information is available for the chocolate pot from the Santa Catalina Island burials, but it is clear that these pots were important grave goods in southern California. Although these pots are Hispanic in origin, they were treated by the Gabrielino in traditional ways as grave goods, including damaging the bases of the vessels to ritually damage or destroy them much in the same way they would have done for a stone or ceramic vessel. These chocolate pots were also wrapped in traditional weavings that contained shell and glass beads.

Spanish conquistadors were first introduced to cacao and to the custom of drinking chocolate beverages during their conquest of central Mexico. Various versions of the beverage, flavored with sugar, cinnamon, anise, black pepper, or the traditional chilies, grew in popularity in the New and Old Worlds during the sixteenth and seventeenth centuries. By the eighteenth century, when the Spanish began establishing permanent settlements in California, the custom of preparing and drinking chocolate was firmly established among all classes of colonial society (Pierce 2003).

Prehistorically, Mesoamerican peoples prepared chocolate beverages by combining ground cacao beans, water, and various spices in tall, cylindrical ceramic vessels, pouring the water from a great height and/or pouring the liquid from one vessel to another in order to create foam (Pierce 2003:246–247). The Spanish modified this technique by using a large, wooden whisk (*molinillo*) to generate the foam and direct it into the small, ceramic bowls or the more-traditional lacquered-gourd bowls or cups, termed *xicalli* by the Aztecs and *jícaras* by the Spanish. Instead of using tall, cylindrical ceramic vessels to prepare the beverage, Spanish colonists began to heat and beat the mixture in a tall, narrow copper pot with a curved or straight handle and often with a copper lid with a hole in its top to accommodate the *molinillo* (Pierce 2003:254). This vessel, which may have derived from the smaller Turkish or Arabic coffeepot, was used by the Spanish at least as early as 1652 (Pierce 2003:254) and seems to have reached its greatest popularity during the eighteenth century.

Chocolate was an important part of the diet in early colonial California, as well as further south, in Mexico. It was used in various contexts as a medicine, as an important food group, as a part of mission hospitality, and as a gift between the Spanish and Native Californians. For many Spanish in the missions, chocolate was part of daily life, both as an essential part of breakfast and as a treat. From as far back as the first Spanish intrusion into California, the Cabrillo expedition, chocolate was likely part of interactions between the Spanish and Native Americans. Grivetti et al. (2009:441) have recently discussed whether it was possible that red calico and chocolate were gifts given to Native Californians. Spanish missionaries in the American Southwest and California brought chocolate north from Mexico, in part as gifts to Native Americans. For example, Father Kino in the Pimería Alta (southern Arizona) wrote in the early eighteenth century of offering chocolate as gifts to the Pima and Comanche Indians as tokens of appreciation (Cabezon et al. 2009:429). There is no indication that chocolate was offered to Native Americans in the missions of the American Southwest or California as more than occasional gifts on specific occasions. Chocolate was an important aspect of daily life for Hispanic colonists, but it was also scarce enough, given the irregular shipments by ship and mule from Mexico, that it was not likely shared with Native Americans except in rare instances. In Arizona and New Mexico, transporting chocolate to missions could only be done during the cooler months of the year, because the mule trains north from Mexico would arrive with melted chocolate during other times of the year (Cabezon et al. 2009:429). At many missions across the U.S. Southwest and California, food scarcity was common in the early mission years; shipments of food north from Mexico by either land or sea were relatively uncommon, and these shipments were often spoiled by the time they arrived. Chocolate, on the other hand, although it did melt, did not spoil, and it was easy to transport in the form of *tablillas* (small rectangles) (Grivetti et al. 2009:445-446).

At the California presidios and missions, chocolate, cacao, and chocolate-related items, such as chocolate pots (*chocolatero* or *jarro de chocolatero*), were in high demand (see Jamieson 2001). Perissinotto (1998) has recently published the *memorias* (requisitions) and *facturas* (invoices) between Presidio Santa Barbara and San Blas from 1779 to 1810. San Blas was the official Spanish colonial supply depot for Baja and Alta California. Each year, presidios and missions in Alta and Baja California would create requisitions of materials they would need for the coming year and submit them to the colonial authority in Mexico. Because of this system, as Perissinotto (1998:19) has pointed out, a complex bureaucracy was created, as well as a large number of documents related to requisitions to Mexico and subsequent invoices of what was eventually shipped north from San Blas. In the recently published requisitions for Presidio Santa Barbara, there are numerous requests for chocolate as well as literally hundreds of chocolate pots and associated items, such as whipping sticks (*molinillos*). For example, in an invoice dated December 29, 1790, for a total of 52 *tercios*, crates, and barrels of material from San Blas to Presidio Santa Barbara, Crate No. 39 included six dozen chocolate pots (Perissinotto 1998:149, Document 15). Another example is an invoice dated June 8, 1796, which documents that Crate No. 21 contained 72 large, tin-plated copper chocolate pots (Perissinotto 1998:271, Document 32). This same invoice states that Crate Nos. 23–28 contained 42 *arrobas* of ordinary chocolate, totaling 1,050 pounds, in addition to Crate Nos. 29 and 30, which contained 12 *arrobas* of good gift chocolate totaling 300 pounds (Perissinotto 1998:271, Document 32). Based on requisitions, it appears that the gift chocolate was for consumption by officers at the presidio. In addition, these quantities of chocolate appear to have been regularized; these same quantities were requested by Presidio Santa Barbara and subsequently shipped from San Blas in 1795 (Perissinotto 1998:247, Document 29; 251, Document 30). In addition, cocoa, the base for chocolate and possibly used in preparing drinking chocolate, was another popular item requested and shipped north. For example, in the June 8, 1796, invoice of materials from San Blas to Presidio Santa Barbara, Crate No. 18 contained 1 *tercio* with 75 pounds of preserved, clean Caracas cocoa and 75 pounds of red cocoa (Perissinotto 1998:269, Document 32). In requisitions and invoices for the Presidio Santa Barbara, cocoa was listed alongside chocolate in many instances. Although there was no detail in these documents as to what the chocolate pots looked like, there were indications that some were copper, like those found in the LAN-62 burial area. It is likely that the materials shipped north from San Blas, which included chocolate, cocoa, and chocolate pots, were destined for the presidio, the surrounding missions, and colonists, padres, and soldiers associated with these institutions (see Voss 2008a).

Gabrielino Economic Connections with Hispanic Society

Several burials contained items likely used by Gabrielino living in the Ballona. Several burials and burial-area contexts contained items associated with horses, suggesting that the individuals in these burials may have been employed as cowboys (*vaqueros*) at local ranchos. These materials included horse tack, a horseshoe, a cinch buckle, saddle trappings (including bells), and a stirrup. Examples of these types of goods were also identified at Humaliwo (Bickford 1982:14–17), leading to similar interpretations (Gamble 2008:202–206; Gamble et al. 1996; Gamble et al. 2001:198–199). Slag and melted metal in two burials suggest that perhaps these individuals were involved in metalworking or blacksmithing. A pair of iron scissors or shears may relate to sheep shearing, which was an increasingly important task across Alta California as sheep numbers rose dramatically (Hackel 2005). During the Mission period, many gentile Gabrielino and Chumash dressed in European clothing and had ties to local farms and ranchos. As noted by a padre during the Mission period: "Here we see nothing but pagans passing, clad in shoes with sombreros and blankets, and serving as muleteers to the settlers and rancheros, so that if it were not for the gentiles there would be neither pueblo or rancho. . . . [T]hese pagan Indians care neither for the Mission nor for the missionaries" (Engelhardt 1927b:9).

It is likely that Gabrielino interested in rancho work would have been inclined to work at Rancho Los Quintos, located in the Ballona, from approximately 1804 to 1809. The Quinto Zuniga family included a neophyte wife and several children of partial Native American ancestry. It is important to note that this marriage between a *gente de razón* and a neophyte was extremely unusual. In 1801, the president of the California mission system wrote that he was aware of only 24 such marriages as of that date (Newell 2009:120). Such marriages became catalysts for contact and interaction between different groups (Newell 2009:120–122). For example, some evidence suggests that Hispanic men who married Native American women became more fully integrated into their wives' societies (Newell 2009:122). Baptisms from the *ranchería* of Guaspet, located in the Ballona and probably tied to the burial area at LAN-62, indicated connections with Rancho Los Quintos and the Quinto Zuniga family, members of which were godparents for several Guaspet baptisms (Stoll et al. 2009). The choosing of Quinto Zuniga family members by individuals from the native village of Guaspet likely helped create and/or reinforce personal alliances, corporate allegiances, and fictive or actual kinship ties (Newell 2009:144). Newell (2009:144) has recently argued that these relationships, though spiritual kinships, also reinforced social, political, and economic connections and networks between Native people and their Hispanic neighbors.

The presence of an iron hoe in the burial area also suggests an economic relationship with the pueblo or ranchos. It is clear that Gabrielino during the Mission period labored in fields owned by pueblo and rancho inhabitants and were paid with between one-third and one-half of the crop when harvested (Archibald 1978:102–103; Hackel 2005; Newell 2009:77–78). It is interesting, though, that an iron hoe would be placed in the burial of an apparent gentile. Although it is unclear, it is possible that access to these types of goods was restricted. For example, Silliman (2004:189–191) has argued for Rancho Petaluma in northern California that during the subsequent Rancho period, items such as these were restricted for use during the day and were likely stored in specific areas of the rancho, away from open access to Native American laborers.

Origin of Hispanic Items in the Burial Area

An important question to ask is, "How did the Gabrielino who used the LAN-62 burial area gain access to these Hispanic items?" The items of Hispanic origin are a mixture of ordinary domestic goods, luxury items, clothing fasteners, defense items of highly restricted access, and specialized goods. In addition, there are items, such as a glass projectile point, that were created by the native residents of the Ballona from Hispanic materials (such as bottle glass).

It is clear that residents of Guaspet, located in the Ballona and likely related to the burial area at LAN-62, were recruited to the Missions San Gabriel and San Fernando Rey. As has been discussed in the culture history and research design chapters (Chapters 3 and 5, respectively, Volume 1 of this series), Gabrielino who were recruited to these missions had access to some Hispanic goods, including nonindigenous clothing and other goods. It is unlikely, though, that many of the items found in the burial area would have been collected by neophytes or gentiles at the missions and taken to the burial area at LAN-62. As discussed in the research design (Chapter 5, Volume 1 of this series), neophytes were allowed to return to their native villages for short durations to see family or to collect supplemental foods during certain times of year or in times of drought. Many of the items in the burial area, such as horse trappings, portions of weapons and knives, copper buttons, chocolate pots, fragmented or whole ceramic vessels, and the like would likely not have been items given to neophytes by the missions. Glass beads, detailed by Lester Ross in Chapter 6 of this volume, were the most likely gifts or payment given to neophytes or gentiles recruited by the mission.

Rather, it is likely that Gabrielino associated with the burial area at LAN-62 collected these Hispanic items through economic interactions with local ranchos and the inhabitants of the Pueblo of Los Angeles. In many cases, it appears that although neophytes were connected into the colonial economic system more directly than gentiles were, gentiles actually had better direct access to Hispanic goods, because they were many times employed by ranchos and inhabitants of the pueblos. Father Isidro Alonzo Salazar, for example, wrote during the Mission period that "the gentile is the farmhand, he is the cowhand, and irrigator, and in a word he does everything, such that at the time of harvest he takes half, and must be given a blanket, and a tunic, so that he goes about better than a Christian, and these never convert because they get along better than in the Mission" (Newell 2009:77–78). In addition, it appears that ranchos in need of indigenous labor paid gentiles in glass beads as well as other goods that they desired. Manuel Nieto, a local rancho owner, reportedly paid gentiles for labor with grain, glass beads, knives, clothing, tools, or "whatever else struck an individual Indian's fancy" (Mason 1993:180–181). In addition, the incorporation of indigenous Ballona residents into the local rancho or pueblo economy as house or field labor could have afforded gentile Gabrielino opportunities to scavenge colonial items, such as bottle glass, individual buttons, metal knives, ceramics, and the like. As Steve Hackel points out in Volume 5 of this series, a number of baptisms of people from the village of Guaspet occurred at the Pueblo of Los Angeles, suggesting that they were living and working there when they were baptized. These Gabrielino from Guaspet likely would have traveled back and forth from the pueblo to Guaspet and would have brought glass beads and other items of Hispanic origin, received as payment for work from residents of the pueblo, back to Guaspet.

Hispanics at local ranchos and the Pueblo of Los Angeles would have received these goods from two major sources: via the annual shipments of materials from San Blas to the Presidios San Diego and Santa Barbara, which would have, in turn, distributed goods to the colonists of the pueblo and surrounding ranchos, or via Yankee-smuggler black-market ships that sailed along the California coast during the late eighteenth and early nineteenth centuries (see Volume 5 of this series). Much has been written about the Spanish supply ships in and out of San Blas (e.g., Hackel 1998; Perissinotto 1998). Although not as much is known about the Yankee-smuggler ships, Miller (2001) has recently published an account of one of these ships, the *Mercury*, captained by George Washington Eayrs. During the Mission period, the Spanish had a monopoly on trade along the California coast and prohibited other sources of goods, such as these Yankee ships. Until 1813, when the *Mercury* was captured by a Spanish ship outside Santa Barbara and confiscated for illegal trade along the California coast, this and other black-market ships sailed a triangle connecting California, Alaska, and China; they traded, among other things, sea-otter pelts from the California coast for goods from China and Manila, where sea-otter pelts were in high demand (Miller 2001; see also Dado 2006; Mason 2004). These black-market ships acquired sea-otter pelts, in part, through direct trade with indigenous groups. Though technically illegal, these ships also traded with inhabitants of pueblos, missions, and presidios up and down Alta and Baja California, because official shipments from San Blas were generally irregular before 1810. After 1810, the year when the Mexican war for independence began, all shipments north from San Blas were discontinued. Miller (2001:18–19) documented that in December 1806, the captain of the *Mercury* traded directly with Hispanic residents living near the Ballona. While the *Mercury* was anchored near San Pedro, just south of the Ballona, it received 171 sea-otter pelts in exchange for cotton cloth, crockery, hardware items, and liquor. Those that traded with the *Mercury* included Fray Nicolas Lasaro of Mission San Fernando, Jose Bartolome Tapis of Rancho Topanga Malibu, and Jose Antonio Yorba of Rancho Santiago de Santa Ana. It is quite possible that Gabrielino traded with these black-market ships directly, offering sea-otter pelts for desired Hispanic items. Although this is a possibility, very small amounts of sea-otter and fur-seal remains have been recovered from analyzed contexts in the project area (see Chapter 10, this volume).

There may have been other, less official sources for weapons to which Native Americans could have gained access. Miller (2001:17) documented that in November 1806, a Yankee black-market ship, the *Mercury,* anchored in Morro Bay for trade with Mission San Luis Obispo and the surrounding area. The ship's account book recorded 60 transactions at this location and traded, among other things, a sword, 12 pounds of gunpowder, and 2 powder flasks. On the same trip down the coast, the *Mercury* also traded with various ranchos and the Missions Santa Barbara, San Ines, San Gabriel, San Fernando Rey, and San Miguel. Mason (1993:176) also suggested that guns were available to colonists in Baja and Alta California through these smuggler ships, as evidenced by their manifests. This suggests that it is possible that there were other sources for weapons in Alta California besides the presidio, which sold to select colonists for protection. The Gabrielino may have been able to access these sources, as well.

Finally, it is possible that some of the more unusual and restricted goods, such as weapons, could have been scavenged from a shipwreck, such as the possible shipwreck of the *San Jose* off the west coast of Santa Catalina Island (Daily 2008). As mentioned above, this possible shipwreck has not been documented. It is peculiar that highly restricted items, such as pistols, rifles, and swords, documented to be in very short supply in colonial Alta California, would be found in burials on Santa Catalina Island and at Humaliwo (LAN-264) as well as at LAN-62. Although it is possible that the gun barrels in the LAN-62 burial area could have been scavenged from Rancho Los Quintos (Pío Quinto Zuniga was, after all, a retired soldier originally stationed at Presidio San Diego), it is unlikely. Neophytes from the *ranchería* of Guaspet had the highest number of marriage ties with Santa Catalina Island (Pimu) of any Native village associated with Mission San Gabriel (King 1994; Stoll et al. 2009), which may have meant that there were many interactions between the inhabitants of Guaspet and those of Santa Catalina Island. A similar kin connection existed between Humaliwo and Santa Catalina Island, which also had weapons of Hispanic origin found in its burial area. How marriage ties of neophytes related to relationships between groups before the arrival of the mission system, though, is unclear (Johnson 1997; Lightfoot 2005; Newell 2009). Although this is simply a hypothesis, it is reasonable, given the highly restricted access to formal weapons in colonial Alta California.

Final Thoughts on Colonial Hispanic Artifacts from the LAN-62 Burial Area

Colonial items of Hispanic origin in the burial area at LAN-62 and in domestic contexts at LAN-211 offer interesting implications for how these items came into the hands of the native inhabitants of the Ballona, what they may imply about the lives of Gabrielino in the Ballona area, and how they functioned in Gabrielino burial contexts. Finding Hispanic items in aboriginal contexts in colonial Alta California is not unusual. For example, at the Russian colony of Fort Ross, north of San Francisco (Lightfoot et al. 1998); on the Mexican-era Rancho Petaluma in northern California (Silliman 2004); and in the Chumash Mission period burial area at Humaliwu (Bickford 1982; Gamble 2008; Gamble et al. 1996; Gamble et al. 2001), native peoples used and adopted European goods for either everyday use or special purposes. What is unusual is that these native peoples used foreign items in ways that were not European but, rather, indigenous. In the case of the Chumash burial area at Humaliwu, for example, Bickford (1982:19–22) has documented a pistol coated in part with asphaltum and altered to be used as a receptacle of some sort. In the case of the burial area at LAN-62, two copper chocolate pots were identified, one wrapped in traditional textiles and possibly placed in a basket. In both examples, the bottoms of the chocolate pots were smashed in a fashion similar to the deliberate destruction of ceramic and stone vessels by Native Americans in ritual contexts. Silliman (2005:66) argued that examples such as these suggest little indication of acculturation, despite the presence of European artifacts at Native American sites. Rather, he argued that such material culture is not simply "Native" or "European" but consists of items "taken up by [indigenous] individuals to forge their way in new colonial worlds" (Silliman 2005:68).

At the same time, there is good evidence to suggest, based on other items in the burial area, that some aboriginal residents of the Ballona were incorporated into the colonial economy as ranch or field hands. Perhaps the most striking find is the difference between items of Hispanic origin found in the burial area at LAN-62 and those found in the more domestic contexts at LAN-211. Whereas there were numerous colonial period items found in burials or in the general burial area (including hundreds of unidentifiable pieces of metal and tens of thousands of glass beads [see Chapter 6 of this volume]), there was only a small handful of colonial-era items found at LAN-211, including small numbers of ceramics and a glass projectile point. This may suggest that the items in the burial area were collected strictly for burials or, perhaps, that items of Hispanic origin were stored in contexts other than domestic ones, like FB 1 at LAN-211. It is clear that these artifacts of Hispanic origin were important to the Gabrielino in the Ballona and that they were used and treated in uniquely indigenous fashions.

Late-Nineteenth- and Early-Twentieth-Century Contexts

Late-nineteenth- and early-twentieth-century deposits containing Historical period artifacts were principally analyzed from LAN-54, LAN-62, and LAN-193. These deposits were secondary dumps containing a mixture of debris, including domestic and commercial materials. One of the more intriguing results of this work was that deposits from both LAN-54 (Feature 33) and LAN-193 (Feature 600) contained hotelware from the same facility, the Ocean Park Casino. These features are located at sites far apart from one another in the project area. All three deposits appear to date primarily to the 1920s and 1930s. The material dating to the late nineteenth and early twentieth centuries from LAN-211 was very scant, and it is difficult to place this material in the same context with materials from the other three sites.

The Ocean Park Casino was an important establishment in the Venice/Ocean Park area, several miles north of the project area, beginning in the 1890s. It is unclear when the Ocean Park Casino was originally built. The casino was not actually a gambling establishment but was, rather, a restaurant and resort facility located at the foot of Ocean Park Pier. Its most famous owner was the famed tobacco millionaire Abbot Kinney, who moved to Santa Monica in 1886 and began the development of the Venice area. In 1891, Kinney and his business partner Francis Ryan purchased a controlling interest in the Ocean Park Casino. Several months later, these partners purchased a large parcel of undeveloped land to the south of the casino that included 1.5 miles of undeveloped oceanfront property (Stanton 1998). Ironically, given the rancho history of the PVAHP area, this land was originally part of the Rancho La Ballona land grant and had been obtained from someone who had foreclosed on outstanding loans of the Machado family (Stanton 1998). Kinney developed this area into the beach resort that would officially become the community of Ocean Park in 1895. The Ocean Park Casino was a founding element of this resort community. By the 1910s, the area became known as the "Coney Island of the Pacific" and contained a number of impressive resort facilities, including several boardwalks, amusement rides, and an ornate bathhouse known as "The Plunge." It is unknown when the Ocean Park Casino closed for business. The great Ocean Park fire of 1912 destroyed the immense Frazier's Pier in Ocean Park and at least six blocks of businesses adjacent to it. It is unclear whether the Ocean Park Casino was destroyed or not. Based on the context of materials at LAN-54 and LAN-193 dating likely to the 1920s and 1930s, which included a surprising amount of Ocean Park Casino hotelware, it is likely that the Ocean Park Casino continued to operate through the 1920s.

It is clear that the domestic and commercial refuse found in Feature 33 at LAN-54 and Feature 600 at LAN-193 did not originate at these locations. In the case of LAN-54, there is little in the way of historical architecture dating to the 1920s. It is quite possible that these remains were the result of wildcat dumping. The placement, burning, and burying of the material at LAN-193, though, is suggestive of other behavior. The LAN-193 area in the 1920s contained the Kitahata Hog Ranch. It is unknown when this hog ranch began, but it likely closed in 1925 or 1926. A *Los Angeles Times* article dated January 4, 1925, stated that the Venice Hog Ranch, the largest hog ranch in the Playa del Rey area, was closing and was moving to El Monte to have more-modern facilities, including concrete pens and housing sheds. This hog ranch, like many others in Los Angeles, underwent an infestation of rats carrying the plague in 1924 and early 1925 (Deverell 2004:172–206). Many hog farms in Los Angeles during this period had buildings destroyed and burned in an attempt to uncover and kill the plague-carrying rats (see Chapter 12 of this volume for photos of the cleanup of the Kitahata Hog Ranch). The Venice Hog Ranch *Los Angeles Times* article is interesting, in part because it states that "the hogs have been fed nothing but garbage, the owners having a ten-year contract with Pasadena, Alhambra, San Gabriel, and other nearby cities for such material." As a result, in a similar arrangement, it is possible that refuse from nearby cities and restaurants, such as the Ocean Park Casino, was fed to pigs at the Kitahata Hog Ranch and that related, nonedible refuse was dumped and burned where Feature 600 was identified at LAN-193.

The LAN-54 and LAN-193 materials are similar, and there are also similarities to the types of materials found in the late-nineteenth- and early-twentieth-century contexts at LAN-62. LAN-62 also had a collection of banded restaurant ware similar to that found at the other sites. LAN-62, though, had more construction-type material in the collection than did the other sites, which indicates that the area around LAN-62 contained not just material associated with restaurant refuse but also material associated with other activities.

In sum, then, it is clear that there are pre-Hughes-era contexts within the project area that are important for understanding early-twentieth-century use of this area. The features and contexts analyzed from these sites suggest that there was a connection between development of the Venice/Ocean Park area, located along the coast just north of the project area, and the early-twentieth-century trash dumps in the PVAHP area.

Archaeological Pollen Samples from the Ballona Area: Their Meaning and Context

Peter E. Wigand

Introduction

Previous research has provided reconstructions of the vegetation and estuarine history of the Ballona (Wigand 2015). The current research will place pollen samples from archaeological sites into this context. Investigation of the microfossil record from the Playa Vista cores by Davis (2015) indicated that the record clearly reflected both local and regional patterns of environmental change. Some of these changes may have been the results of regional and/or local climatic change, but others may reflect changes in geomorphic processes as the result of climatic, tectonic, or oceanic (e.g., tidal, current, and/or wave-action) influences. Wigand (2015) examined these changes from the view of some of these other issues. He examined the southern California estuarine record from the viewpoint of post-Pleistocene sea-level adjustments and infilling of coastal embayments. The pollen record as revealed in the cores clearly indicated the regional impact of climate upon estuarine, coastal, and chaparral vegetation. These changes were even reflected in shifts in Native American demography and changes in resource utilization (Wigand 2015).

The Environmental Setting

The primary problem with interpreting the pollen records from Playa Vista, as well as from other sites along the coast of southern California, is that because of human impact, we have few modern analogues for what the Ballona may have looked like in the past or what might have composed its vegetation community. Prehistoric (natural) diversion of the Los Angeles River from the upper reaches of Ballona Creek, historical-period channelization of Ballona Creek, and construction of Marina del Rey resulted in dramatic changes in the hydrology of the Ballona (Shelley et al. 2003). Today, the Ballona is a salt-affected palustrine environment with tidal flushing controlled by gates. Though once forming a large estuary at the mouth of the Los Angeles River, much of it has been filled in, developed, or disked for agricultural purposes. Nonnative plant species compose a large part of its flora (see Henrickson 1992).

The destruction of this wetland is symptomatic for southern California, where it is estimated that between 75 (Zedler 1982) and 90 (California Coastal Commission 1989) percent of the estuarine wetlands have been lost as a result of filling or dredging during the last century. What little is left of these once-extensive coastal wetlands provides the only hints available from which to reconstruct not only the composition but also the structure of past wetlands that may have been available to prehistoric Native American populations.

Prehistorically, wetlands transformed from one type to another or from one system to another, either as the result of long-term infilling or, more drastically, through natural catastrophic events, such as floods, tidal-storm surges, and earthquakes in structural basins. These processes are ongoing but have been supplemented and complicated by "anthropogenic" processes of conversion that include: (1) agricultural development, (2) urbanization, (3) state- or federal-agency activities, (4) resource extraction, (5) recreational activities and access, and (6) introduction of invasive exotic species. To place the archaeological pollen samples into their environmental contexts, modern analogue samples from the few remaining "natural" habitats have been used. Though not exact analogues, they seem to provide adequate comparisons for assessing the archaeological pollen.

Ecoregion and Local Geology and Topography

The archaeological sites of the Ballona lie within the geographical section of California known as the Southern California Coast (or Section 261B) (Miles and Goudey 1997). This geographical region includes the entire coast from Santa Maria (north of Santa Barbara) to the Mexican border and the interior mountains, hills, valleys, and plains of the Transverse and Peninsular Ranges that flank this coastline.

It is characterized by the narrow ranges and the broad fault blocks, alluviated lowlands, and coastal terraces that make up the geomorphic provinces of the Transverse and Peninsular Ranges. Lithologically, the region is characterized by Cenozoic marine- and nonmarine-sedimentary rocks and alluvial deposits. Because this section lies along the Pacific Ocean, its climate is greatly modified by marine air.

The Los Angeles Plain (Subsection 261Bg) portion of this ecoregion comprises the central-most geographic subsection within the Southern California Coast geographical section (Miles and Goudey 1997). This subsection, where the sites are located, includes the Los Angeles Plain, the San Fernando Valley, the Verdugo Mountains, the San Rafael Hills, and the Palos Verdes Hills. The Los Angeles Plain is the largest part of this section and lies just south of the Santa Monica and San Gabriel Mountains and west of the San Jose and Puente Hills. The subsection is covered primarily by Quaternary alluvium. The Verdugo Mountains and the San Rafael Hills, which emerge from this alluvium, are composed mostly of pre-Cambrian gneiss and Mesozoic granitic rocks. Most of the region is characterized by nearly level floodplains and terraces and very gently to gently sloping alluvial fans. There are small areas of marine terraces, but they are relatively restricted in extent, compared to fluvial terraces. Steep mountains and moderately steep hills are small but important parts of the subsection. Dunes are present along the coast north of the Palos Verdes Hills, and sand has spread across Quaternary terraces behind those dunes. The elevational range of the subsection is from sea level to about 305 m (1,000 feet) on the Los Angeles Plain, slightly higher in the San Fernando Valley, and up to 938 m (3,077 feet) in the Verdugo Mountains.

Weathering of exposed rock and sediments is dominated by chemical weathering rather than mechanical weathering. Fluvial transport and deposition are the dominant geomorphic processes in the region. Mass wasting is important in the mountains, especially during El Niño cycles or after chaparral fires. Wind is an important geomorphic agent in sandy areas along the coast.

The sites from which the pollen samples in this study were collected are east of Lincoln Boulevard, at the base of the Westchester Bluffs; most rest on the lower slope (Figure 198; see Figure 3). From this position, they overlook both Centinela and Ballona Creeks. They range in elevation from approximately 3 to 24 m (11–70 feet) above sea level. LAN-54 lies in the floodplain, away from the Westchester Bluffs, just north of Ballona Creek. All the sites are exposed to both onshore and offshore winds generated daily in the Los Angeles Basin, as well as coastal fogs. Windblown pollen from both interior and more-coastal locations might be deposited in the sites.

The soils in this region are mostly Typic Xerorthents and Typic and Mollic Haploxeralfs (Miles and Goudey 1997). Soils on Miocene sedimentary rocks are shallow Typic Xerorthents, Calcic and Pachic Haploxerolls, Typic Argixerolls, Chromoxererts, and Pelloxererts. Dune soils are Typic Xeropsamments. The soils are well drained, reflecting both the alluvial and aeolian origins of these coarser sediments. High evaporation rates have resulted in the accumulation of carbonates in some of the soils. Carbonates have also accumulated as a result of capillary action above shallow groundwater. Soil-temperature regimes are thermic (warm). Soil-moisture regimes are xeric (dry).

Climate

The climate is warm and subhumid, although it is moderated by marine influences. The mean annual precipitation is about 305–508 mm (12–20 inches), most of which falls as rain (see Appendix H.1). However, it can vary between 122.5 and 735 mm (5 and 30 inches) per year (Bailey 1975). Topography is the major factor influencing local differences in the distribution of rainfall. The mean annual temperature is about 14.4°–17.8°C (58°–64°F). The mean frost-free period is about 300–350 days. The Westchester Bluffs are encompassed by the southern California climatic region known as the Maritime Fringe, which is primarily confined to the coastal strip from 5 to 25 km (3–15 miles) from the ocean (Bailey 1975). The bluffs are characterized by cool summers, when the average temperature of the warmest month is less than 22.2°C (72°F), and warm winters, when the average temperature of the coldest month is above 10°C (50°F). This region has the longest growing season of southern California.

Cloudiness is limited in the region; seven-tenths or more of the sky is covered with clouds for less than half of the days in the cloudiest month (Bailey 1975). Heavy fog occurs on the order of 53 days of the year; most of that is limited to the cooler half of the year. The number of days with heavy fog (less than 1/4-mile visibility) decreases southward from 88 days in the north, where ocean temperatures are coolest, to approximately 30 days in the south, where ocean temperatures are warmer. During the summer months, relative humidity is high in the Maritime Fringe; humidity reaches above 60 percent in the morning and late afternoon and peaks at 80–90 percent around approximately 4 a.m. (Bailey 1975).

A comparison of weather records from the Santa Monica Pier, Culver City, and LAX weather stations provided a summary of the weather conditions in the western portion (Maritime Fringe) of the Los Angeles Basin during the modern period of record (Wigand 2005:Figures 12.3–12.7).

The coldest months are December and January, and the warmest are July, August, and September. Although monthly average-maximum and -minimum temperatures vary little among the three stations (Wigand 2005:Figures 12.3a–c), the temperature record from the Santa Monica Pier station was slightly warmer in winter and cooler in spring, summer, and fall than either the Culver City or the LAX record. This reflects the ameliorating effect of the ocean and may have been, in part, due to the moderating effect of maritime air closer to the coast. In general, the Culver City weather record had greater monthly extremes—i.e., it had warmer monthly average-maximum temperatures but lower monthly minimum

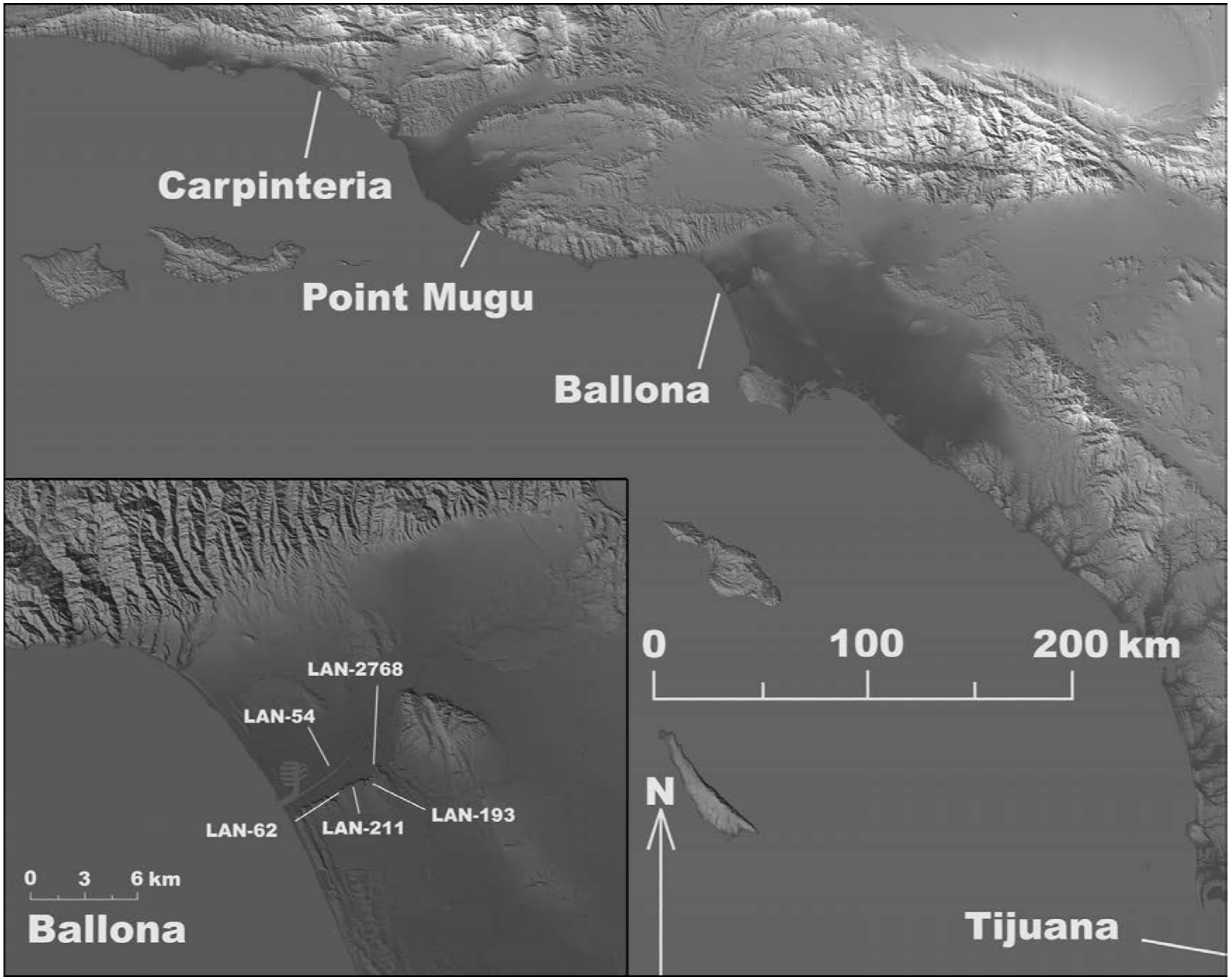

Figure 198. Map of southern California showing the wetlands mentioned in the text.

temperatures that reflect the more continental nature of the local climate there. Although the LAX record had monthly maximum temperatures between those of the Santa Monica Pier and Culver City records, it had warmer monthly average-minimum temperatures from late spring to early fall than the record of either of the other two stations. The average monthly minimum temperature at LAX was between those of the Santa Monica Pier and Culver City stations from late fall to early spring. These temperature records indicated that sites on the coastal plain near the ocean, such as the Santa Monica Pier, have their annual climate moderated by moist ocean air. The Culver City record, even though it is from a location only slightly inland, reflects the greater swings in temperature characteristic of terrestrial sites. Its much cooler monthly average-minimum temperatures, especially during the winter, reflect the effect of cold-air drainage from the mountains to the east (Wigand 2005:Figure 12.3c). Although the record from LAX was more terrestrial in nature and had warmer maximums than the Santa Monica Pier, the LAX station is at an elevation high enough not to be affected by cold-air drainage from the mountains east of the Los Angeles Basin (Wigand 2005:Figures 12.3a–c). The temperature record at PVAHP sites is probably most similar to that of LAX in that it reflects a setting that is more terrestrial in nature and cooled slightly by marine air during the summer but high enough not to be affected by cold-air drainage from the eastern mountains.

Late-spring through early-fall drought characterizes the region (Wigand 2005:Figure 12.4); snow occurs only very rarely. In general, although precipitation varied only slightly among the sites, it was greater at the Santa Monica Pier and Culver City stations than at LAX during most of the year, except in early fall, when it was slightly greater at LAX. Most of the Pacific Ocean storms are channeled by the prevailing south-southeast winds into the Los Angeles Basin and are deflected eastward by the Santa Monica Range. Cooler temperatures in late fall and winter at inland sites, such as the Culver City location, wring more precipitation from these storms than does the environment of either the Santa Monica Pier or LAX (Wigand 2005:Figure 12.4). The precipitation-to-evaporation ratio showed the same pattern for these stations as did the actual precipitation (Wigand 2005:Figure 12.5). Taking the LAX-station precipitation record as representative of the PVAHP sites, a slightly drier climate than that of much of the remaining Los Angeles Basin was probably the norm.

The number of days between the last spring freeze and the first autumn freeze provides a rough measure of the length of the growing season. However, in order to measure the efficiency of the growing season, degree-days are calculated. Degree-days are the number of degrees by which the daily mean temperature is above or below a selected base temperature. To better characterize the actual impact of temperature on plant growth, upper and lower temperature limits are applied. Usually, temperate-region plants do not really respond with significant growth to temperature increases until about 10°C (50°F). Growth is inhibited above 30°C (86°F), as well. As a result, growing degree-days are usually considered to occur in the temperature range of between 10°C (50°F) and 30°C (86°F) that contributes to plant growth.

A comparison of the weather records from the Santa Monica Pier, Culver City, and LAX indicated that the mean monthly total growing-degree-day averages during the summer were much higher at the Culver City and LAX weather stations than at the Santa Monica Pier station (Wigand 2005:Figure 12.6a). From November through February, all three stations recorded similar average monthly growing degree-days. Differences between the average monthly growing days at the Culver City and LAX stations were negligible (Wigand 2005:Figure 12.6a). The much lower average of monthly growing degree-days recorded at the Santa Monica Pier weather station reflects the cooling affects of marine air, especially during the summer. The peak growing degree-days coincided with the driest part of the year (i.e., May through October). It is clear that the greatest degree-day amounts were skewed toward late spring and summer, so that temperatures favoring most plant growth are greatest after May but drop off sharply by July. This is in juxtaposition to the supply of precipitation in the region, indicating that winter storage of precipitation is crucial for adequate plant growth during the following summer. Biotic production in the region is maximized during the spring, when conditions of increasing growing degree-days coincide with the highest levels of stored soil water from winter rainfall. During late fall and winter, differences in average monthly growing degree-days among the stations are negligible. Under this kind of climatic pattern, winter droughts can be regionally catastrophic for plant growth. During periods of drier conditions, plant maturity occurs earlier in the year. That is, plant foods will mature up to more than a month earlier than during wetter years. Under normal conditions, plants growing in the drier areas of the Los Angeles Basin will mature earlier than those in wetter areas. Therefore, with the diversity of microclimates found in the area, the harvest of specific plant species can be extended by collecting first in warmer, drier areas and then later at cooler, wetter locations.

The climatic pattern in southern California is opposite that of the Southwest, where summer monsoons (the highest annual input of precipitation) coincide with the highest growing degree-days. Therefore, southwestern plants, although they use stored winter soil water to begin their growth, are adapted to take advantage of, and indeed require, dramatic inputs of surface water during the summer. On the other hand, in southern California, plants depend on the soil water stored during the winter rainy season.

The accumulation of some growing degree-days in winter indicated that some plant growth occurs in winter in southern California (in northern California or in the Great Basin, there is no accumulation of growing degree-days during the winter months). This means that plant species that have adapted to take advantage of this could have been available for collection by Native populations throughout the year.

When these various climate parameters are compared with each other (Wigand 2005:Figure 12.7), and using the LAX record as a proxy for the Ballona sites, the climate can be summarized as cool and moist in winter and warm to hot and dry in summer. It is, however, drier than other Los Angeles Basin sites to the north and northeast in winter and moister than other inland sites in summer. It has a relatively long growing season similar to that of inland sites. Its precipitation-to-evaporation index was lower than those of many other areas in the Los Angeles Basin, which, coupled with the high number of growing degree-days, may explain the formation of the Los Angeles Coastal Prairie slightly higher than and just south of these sites. Finally, the proportion of winter/spring rainfall was just over twice that of the summer/fall rainfall. Only sites immediately on the coast had a higher proportion of winter/spring to summer/fall precipitation.

In summary, the Ballona sites are in an area where marine-air masses moderate the effects of the hotter and drier interior locations in southern California, and they are high enough (up to 24 m [78 feet] at their eastern end) to avoid more-extreme winter cooling caused by cool-air drainage from the eastern mountains. Higher evaporation rates result in drier conditions than those in the lowlands to the north and northeast.

Surface Water

Runoff in the region is rapid, although infiltration in the sandier areas may exceed runoff rates. The Los Angeles River is the largest stream on the plain. It drains the San Fernando Valley and much of the San Gabriel Mountains, flowing in alluvial and weak bedrock channels westward to the Pacific Ocean. Flow rates in Ballona Creek (which rises in the eastern part of the Santa Monica Mountains) have varied considerably in the past, not only because of changing precipitation rates but also because of shifts in the channel of the Los Angeles River. At least five shifts in the river channel have occurred during the last 200 years, resulting in a change in the position of the river mouth. It is clear that most historical shifts between outlets of the Los Angeles River occurred during major episodes of flooding. However, over the long term, tectonic movement on the floor of the Los Angeles Basin and variations in sediment compaction and basin subsidence may, in part, explain which outlet became the easiest path to the sea to follow during these events. This would also have determined where freshwater and saltwater marshes may have lain.

In regard to other surface drainage in the Los Angeles Basin, all but the larger streams and spring-fed drainages, such as Centinela Creek, were dry through the summer, suggesting that little actual water storage occurs in the surrounding hills. Prehistorically, no natural lakes or ponds were present, although "vernal pools" (ephemeral wetlands that occupied depressions in both grasslands and woodlands and remained wet during the spring and occasionally into early summer) were common in many areas, especially in the Los Angeles Coastal Prairie to the south. They were filled through the collection of runoff from surrounding areas and the accumulation over time of clay-rich (argillic) horizons in the bottoms of these basins that prevented percolation of water into the sandier substrates beneath. The seasonal duration of these pools was limited by the amount of water that amassed during the winter months, their surface area, and spring- and summer-season air temperatures. During the Holocene, their seasonal persistence may have varied considerably.

Vegetation

The predominant natural plant communities in the Los Angeles Basin are the California sagebrush–California buckwheat series and the Mixed sage series. The Coast live oak series and California walnut series are common but not extensive. Chamise series and mixed-chaparral shrublands are common in the Verdugo Mountains and the San Rafael Hills. The California sycamore series occurs in riparian areas, and the Pickleweed series is common in estuarine areas. Critchfield (1971) provided several vegetation transects north and south of the Los Angeles Basin that were recorded in the late 1930s and early 1940s; these give some clues as to the "natural" distribution of terrestrial vegetation in the area before much-more-intensive development occurred.

Locally, the vegetation series that probably characterized the area around the Ballona sites prehistorically included variations of Mixed sage series on the slopes south of and above the sites, California annual grassland series south of the sites in the Los Angeles Coastal Prairie, and Pickleweed series on the floor of the Ballona below the bluffs.

The preceding names and the following descriptions are abstracted from *A Manual of California Vegetation* (California Native Plant Society 2000), prepared with funding provided by the California Native Plant Society; the Information Center for the Environment; the University of California, Davis, Herbarium; and the U.S. Geological Survey.

Mixed Sage Series

This series is defined as a mixed-evergreen-deciduous shrubland with at least three or more species codominating any stand of this series. This shrub-dominated series is often regarded as part of the coastal scrub or as a collection of shrub series. The Mixed sage series is more narrowly defined than is coastal scrub, but coast-bluff scrub is included. Species included in this series are California buckwheat (*Eriogonum fasciculatum*), California sagebrush (*Artemisia californica*), coyote brush (*Baccharis pilularis*), black sage (*Salvia mellifera*), purple sage (*S. leucophylla*), and white sage *(S. apiana*). Definitions differ in plant height and cover from coastal scrub but contrast little in species composition. The Mixed sage series is found on slopes with shallow soils, commonly at elevations between 0 and 1,200 m.

California Annual Grassland Series

This series is defined as a temperate (or subpolar) annual grassland or herbaceous vegetation and is composed of many alien and native annual species. Its composition varies from stand to stand and through time, as well. It is dominated by herbaceous plants and usually has a height of less than 1 m. Stands of this series are now composed of nonnative annual species mixed with native perennial grasses and herbs. Among those species commonly occurring in these grasslands are ripgut (*Bromus diandrus*), soft (*B. hordeaceus)* and foxtail (*B. madritensis*) chess, storkbill (*Erodium botrys* and *E. cicutarium*), California goldfields (*Lasthenia californica*), miniature lupine (*Lupinus bicolor*), slender wild (*Avena barbata*) and wild (*A. fatua*) oats, and Italian ryegrass (*Lolium multiflorum*). Fall temperatures and precipitation are major factors determining grassland composition, along with light intensity affected by shading from plants and litter, as well as differences in microtopography. The series is found in upland localities in all topographic locations, commonly at elevations between 0 and 1,200 m.

Pickleweed Series

This series is defined as a temperate or subpolar grassland with a sparse shrub layer and either a continuous or an intermittent vegetation cover generally less than 1.5 m in height. In wetlands, pickleweed habitats can be regularly or irregularly flooded or permanently saturated with a shallow water table. The water chemistry can be mixohaline, euhaline, hyperhaline, or saline. In estuaries, these habitats can be mudflats, banks, berms, margins of bays, deltas, sandbars, valley bottoms, or the lower portions of alluvial slopes. The Pickleweed series habitat is classified as an estuarine, intertidal, persistent, emergent wetland or as a palustrine, persistent, emergent, saline wetland. Five species of pickleweed (*Salicornia* sp.) grow in California. Bigelow pickleweed (*S. bigelovii*) and common pickleweed (*S. virginica*) are frequently found in coastal salt marshes. Utah pickleweed (*S. utahensis*) occurs in alkali meadows. Common glasswort (*S. europaea*) and Parish's pickleweed, or samphire (*S. subterminalis*), are found in both habitats. The Bulrush, Cordgrass, Ditchgrass, Pickleweed, Saltgrass, and Sedge series can occur in association in California salt marshes. The Pickleweed series is commonly found at elevations between 0 and 1,200 m.

Vegetation Context

It is clear from the discussion above that little remains of the prehistoric coastal wetlands of southern California to provide us with a true indication of their composition. Many of the plant species that still survive are on the rare and endangered species list, and nonnative plant species have invaded these habitats, become naturalized, and replaced and/or are encroaching upon the remaining native plant species. More detailed analysis of the pollen records from the Ballona requires a more precise knowledge of the plant species that should be encountered in a relatively undisturbed estuarine habitat. Data from several well-studied estuaries provided crucial supplementary information that complemented the data gathered by Henrickson (1992) for the Ballona.

Nearby coastal marshes that could provide some information on modern vegetation include the San Joaquin Marsh (Bowler and Elvin 2002); online data from both Carpinteria Salt Marsh and the Tijuana Estuary (see Figure 198) provided additional data for relatively disturbed and undisturbed estuarine environments north and south of Ballona, respectively.

The vegetation of Carpinteria Marsh was described by Ferren (1985) and is primarily composed of salt marsh (133 acres) dominated by pickleweed, saltgrass (*Distichlis spicata*), and alkali heath or yerba reuma (*Frankenia salina*). Less-abundant species include fleshy jaumea (*Jaumea carnosa)*, marsh rosemary or sea-lavendar (*Limonium californicum*), and saltmarsh bird's beak (*Cordylanthus maritimus*). Intertidal flats (17 acres) contain monospecific stands of pickleweed. Salt flats, though mainly unvegetated, contain stands of alkali heath and pickleweed. A brackish-water marsh (2 acres) is dominated by cattail (*Typha* spp.), bulrush (*Scirpus* spp.), and wild celery (*Apium graveolens*). Unfortunately, the cattail species were not identified, a point crucial to this archaeological pollen study. Salt-marsh vegetation in the Tijuana Estuary today includes saltgrass, pickleweed, California cordgrass (*Spartina foliosa*), yerba reuma, and saltmarsh bird's beak, an endangered species.

These species distributions indicated that salt-marsh composition is similar, allowing for local variations in habitat, from at least 130 km (79 miles) north-northwest of the Ballona, at the Carpinteria Salt Marsh, to 190 km (115 miles) south of the Ballona, at the Tijuana Estuary. Henrickson (1992) indicated which of the most distinctive species of southern California salt marshes were found in the salt marshes of the Ballona. He indicated that much of the vegetation seen today in the salt marsh at the Ballona was introduced.

Native American Use of Coastal-Wetland Plant Resources

It is usually assumed that the socioeconomic values (food, medicinal, textile, tool, religious, and other resources) of estuarine wetlands were extremely high for Native American cultures before the arrival of Euroamericans. The high concentration of prehistoric sites around such areas is considered to be strong evidence of this. For example, in the vicinity of Carpinteria Salt Marsh and Goleta Slough in Santa Barbara County, there have been approximately 9,000 years of continuous residence by humans. Over thousands of years, there was an evolution of Native American cultures toward a greater dependence on marine and estuarine resources (Ferren 1985). Coastal groups, such as the Chumash, used plants, shellfish, and fish from the estuaries of the Santa Barbara region. Some groups who may have arrived along the coast from the interior (the alkali playas of the Mojave Desert and the Great Basin) may have already had knowledge regarding the use of many of the coastal-salt-marsh plant species that they encountered (see Ciolek-Torrello and Douglass 2002), which, combined with their knowledge of freshwater-marsh and riparian plant resources, preadapted them to a salt-marsh economy. Even today, these estuaries and their adjacent habitats are a source of small, remnant populations of native wetland plants (e.g., *Anemopsis californica* for medicinal purposes and *Juncus textilis* for basketry).

An additional factor that may have conditioned preadaptation of interior peoples to the coastal and near-coastal environments of southern California was their familiarity with the resources found in the sagebrush-steppe and desert-shrub communities of the Great Basin and the Mojave Desert. Many of the genera found in the Coastal Sage–Chaparral Scrub, the Diegan Coastal Sage Scrub, and the Venturan Coastal Sage Scrub communities, among other coastal-shrub communities, also occur in the sagebrush-steppe and desert-shrub communities east of the Sierra Nevada in the Great Basin and the northern Mojave Desert. In particular, the genera *Artemisia* (sagebrush), *Encelia* (brittlebush), *Salvia* (true sages), and *Eriogonum* (buckwheats)—all of which are found in the coastal "chaparral" that grows on the north-facing slope of the Westchester Bluffs—were commonly used by peoples of the interior. Use of these, as well as any number of large-seeded grasses, would have required little or no adjustment for immigrants from the interior.

Estuarine and Climate History

Two events dominate the history of the Ballona and the surrounding terrestrial landscape. The first event was the arrival of sea level at its current elevation. The second event was the transformation of southern California sagebrush steppe into coastal and higher-elevation chaparrals. The following discussions of estuarine and chaparral history are drawn from reanalysis of the pollen records from the Ballona reported by Wigand (2015). Note that dates have been converted from the reported radiocarbon dates into calibrated B.P. dates.

The best records for the encroachment of sea level to its current levels and the subsequent history of the Ballona were obtained from a melding of the proxy information derived from the analyses of diatoms, foraminifera, ostracodes, algae, and aquatic plants in Cores 1, 8, and 11 (Wigand 2015:Figure 10). From the record near the mouths of Ballona and Centinela Creeks (Core 8), the first clear indication of marine transgression occurred at approximately 7200 cal B.P. Prior to that time, terrestrial freshwater marsh and terrestrial habitats characterized the floor of the Ballona north of and directly beneath the bluffs (Wigand 2015). The "Ballona" bay and presumably a mid-bay bar characterized the area north of LAN-62 A at that time, and the main estuary lay further east, at the margin of the bay (see Volume 1 of this series). However, a smaller estuarine strip may have been located along the foot of the alluvial fans, at the base of the bluff (e.g., at LAN-62 G) (see Volume 1 of this series).

A period of clear oceanic incursion into the estuary characterized the period between approximately 7200 and 5750 cal B.P. Between approximately 5750 and 5450 cal B.P., a period of continental/fluvial conditions prevailed when significant marine influences were absent. This episode was followed by the only other period (approximately 5300–4600 cal B.P.) of significant marine influence in the estuary during the remainder of the record.

The absence of algae and littoral pollen and the low values of Chenopodiaceae (saltbush family) pollen suggest a hiatus between approximately 4600 and 4550 cal B.P. This was followed, between approximately 4500 and 4100 cal B.P., by some of the highest values of sedge and cattail pollen, indicating that the area beneath the bluffs lay within an extensive freshwater marsh. Renewed and heavy flows filled the streams feeding the Ballona and inundated areas that had been dry during the previous period. Marshes formed in the newly submerged lands of the Ballona. This period corresponds to the highest inputs of Neogene Glacial (or Neopluvial) period moisture elsewhere in the West (Wigand 1987; Wigand and Rhode 2002).

Between approximately 4100 and 3400 cal B.P., a continental/fluvial system in the estuary was characterized by a highly variable environment that was, at times, dominated by fresh through euryhaline conditions (Wigand 2015). Moderate values of cattail pollen during this period, centered at approximately 3570 cal B.P., seem to have mirrored an episode of wetter climate recorded elsewhere in pollen records from the Mojave Desert and the Great Basin during the Neopluvial period (Mehringer 1986; Wigand 1987; Wigand and Rhode 2002). Four previous increases in cattail pollen relative to sedge, occurring at approximately 5600, 4850, 4500, and 4250 cal B.P., also coincided with episodes of wetter climate in the interior West (Mehringer 1977, 1986; Wigand 1987; Wigand and Rhode 2002). The Ballona during this period could be characterized as a highly variable estuarine system with periods of extensive salt-marsh and/or alkali flats alternating with freshwater marsh and, occasionally, the absence of both. The dynamics of the estuary at this time reflects high climatic variability and a pattern that characterized the generally moister Neopluvial between approximately 4450 and 1950 cal B.P.

The two subsequent periods in the Ballona record formed part of the Neopluvial, as well. The first, between approximately 3400 and 3250 cal B.P., revealed a sedge-dominated marsh with no significant inputs of freshwater (Wigand 2015). This mirrored a brief episode of drier conditions during the Neopluvial in the Great Basin (Wigand 1987). The period between approximately 3250 and 2700 cal B.P. had at least one major influx of freshwater from the interior, as evidenced by increased cattail abundance at approximately 3250 cal B.P. Weaker episodes occurred at approximately 2950 and 2800 cal B.P., indicating that the effects of the Neopluvial climate were weakening.

From 2700 to 1100 cal B.P., the freshwater marsh seems to have contracted, and the salt marsh may have migrated farther west in the estuary as it filled (Wigand 2015). A gap in the record between 2000 and 1350 cal B.P. may reflect a period during which the area where Lincoln Boulevard crosses the Ballona was composed of bare sand flats. From 1350 to 1000 cal B.P., sedge marsh began expanding once again, along with salt-marsh and/or alkali salt flats. In fact, it seems that during much of the period between 2700 and 2000 cal B.P., the area where Lincoln Boulevard crosses the Ballona may have been an intermittently or substantially exposed, sandy flat. Finally, between 1000 and 800 cal B.P., a cattail-dominated freshwater marsh expanded into the area below the bluffs, probably in response to a renewed input of freshwater from the streams feeding the lagoon.

Figure 199 summarizes the abundance of sedge and cattail pollen from Core 8 recovered from north of LAN-62. After about 3000 B.P. (approximately 3200 cal B.P.), there was a significant decline in the abundance of both sedge and cattail pollen and then an absence of these pollens between 2200 and 1900 B.P. (approximately 2250–1800 cal B.P.), until a sudden increase during the wet event between 1200 and 900 B.P. (approximately 1100–900 cal B.P.).

Core 11, from an area on the Ballona floor in the western portion of the lagoon that dated to the last millennium, indicated the presence of a cattail-dominated freshwater marsh with nearby salt marshes from 530 to 515 cal B.P. (Wigand 2015). Although higher foraminifera values suggested at least one incursion of marine waters (possibly a tsunami), the Ballona was characterized by the presence of nearby salt marshes from approximately 520 to 430 cal B.P. From 430 to 300 cal B.P., a cattail-dominated freshwater marsh characterized the estuary floor east of Lincoln Boulevard, and salt marsh seems to have predominated in areas to the west. From 305 to 290 cal B.P., freshwater marsh still characterized the area, but the salt marsh may have been inundated at that time. Finally, between 290 cal B.P. and the present, salt marsh predominated in the area, although cattail and sedge marsh seem to have fringed the freshwater channels leading to the sea.

The paleoenvironmental record from the westernmost Playa Vista core, Core 1, indicated that there may never have been a freshwater marsh dominated by either sedge or cattail at that locale (Wigand 2015). Although there may have been a pickleweed-dominated salt marsh at some distance from the site during the late Pleistocene and early through middle Holocene, it was not until 4100 cal B.P. (Wigand 2015) that it arrived at the Core 1 locale, where it remained until 3500 cal B.P., when it began fluctuating in its extent. After 2500 cal B.P., the pickleweed community expanded once again into the area, becoming extremely dense between 1525 and 950 cal B.P. Information for the last 900 years was missing

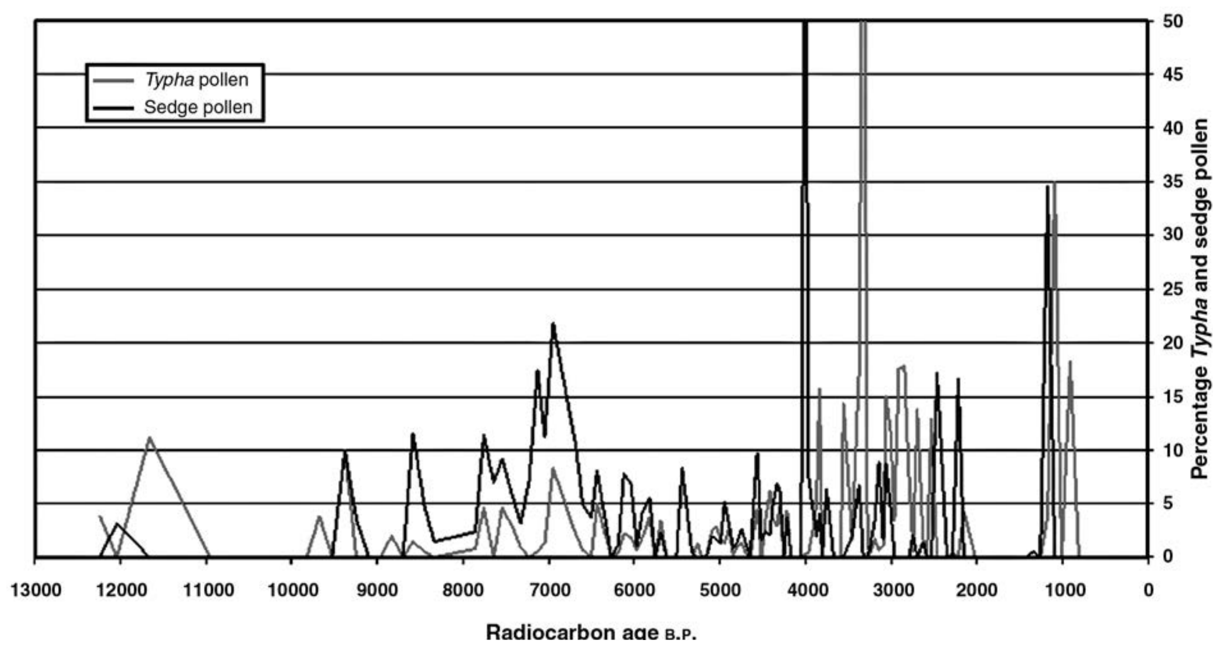

Figure 199. Sedge and *Typha* (cattail) percentages from Playa Vista Core 8.

from the Core 1 record but could be partially extrapolated from the record for Core 11, just to the east.

Documentation of a Short-Term Late Holocene Regional Climatic Event

A brief, though very strong, climatic event lasting 150 years and centered between 2,070 and 1,970 cal B.P. was recorded in a high-resolution pollen record from Lower Pahranagat Lake in the Mojave Desert (Wigand and Rhode 2002). It was marked there by huge increases in pine, juniper, and sagebrush pollen, indicating much wetter conditions. The pollen response seen there was not due to the establishment of new trees or shrubs on the landscape, because the climatic event was too brief, but rather, it was due to increased pollen production of plants already on the landscape. This event was also recorded in the fluvial record from the Mojave River as a period of increased flows (Ely et al. 1993; Enzel et al. 1989; Enzel et al. 1992). The Mojave River record is significant because its source is at the east end of the San Gabriel Mountains, which form the northeastern flank of the Los Angeles Basin. Therefore, the Mojave River record is a proxy for rainfall in the Los Angeles Basin, or at least its eastern edge. In Core 1, this event manifested as a dramatic increase in the abundance of pine vs. oak pollen (Wigand 2015:Figure 14). Sediments of that age did not appear in Core 8 (it is possible that the sediments containing this event may have been washed away as a result of greatly increased stream flow into the estuary due to regionally increased rainfall). The magnitude and widespread impact of the event and its potential for disrupting fluvial systems has been demonstrated in studies of the fluvial geomorphology of north-central Nevada. Several studies along the Humboldt River indicated that the entire channel was displaced by a flood event that cut a new and deeper channel for the river (House et al. 2001; Miller et al. 2004; Ramelli et al. 2001). After 2000 B.P., the old channel was left isolated at a slightly higher elevation than the new channel, into which sediments of the last 2,000 years have been deposited. The global impact of this event was also very clear in the reconstructed annual-rainfall amount and frequency for LAX (Wigand 2015).

Macrophysical Climatic Modeling

As part of the discussion of the pollen record, Macrophysical Climatic Modeling (MCM) is utilized. MCM is a model based on the relationship between large-scale atmospheric dynamics and synoptic climatology (Bryson and Bryson 2000) ("synoptic" refers to the use of the spatial distribution of meteorological elements—in this case, the position of the mean centers of high and low sea-level pressure systems). The MCM is a heat-budget model predicted on orbital forcing (solar insulation), variations in atmospheric transparency (dust, volcanic ash, and the impact of glacial albedo), and the principals of synoptic climatology (Bryson and DeWall 2007). The basis of the MCM is calculation of the position of the principal global circulation features—i.e., the position of the mean centers of high and low sea-level pressure representing the principal circulation features that help determine mid-latitude weather and wind systems. In addition, the model also incorporates the jet streams and the Intertropical Convergence. The North American model uses five modules: the North Pacific High at 135°W, the European or North Atlantic High at 0°, the Intertropical Convergence at 90°W, the jet stream at 120°W, and the Northern Hemisphere temperature gradient. To activate the program and to generate the climate trends at a 100-year resolution for the last 16,000 years, one only has to enter the modern monthly averages of temperature, precipitation, evaporation, etc., from the weather station in the area of interest. This model provided a reconstructed climate for the LAX area that is used in the discussion below (Figure 200).

Pollen Analysis

The 309 sediment samples taken from LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768 were extracted for pollen in the Department of Geography Paleoecology Laboratory at the University of Nevada, Reno (see Appendix H.2). Of these, 16 were duplicate samples run to check the extraction procedure. Twenty-three modern surface samples collected from both estuarine and bluff contexts were also processed. These were collected in the summer of 2004 at sites from as far south as the Tijuana Estuary to as far north as Point Mugu State Park (see Figure198). An additional 11 samples were extracted from pollen collected from voucher plant collections to confirm the identification of some of the more common, as well as some of the rarer, plant-pollen types that appear in the coastal-shrub community and that were missing from my own collection. The pollen samples were extracted using the following procedure.

Extraction

Processing of each sample for pollen and selected spores began with the placement of 2 teaspoons of sample into a 400-ml plastic beaker with triple-distilled water. For statistical purposes, four *Lycopodium* tracer-spore tablets (Batch No. 483216, with 18,583 ± 762 spores per tablet) were added to each of the samples. This equaled 37,166 ± 1,524 tracer spores per sample.

Because of the high probability that the pollen in these samples may have been degraded (usually to be expected with samples from open sites in sandy substrates), the extraction

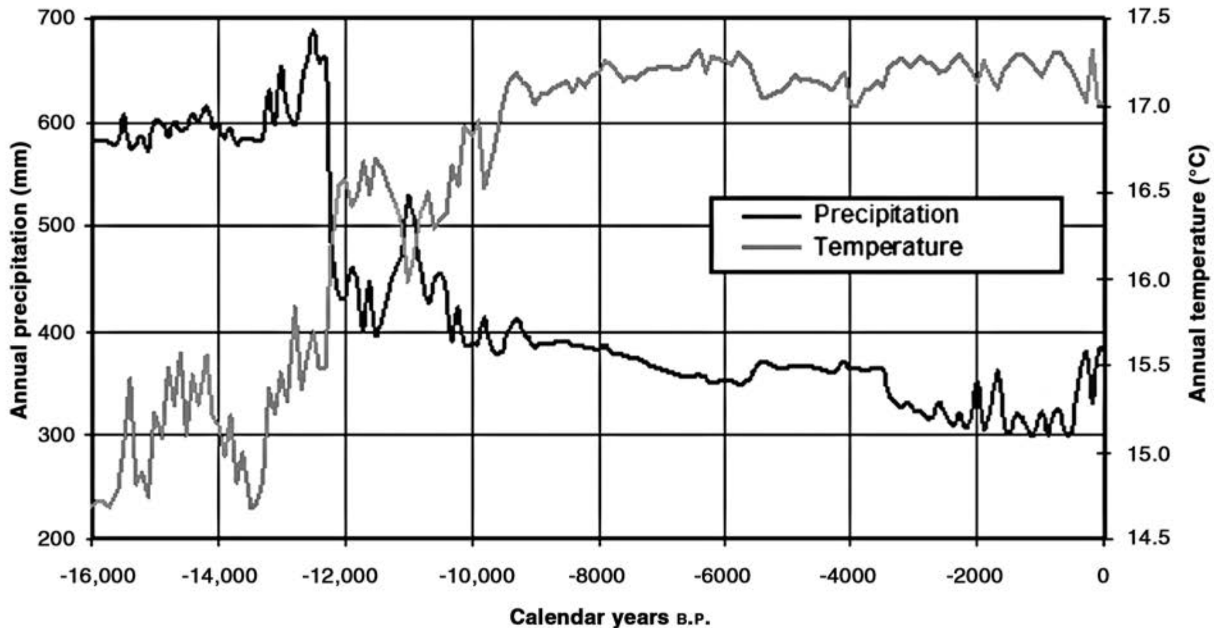

Figure 200. Reconstruction of MCM January and July precipitation in the LAX area for the last 16,000 calendar years.

procedure was slightly modified to remove those steps that might be more damaging to the pollen during processing. The modified procedure was as follows. Samples were treated with concentrated hydrochloric acid (HCl) to remove carbonates and rinsed through 150-mesh screen using distilled water. They were transferred to 15-ml test tubes, treated with hydrofluoric (HF) to remove inorganic materials (primarily silicates), and left to stand overnight. The next day, additional treatment with HF while in a 30-minute hot-water bath was followed by two rinses of the samples with distilled water. Another HCl treatment followed by a distilled-water wash removed silica gels generated during the HF treatment.

The processing of these samples was resumed by drying the pollen with two treatments of ethyl alcohol (ETOH) (the first at a 95 percent concentration and the second at a 100 percent concentration). The pollen was then stained with safranin O, and the samples were transferred to vials with Tertiary Butyl alcohol (*tert*-Butanol, or 2-methyl/2-propanol, *t*BuO-Na^+ + H_2) and completed with the addition of a mounting medium (2,000 cs of silicone oil). Finally, the Tertiary Butyl alcohol was evaporated from the samples in a low-temperature oven for a couple of hours.

Forty samples were treated with a solution of sodium polytungstate ($Na_6[H_2W_{12}O_{40}]$) with a specific gravity of 2.1 after the HF treatment. This floated all pollen, acid-resistant algae, insect parts, etc., in order to concentrate them. The float was decanted into a new test tube and concentrated using a centrifuge. The residue (material which did not float) was saved.

There followed numerous hot-distilled-water washes to remove suspended clays, charcoal, and colloidal materials that were also floated during the sodium polytungstate procedure. As with the standard extraction procedure, after the water washes, the samples were dried with two treatments of ETOH alcohol (the first at a 95 percent concentration and the second at a 100 percent concentration). The pollen was stained with safranin O during the first alcohol treatment, and the samples were transferred to vials with Tertiary Butyl alcohol and completed with the addition of a mounting medium (2,000 cs of silicone oil). Finally, the Tertiary Butyl alcohol was evaporated from the samples in a low-temperature oven for about 2 hours.

Pollen samples were mounted on glass slides and counted. Several criteria were used in counting these samples, because pollen abundance in all samples was low: (1) if the *Lycopodium* tracer count was high and no pollen had been encountered, the count was discontinued, and (2) except in a few rare cases, if at least 100 pollen grains had been counted, the count was discontinued. In many cases, after counting at least half or more of the slide, if it was clear that a count of the entire slide would yield only a handful of pollen grains, the count was discontinued.

Pollen grains were identified using the investigator's knowledge and standard pollen keys, and in a few cases, identification of certain unknown pollen types was assisted by the use of a reference slide collection, several online pollen floras from a Web site at the University of Arizona (http://www.geo.arizona.edu/palynology/pol_pix.html), and several pollen photomicrograph publications of southwestern pollen types that were helpful for types that seemed to be intrusive from the Southwest (Martin and Drew 1969, 1970; Solomon et al. 1973).

Results

The most common of the raw terrestrial- and aquatic-pollen and -spore counts (see Appendix H.3) were converted to percentages (see Appendix H.4) (Birks and Gordon 1985). Using Maher's (1972) formulas for calculating pollen-population estimates and employing the *Lycopodium* tracer spores that had been introduced into the samples, the raw counts of major types were used to generate estimates of (1) *Aster*-type-pollen percentage per sample, (2) total *Aster*-type pollen per sample, (3) total *Typha*-monad pollen per sample, and (4) total pollen per cubic centimeter (see Appendix H.4). Because pollen counts were low in many of the samples, the relative percentages of less-abundant pollen types varied erratically. "Unknown," "undeterminable," and "deteriorated" pollen grains were grouped in the category, "undeterminable."

Discussion

It is clear from the pollen counts that although there were many pollen types (37), there were only a handful of pollen types that are abundant. These included (in relative order of abundance) *Aster*-type, Malvaceae-type, *Typha*-monad (*T. angustifolia*), cheno-am (or Chenopodiaceae), *Ambrosia*-type, and Cyperaceae (sedge, rush, and tule) pollen (see Appendix H.3). In general, preservation was poor. Several pollen groups were derived using the criteria of relative preservation and overall abundance, as well as whether the plants represented by the pollen were native or exotic (introduced) species. The groups of pollen are outlined below.

Group 1

This group included poorly preserved pollen grains with pitted surfaces and/or indistinct features or those that had been torn into fragments. The pollen grains in this group could date to the time of site occupation, having been deposited at the same time that people used the site, or conversely, they could predate the age of site use and could have been present in the sediments that composed the site. After site abandonment, as the site was buried from adjacent sediments through colluvial or aeolian deposition, they entered cultural contexts. The poorly preserved state of the pollen could be the result of age (long exposure to degradation) or of soil conditions that favored pollen degradation (high soil pH [basic] and/or high Eh-oxidation potential). It could also be the result of bacterial activity, which is favored by wetting and drying during cycles of warm, moist conditions. It was impossible to identify the grains in this group, because their preservation was too poor. They were usually included in the "undeterminable" category. Many of the pollen grains that were identified were also poorly preserved, but they had structural characteristics that made them relatively easy to identify.

Group 2

This group comprised pollen grains that appeared to be well preserved (*Aster*-type pollen) but whose abundance was much greater than would be expected in any "natural" plant community. As with the pollen grains of Group 1, these pollen grains could date to the time of site occupation, having been deposited at the same time that humans used the site, or conversely, they could predate the age of site use and could have been present in the sediments that composed the site. Or, as with Group 1 pollen, they could have been incorporated into the site during feature burial through alluvial, colluvial, or aeolian deposition. Of the more-common pollen types included in this group were most of the "*Aster*-type" pollen, all of the "other Chenopodiaceae" pollen, and Poaceae (grass) and *Typha* pollen. As indicated above, many of these were also poorly preserved but, because of easily distinguishable features, were classifiable. The pollens in this group had relatively heavy walls resistant to degradation. Their overrepresentation may be the result of the destruction of other types of pollen.

Group 3

The pollen grains of this group were native species. They were background pollen—i.e., deriving from the local plant community—but they appeared to be much better preserved than most of the other pollen grains in the samples. Therefore, they may or may not represent pollen that was introduced during collection of the pollen samples. These pollen types include *Proboscidea* (devilsclaw) and some very fresh-looking pine, among others.

Group 4

These pollen grains were well preserved and clearly represented nonnative species. Some even contained cytoplasm within the pollen grains. Primary among these pollen types were *Erodium* (storkbill), which often appears in Historical period pollen records for southern California. These may reflect contamination during sample collection or mixing due to bioturbation.

Group 5

There was at least one species of Onagraceae (the evening primrose family) that, though a modern native plant, had pollen that appeared much darker and more flattened than most other pollen grains in the samples. These characteristics are typical of pollen eroded from much older deposits and redeposited into younger sediments. The much darker color could also be the result of burning of the pollen grains before deposition. Although Onagraceae pollen was uncommon, it did appear sporadically throughout.

Pollen Preservation and Interpretation of the Record

There were several factors suggesting that the pollen preservation in these samples was poor. First was the eroded appearance of many of the grains. Second was the overrepresentation of one or two pollen types, especially those that studies have shown are resistant to erosion (they usually have a much thicker pollen wall). Along with this factor was the lack of diversity of pollen types in the samples. Finally, there were usually very low numbers of pollen grains per cubic centimeter of sediment in each sample. This low density could have been caused by rapid deposition rates, as well, but in combination with the other factors, it indicated poor preservation. All of these factors seemed to be reflected in the pollen from sites in and around the Ballona.

Grain erosion could have been a result of bacterial action, oxidation, or mechanical damage during transport. Thin-walled pollen grains were affected the greatest. However, even some of the thick-walled pollen grains, such as the Chenopodiaceae and *Aster*-type pollen, could also be highly eroded.

Low numbers of pollen per square centimeter per year per sample, and especially per cubic centimeter, indicated that pollen preservation was fair to poor in all samples. In a semiarid to subhumid environment, the amount of pollen deposited per square centimeter per year will range from 6,000 to 8,000 pollen grains (occasionally up to 10,000 in wet years). Each of the pollen samples submitted for analysis (given their initial volumes) should have contained sediment accumulated from several years with pollen abundance on the order of 18,000–30,000 grains per cubic centimeter. The pollen-density estimates of these samples did not even approach such values (see Appendix H.4). This suggests either poor pollen preservation or rapid sediment deposition. Although rapid deposition does not affect pollen preservation, it exacerbates the problem of pollen scarcity. That is, if sediment deposition rates are rapid, pollen will be more thinly distributed through the sediment. Add to this the issue of poor preservation, and the pollen will be even more thinly dispersed through the sediment. A sample taken from such soil will yield very little pollen.

Another clue to the state of pollen-sample preservation is how well the pollen collection reflects the current or assumed-past vegetation community. In this case, the dominant types recovered from the pollen samples were *Aster*-type (sunflower-family) plants, Chenopodiaceae (saltbush-type) plants, or *Typha* monads that shared dominance with *Aster*-type pollen. Although these pollen types occur in nearby modern vegetation communities, they are not the kinds of collections that one would expect in the modern pollen rain (see the discussion of modern analogue samples below). The detailed scan of the pollen samples undertaken for this study clearly indicated that the pollen samples (when pollen was even found) from these features did not seem to reflect the relative abundance of the pollen types expected in the current or past local/regional pollen accumulation. The lack of diversity (e.g., the extremely low abundance of grass and sagebrush pollen as well as other pollen types) strongly suggested that these types were eroded away after deposition in these sediments.

Finally, the lack of pine pollen in most of these samples was another indication that preservation was poor. Although most winds along the southern margin of the Ballona are generally from the west, where no pine pollen would be picked up, at times during the year, such as during Santa Ana winds, there should be sufficient east winds to bring pine into the record, especially considering its abundant production. Even in a desert environment, long-distance transport of pine pollen on the regional winds floods the local pollen record. It was clearly present in the nearby cores from Ballona (see Volume 1 of this series).

The poor pollen preservation could reflect any number of factors. It may reflect not only the basic pH of the soil (acidic soils favor pollen preservation, but basic soils are inimical to pollen preservation) but the coarseness of the soil matrix within which it was found. The coarse texture of the sediments was noted during extraction of the pollen in the laboratory. This already hinted at potentially poor pollen preservation, despite the dark color of some of the sediments. Coarse soils allow for rapid water infiltration followed by drying and oxidation. Frequent wetting and drying of the soils indicates well-drained conditions with plenty of aeration that are ideal for high oxidation potential to occur. High oxidation potential is very destructive for pollen, because it creates an environment favorable to aerobic bacterial growth. Bacteria that thrive under such conditions literally eat pollen.

Soils in the Ballona sites are of multiple origins. Originally, these soils derived from the alluvium that was eroded from the mountains around the Los Angeles Basin and was subsequently reworked by local streams, the ocean, and winds to accumulate in beaches, spits, estuarine sand flats, sand sheets, and dunes around the Ballona. The Westchester Bluffs themselves are composed of ancient marine deposits capped by aeolian deposits that provide a rich source of sands and silts. Aeolian winnowing processes may have eliminated much of the pollen deposited on the ground surface. That is, because pollen is a silt-sized particle, if prevailing winds are strong enough, pollen and similar-sized silts will be blown away, leaving only sands in lag deposits. Although the Ballona sites contained some silts (and, as a result, pollen) in the sediment matrix, much of the matrix was sand. In addition, aeolian transport also results in severe mechanical damage, because surfaces can be heavily eroded through abrasion.

Any one of the factors above could result in poor pollen preservation, but together, they assure that pollen survival will be extremely poor or, at best, rare. Unfortunately, these conditions are similar to those encountered by many palynologists who have conducted archaeological palynology investigations throughout southern California and the U.S. Southwest.

The Pollen Record

Having covered the "cons" in regard to the pollen record from the Ballona sites, the discussion now turns to what other information can be gleaned from the record. Pollen samples from LAN-54, LAN-62 C, LAN-193, and LAN-2768 were totally unproductive; they contained little or no pollen (see Appendix H.4). Pollen samples from LAN-211 were also relatively unproductive, although a few of them did contain sufficient pollen to obtain a good count. Samples from LAN-62 A and LAN-62 G were the most productive. In most cases, pollen preservation was better in samples from deeper strata or from immediately beneath the surface (see Appendix H.3). This pattern was apparent upon checking the samples from deeper contexts.

Terrestrial vs. Aquatic Pollen Samples

Based on the results from samples with higher pollen content, most clearly fell into one of two categories: (1) samples dominated by *Aster*-type pollen, with Chenopodiaceae, Malvaceae, or *Ambrosia*-type pollen next in abundance (*T. angustifolia* pollen may also be relatively common), and (2) samples in which *Typha* monads were much more common, with Cyperaceae often next in abundance, although *Aster*-type pollen was still common to abundant (see Appendix H.3). This variation can clearly be seen in the samples from LAN-62 G (see Appendix H.5). When compared to modern pollen analogue samples, most of these samples appeared to reflect terrestrial environments (see Appendixes H.6 and H.7). Both modern sedge- and cattail-marsh-pollen analogue samples contained abundant Cyperaceae or *Typha*-monad pollen. *Aster*-type-pollen abundance was relatively low (under 20 percent). Even in shoreline contexts, *Typha*- and Cyperaceae-pollen abundances remained high with respect to *Aster*-type pollen. The pollen spectra from LAN-62 A, Level 71, which had high values of *Typha* pollen, still had very high *Aster*-type-pollen abundance, indicating that it was from a terrestrial and not an aquatic environment. Abundant *Typha* pollen in this sample may reflect collection and processing of cattails by Native peoples. On the other hand, it may simply reflect statistical vagaries due to the relatively low pollen count of the sample. Note that *Pinus*-pollen abundance was around 20 percent in all of the modern aquatic analogue samples (see Appendixes H.6 and H.7).

All modern terrestrial samples collected from the slopes above LAN-2768 generally contained higher abundances of *Aster*-type pollen than the modern aquatic analogue samples. In addition, they contained little or no *Typha* or Cyperaceae pollen (see Appendixes H.6 and H.7). Only the sample from the base of the slopes and closest to the modern marshes contained *Typha*- and Cyperaceae-pollen values between 10 and 20 percent. Also note that none of the modern analogue pollen samples contained values of *Aster*-type pollen approaching those found in many of the archaeological pollen samples. This confirms the supposition that more-resistant pollen types, such as *Aster*-type pollen, were more persistent in the record.

When all 46 pollen samples with the greatest pollen abundance were plotted, the pattern described above was clearly seen (see Appendix H.8a and b). *Aster*-type pollen predominated throughout; some samples had greater abundances of *Typha* pollen, some had greater *Ambrosia*-type-pollen abundances, some had greater Malvaceae-type-pollen abundances, and yet others had greater Chenopodiaceae-pollen abundances. Pine abundance was low in all of the samples, again suggesting poor preservation. All samples from LAN-211 and two from LAN-62 with *Typha*-monad-pollen abundances higher than those of any other samples were from features that may reflect the processing or storage of cattails in terrestrial contexts.

Aster-type-dominated pollen collections were clearly terrestrial (although many had higher numbers of *Typha* pollen, as well). The abundant *Aster*-type pollen in these and the other samples derived from the many plants of the composite family that grow in the area. Perhaps one of the major sources of this pollen type, especially from along Centinela Creek, is the genus *Baccharis*. Several species of this genus grow in the areas below the Westchester Bluffs, in riparian areas, in the coastal chaparral on the bluffs, and in the Los Angeles Coastal Prairie community south of the Ballona. *B. glutinosa* is found in the freshwater marshes and riparian areas below the site (Gustafson 1981). *B. pilularis* ssp. *consanguinea* is found in disturbed areas and in coastal-shrub communities on bluffs (Gustafson 1981). Another species, *B. emoryi*, is found in the dry bottoms of vernal pools of the Los Angeles Coastal Prairie community and on the sandy edges of rivers, washes, and salt marshes (Hickman 1993; Mattoni and Longcore 1997). As with all composite species, they produce copious amounts of pollen. It is to be expected that they would be well represented in the pollen record, but not to the extent that occurred in the samples from the Ballona sites. An indication that much of the *Aster*-type pollen was from *Baccharis* was that the pollen was relatively small and had morphology consistent for *Baccharis*.

However, the diversity in *Aster*-type pollen found in the samples indicated that many species, not just *Baccharis,* contributed to the *Aster*-type pollen recovered. If preservation had been better, the *Baccharis* pollen could have been separated from the other *Aster*-type pollen recovered in the counts.

Pollen of clearly identifiable salt-marsh species was not present. The saltbush (Chenopodiaceae) pollen that did appear was not, except in one or two cases, *Salicornia* (pickleweed) pollen. Chenopodiaceae pollen, as mentioned above, was primarily from non-*Salicornia* species. Much of it had a morphology consistent with the genus *Atriplex,* although other genera could not be ruled out. Various species of *Atriplex* occurred both in the Ballona and on the bluff slopes. In particular, *A. lentiformis* (big saltbush) grows on bluffs near the seashore and can also be found in the salt marsh, along with *A. californica* and *A. patula* var. *hastata*. These also produce copious amounts of pollen. One other point is that both these pollen types often represent weedy plant species that are often found in disturbed areas around human-habitation sites.

The abundance of these two pollen types in these site contexts probably did not relate to the processing of plant materials. Although it is probably not likely, *Baccharis* could have been collected during its blooming season for some use, thus shedding its pollen in site sediments during processing. This was probably not the case for Chenopod pollen, because the primary use for *Atriplex* was its seeds, which can only be collected from separate female plants. If beating baskets were used to harvest seeds from pickleweed, only female shrubs would have been beaten for seeds. Male shrubs, from which the pollen originates, would not have been touched.

The appearance of immature Chenopodiaceae pollen (Chenopodiaceae pollen with faint pores) in the record suggested that immature male plants may have been utilized at the sites for some as-yet-undetermined reason. It certainly would not have been for seeds, but it could have been used for the production of tools or may have been used simply to sweep the site.

One final explanation for the overabundance of *Aster*-type and Chenopodiaceae pollen in the sediments of the archaeological sites is that this pollen came from weeds that had established themselves around the areas in which Native Americans were living and working. Trampling and other activities disturb, or even destroy, the natural vegetation around human-habitation sites. In many cases weedy (or pioneer) plant species take advantage of the newly opened habitats and establish themselves in place of the "natural" vegetation. These species are often high pollen producers, which tend to swamp the "background" or normal pollen production. This and the preservation issues might have conspired to create the pollen collection that we saw.

The samples containing more-abundant aquatic-plant pollen are more interesting. Appendix H.3 distinguishes among *Typha* monads (one cattail-pollen grain), *Typha* diads (two attached cattail-pollen grains), *Typha* triads (three attached cattail-pollen grains), *Typha* tetrads (four attached cattail-pollen grains), and *Typha* anthers (clumps of many cattail-pollen grains). These groupings are important indicators of either a particular cattail species or cattail hybridization. There are two cattail species—*T. angustifolia* (narrowleaf cattail) and *T. domingensis* (southern cattail)—that produce single-grained pollen—i.e., *Typha* monads. In California, *T. angustifolia* grows below 2,000 m in elevation, and *T. domingensis* grows below 1,500 m in elevation. *T. domingensis* can be one-third again as tall as *T. angustifolia,* and its pollen is larger than that of *T. angustifolia*. The *Typha*-pollen grains encountered in the Ballona records were generally small and within the size range of *T. angustifolia*. However, there was a better indicator that we were dealing with narrowleaf cattail.

Typha tetrads are only produced by *T. latifolia* (broadleaf cattail), which actually hybridizes with *T. angustifolia* to produce aberrant clusters of cattail pollen. That is, it produces *Typha* diads and triads. The presence of both *Typha* diads and triads in the pollen record provided additional proof that the *Typha* monad represented *T. angustifolia*. In addition, the modern analogue sample from the restored marsh at the corner of Lincoln and Jefferson Boulevards was clearly that of *T. angustifolia*.

Apparently, *T. angustifolia* has been increasing its range on the North American continent over the past 150 years, and the pollen record has the potential to document this spread. It is an environmentally significant indicator of both water chemistry and air temperature. Although its distribution in California is apparently less extensive than that of *T. domingensis*, narrowleaf cattail is common along the southern coast of California. *T. latifolia, T. angustifolia,* and *T. domingensis* fall along an environmental gradient from cooler climates, fresher water conditions to warmer climates, and more-alkaline water chemistry. The occurrence of both *T. latifolia* and *T. angustifolia* pollen in the record from the base of the Westchester Bluffs indicated that the marshes there were relatively fresh and that climates were relatively cooler than those further in the interior.

Now the question arises as to why *Typha* pollen was so abundant in the pollen record from certain locations in the Ballona. There are basically three explanations. First, these locations are downwind of cattail-rich marshes from which the pollen was blown and deposited at the sites. Second, winds could have picked up the pollen along with sediments from periodically dry marshes upwind of the sites and deposited the pollen along with the sediments at the sites. Third, the pollen could have originated from plants that were processed at the sites. The heads of cattails could have been processed at the sites for seeds and/or even pollen (which was clearly eaten by the Paiute in the northern Great Basin). The abundance of pollen indicated that if the cattail heads were processed, they were collected at a time when the seeds were mature, but there was still pollen in the male flower at the top of the head, above the female flower. If the cattail head had been harvested late in the season, the pollen from the male flower would have been gone. The presence of clumps of immature *Typha* pollen suggested that strong winds carried the pollen onto the sites or that the cattail heads were processed for pollen before the seeds were mature.

If the cattail pollen was carried from the freshwater marshes north and west of the sites, it is clear that sedge could not have been very common in those marshes. Cyperaceae (sedge) pollen was not very common at all in any of the samples. However, Sedge has a relatively thin wall, whereas *Typha* has a fairly thick, double wall. So, poor preservation could explain the lack of sedge pollen in the record.

A modern analogue sample collected from the restored marsh at the corner of Lincoln and Jefferson Boulevards indicated a much greater diversity of plant species than was found in the archaeological record. Not only were there many more aquatic-pollen types, but there were acid-resistant algae (*Pediastrum boryanum*); a greater diversity of littoral plant species, such as ditchgrass (*Ruppia* sp.); and a good representation of the terrestrial-plant species growing near the marsh (see Appendix H.5).

What was clear when all the samples that had pollen (even those with extremely low counts) were examined was that *Aster*-type pollen recurred most consistently (see Appendix H.9). In addition, pollen of both Chenopodiaceae (saltbush) and *T. angustifolia* (narrowleaf cattail) also occurred quite commonly. Finally, the Playa Vista pollen record documented that the appearance of Cyperaceae (sedge and rush) pollen, though more variable, was persistent in the pollen record from the Ballona sites. In general, it was apparent that pollen-accumulation rates (grains per cubic centimeter) of all of these types were very low (see Appendix H.9). Only occasionally did any of the samples have more abundant pollen content.

The Near Absence and Presence of Other Terrestrial Pollen

The most interesting problem with all the pollen from the Ballona samples was the absence of *Artemisia* (sagebrush), *Eriogonum* (buckwheat), and Lamiaceae (true sage). These should all be relatively common in the record, if they occurred in the past as they do today in the Ballona. They are tough, double-walled pollen grains that should survive poor postdepositional conditions, but they were extremely rare. This can only suggest that postdepositional conditions were extremely harsh for pollen preservation. Those types that did appear must have been extremely abundant at the time they were deposited in the archaeological record.

Devilsclaw (*Proboscidea* cf. *parviflora*) pollen, though rare, also occurred in the samples processed from the Ballona sites (see Appendixes H.3 and H.8a and b). The seed pods of this annual were used by Native populations in the manufacture of basketry. There was little or no possibility that pollen of devilsclaw could have been collected along with the seed pod, because the time when these plants flower and the time when they produce mature seed pods are many weeks apart. However, collection and use of these plants by Native peoples might have led to the establishment of some of the plants adjacent to or in the settlements, perhaps even near the work areas at the sites. Alternatively, there may not have been any use of devilsclaw on the site. The appearance of its pollen in the record may have been purely coincidental, because it grew as a nearby weed (a devilsclaw-pollen grain appeared in the modern analogue from the restored marsh at the corner of Lincoln and Jefferson Boulevards).

Finally, the occurrence of several small Malvaceae-pollen grains was puzzling (see below). This grain, when it appeared, was darkened, sometimes scorched. This was true, as well, of the few globemallow- (*Sphaeralcea* sp.–) pollen grains that appeared. Malvaceae flowers were sometimes ingested, or an infusion was made from the flowers. If the flowers were processed, the pollen would certainly have appeared in the archaeological sediments, because it is a relatively heavy pollen grain.

Archaeological Pollen Samples, *Typha* Marsh, and Climate

The dating of the archaeological pollen samples needs to be resolved in detail. Only a few of the pollen samples that had pollen had associated dates. However, some comparisons could be made among the relative depth of the samples in the sites, the range of their radiocarbon dates, and the reconstructed climate of the region.

Pollen samples from LAN-62 G provided the best example of a stratigraphic record from the current collection of pollen samples (see Appendix H.5). Twenty-five pollen samples with relatively higher counts displayed clear environmental changes. The record from LAN-62 G can be divided into three zones based on the abundance of the more-common pollen types. Pollen samples in the deepest zone (Zone I), as with all other samples from LAN-62 G, had abundant *Aster*-type and *Typha*-monad pollen. However, samples from Zone I generally had greater abundances of Chenopodiaceae pollen than did samples higher in the profile. The Chenopodiaceae pollen were not *Salicornia*-type pollen, which would suggest the presence of a salt marsh. Instead, they suggest more-xeric (drier) conditions than occur in the area today. *Ambrosia*-type pollen, though common, were not nearly as abundant as in the overlying Zone II.

Zone II had abundant *Aster*-type and *Typha*-monad pollen, but Chenopodiaceae pollen was much less abundant (see Appendix H.5). *Ambrosia*-type pollen was much more abundant, suggesting greater disturbance, either by people or as a result of alluvial/colluvial processes. In many respects, this zone appeared to be transitional, because pollen types that were abundant in the lower zone were less abundant in this zone (e.g., Chenopodiaceae), and pollen types that were more common in the overlying zone appeared to be or were more abundant (e.g., Malvaceae). This zone suggested that climatic conditions are changing locally and perhaps regionally. These changes were reflected in less-xeric conditions with perhaps more rainfall that resulted in more sediment movement, as indicated by the greater abundances of disturbance species, such as *Aster* and *Ambrosia* species.

Zone III had more sporadic and sometimes considerably lower values of *Aster*-type pollen (see Appendix H.5). This, together with reduced abundance of *Ambrosia*-type pollen, may indicate reduced human disturbance or less alluvial/colluvial activity. Values of *Typha*-monad pollen were initially high and then considerably lower near the surface, where Cyperaceae (sedge and rush) pollen became more abundant, suggesting a shift in the nature of the marsh to more-brackish conditions. Considerably increased values of Malvaceae-type pollen were also noted. This pollen type may reflect the genus *Malvella* (alkali mallow), which is found in alkaline soils. Its abundance may simply reflect its appearance in the shrub community near the site, indicating increasingly saline soil conditions (most likely), or perhaps the use of this plant by Native Americans (less likely). The fact that in some samples, many of the Malvaceae pollen grains were scorched could suggest the latter possibility, or conversely, it might suggest recurrent wildfire around the margins of the Ballona. Apparently, its root was used by Native Americans in the eastern United States for medicinal purposes, to treat dysentery, diarrhea, inflammation of the bowels, burns, etc. (Campbell 1951).

As indicated earlier, many of the better-preserved pollen samples appeared to be from the lower portions of the sites. Judging by the depth of the radiocarbon samples relative to that of the archaeological samples that have been analyzed, this would put a number of the well-preserved samples during the late Millingstone and early Intermediate periods—i.e., between 4000 and 2000 cal B.P. This corresponds with the highest cattail and sedge values from the core (see Figure 199).

More revealing is the timing of cattail-marsh expansion and specific climatic shifts. The earliest cattail-marsh expansions did not occur until modern sea level had been established, around 7100 cal B.P., and some infilling of the Ballona had begun to occur. As discussed in Volume 1 of this series, at the beginning of this period, the Ballona bay may have been at its peak, but there may have been a broader estuary to the east and north of the bay. After that, it seems that spring (April, May, and June) precipitation may have been the most important factor in maintaining cattail-marsh expansions (see Appendix H.10). Although winter precipitation may have played a role, it seems that high values of spring precipitation were required for maintaining freshwater in the marsh. When spring precipitation declined after 3100 cal B.P., cattail-marsh expansions ceased. A re-expansion about 900 cal B.P. corresponded with increased spring precipitation. The relationship between spring precipitation and episodes of cattail-marsh expansion probably reflects a shift toward more freshwater in the marsh. If spring precipitation is low, the marsh becomes brackish. Neither *T. angustifolia* nor *T. latifolia* is favored by more-brackish conditions; sedges should survive better under such conditions. If spring precipitation is high, marsh-water chemistry remains relatively fresh. High winter precipitation by itself seems never to have been high enough to ensure that marsh-water chemistry remained fresh into the summer.

The correspondence of climate, marsh change, and people becomes clearer when the timing of the decline in spring precipitation is compared with the cultural record from the Ballona (Figure 201). The decline of spring-season precipitation clearly corresponded to the transition between the late Millingstone and early Intermediate periods just around 3100 cal B.P. The change in marsh hydrology brought about by the disappearance of spring runoff clearly changed the nature of the marsh in front of the Ballona sites. In short, both the composition and the biomass of the marsh may have changed significantly. The abundance of marsh resources would have declined, as well as their diversity. This would have resulted in fewer available resources for Native Americans.

In response, Native Americans would have had to redirect their efforts from freshwater- (cattail-) marsh resources to a greater variety of resources. They not only had to utilize resources from more-brackish water or salt-marsh resources but probably had to range further into terrestrial-plant-resource areas. The reduction in the freshwater marsh may have forced them to disperse their settlements in order to take advantage of more widely dispersed resources. And they may have had to adapt a foraging pattern similar to the seasonal-transhumance way of life of Great Basin natives. Such settlement changes would especially have been true during the Medieval Climatic Anomaly, when marshes may have become much less widespread. These environmental changes may explain the sudden decline in settlements in the Ballona during this period.

Such changes in settlement would have been easy for peoples from the interior who simply expanded one part of their yearly collection rounds and restricted those parts of the annual cycle that no longer proved advantageous. This is done on an annual basis by peoples of the interior of western North America. Therefore, although the kinds of marsh resources utilized by Native peoples of the Ballona may not have changed much, the proportion of their livelihood that marsh resources composed was probably drastically reduced.

Conclusions

Investigation of archaeological pollen samples from a series of sites along the southern margin of the Ballona was the final phase of a series of studies that have attempted to establish an environmental context for the archaeology of the PVAHP and human exploitation of that environment. As with many sites in southern California, pollen preservation has been an ongoing issue. However, in summarizing all of the pollen analysis that has been conducted in the area, several points can be made in regard to the local and regional environment. By synthesizing everything at this time, a clearer picture of the sequence of events in the Los Angeles Basin is formed. The conclusions of previous research (Wigand 2015) and of this analysis are summarized below.

Ecological Inferences

The results of the palynological studies in the Ballona (Wigand 2015 and the current study) have provided insight into the following 15 inferences regarding the paleoecology of the region.

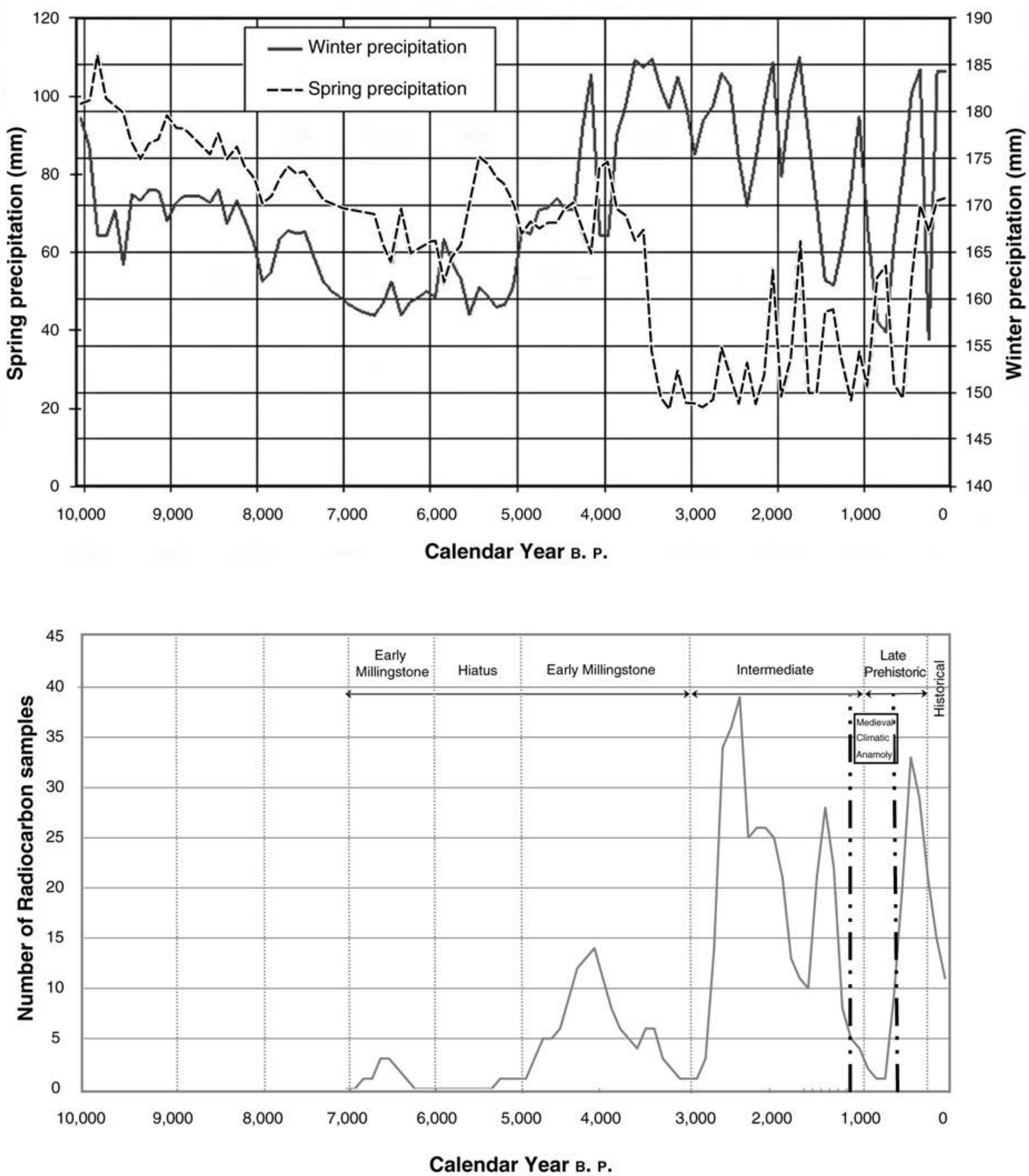

Figure 201. Macrophysical Climate Model-modeled winter and spring precipitation compared with the summed radiocarbon dates from archaeological sites of the Ballona.

1. Microfossil evidence from Core 8, the San Joaquin Marsh, and the John Wayne Freshwater Marsh all confirmed an arrival of sea level at its current elevation 7,000 cal B.P. Evidence from Core 1 suggested that there may have been considerable uplift at the location of this core.

2. Core 1 contained strong evidence of a late Pleistocene (between 16,000 and 14,390 cal B.P.) subalpine woodland dominated by "limber" pine in the surrounding mountains. The identification of limber pine was based on the occurrence of current species in the region and the vegetation history derived from ancient woodrat middens in the Mojave Desert.

3. At middle elevations, a nonchaparral shrub steppe, composed in part of Ceanothus and Rosaceae (a variety of rose family) species, characterized the vegetation of the Los Angeles Basin.

4. At low elevations was a sagebrush steppe (more widespread than that of today) characterized by higher proportions of *Aster*-type (sunflower-family) plant species and much lower grass abundance.

5. There was clear evidence of an early Holocene establishment of a "chaparral"-type vegetation community in the hills of the Los Angeles Basin about 9,000 cal B.P.

6. The maximum Holocene expansion of this vegetation type was between 7800 and 5700 cal B.P., when, as climatic-model reconstructions have suggested, winter and spring precipitation was at its maximum.

7. This expansion was primarily at the expense of low-elevation sagebrush steppe that yielded to expanding "chaparral" 9,000 cal B.P.

8. Isolated coastal-chaparral communities, such as those on the north-facing slope of the Westchester Bluffs, became more mesic (wetter) in aspect as species that were favored by wetter climates became more dominant, between 7800 and 5700 cal B.P.

9. After 5,700 cal B.P., there was a regional decline in "chaparral" vegetation to the levels that currently characterize southern California.

10. Coincident with the establishment and spread of "chaparral"-community vegetation was a regional increase in pine (probably warm-temperature, fire-climax pines, such as ponderosa and Jeffery pine).

11. Extensive marshes developed after the establishment of modern sea level and sufficient infilling of the Ballona. The period between 6,000 and 3,000 cal B.P. was punctuated by major expansions of cattail marsh. These expansions resulted from increased spring precipitation that kept the water chemistry favorable for cattail species to survive.

12. The most dramatic increase of pine (*Pinus*) and sagebrush (*Artemisia*) during the Holocene occurred between 2200 and 1900 cal B.P., which correlates with a similar event recorded in tree-ring, pollen, and fluvial records from the eastern Sierra Nevada and the northern Mojave Desert. This period is associated with an episode of both global cooling and increased precipitation.

13. Although there were no charcoal counts available from the PVAHP cores, based on current knowledge of secondary vegetation succession after fire, episodic occurrences of Rosaceae pollen apparently reflected fires in the "chaparral" community.

14. After 3100 cal B.P., there was a rapid westward expansion of salt marsh south of the main outlet channels for Ballona and Centinela Creeks, between the freshwater marsh centered in the eastern portion of Ballona and the shoreline dunes on the west. A similar expansion may have taken place north of these channels, but there were no cores analyzed for that area. The timing of this coincided with the decline of cattail marsh in the eastern portion of the Ballona. This may again be explained by a reduction in spring precipitation. Reduced spring rains would result in reduced flow of freshwater to the marshes. Not only did it result in the elimination of cattail as the dominant marsh species in the east, but reduced stream flow would have resulted in increased deposition of sediment at the mouths of the streams and accelerated the formation of salt marsh where those sediments were dropped. Increased silt deposition would have occurred, because the vegetation cover on the uplands surrounding the Ballona was reduced as a result of the loss of precipitation, exposing these slopes to increased erosion when rains sporadically occurred. Whenever they occurred, the rains would have swept sediments into the marshes and quickly deposited them within the confines of the marshes.

15. Microfossils that reflect water chemistry (foraminifera, diatoms, ostracodes, and algae) seem to be the best evidence of the relative importance of marine versus freshwater predominance in estuarine environments. They also provide the best proxy data for inputs of freshwater related to moister climates. They may even signal the occurrence of dramatic marine incursions (tsunamis and/or tidal surges due to tropical storms) into the Ballona.

Climatic Inferences

1. There is very close correspondence between the Bryson MCM for southern California climate and the reconstructed history of the "chaparral" community. This correspondence suggests that "chaparral" establishment was tied to the increasing amount of annual precipitation and the increasing frequency of rainfall events in each month. Although temperature may have played a role, it was less clearly a direct cause.

2. There is a very strong correspondence between the Bryson MCM modeling of increased spring precipitation and periods when Ballona marshes were dominated by freshwater. In addition, the MCM model also indicates a possible correspondence among reduced spring precipitation, decreased stream competence, more-rapid infilling of the western portion of the Ballona, and formation of the saltwater marsh.

3. Finally, there is a close correspondence between episodic occurrences of Rosaceae pollen in the record and winter drought in the MCM model. The suggestion is that winter drought led to conditions under which fire could occur, resulting in secondary vegetation succession that was initially dominated by Rosaceae (probably chamise) expansion. This appears in the pollen record of the Playa Vista cores (see Volume 1 of this series).

Anthropological Inferences

1. Because both estuarine/riparian and coastal-chaparral/prairie vegetation communities were the primary Native American resource areas in the Ballona, variations in their compositions, locations, and extents through time were vital and affected lifeways and seasonal activities. This was true even around the margins of the Ballona, where coastal-chaparral communities varied considerably during the Holocene. This habitat would have been an important source area for many of the weedy species that have been identified in the macrobotanical remains from archaeological sites in the Ballona (see Wigand 2005).

2. Because sea level did not reach its current elevation until 6100 cal B.P., many, if not most, coastal archaeological sites in the Los Angeles area dated to earlier than that are probably concentrated beneath the Pacific Ocean under several meters of water, offshore, within 4 km from the modern coastline. Alternatively, they should be found outside the floodplain, where they would have been buried by infilling of the estuary as streams graded to their new base levels.

3. Because estuarine communities are dynamic with periods of freshwater-marsh or salt-marsh predominance that are relatively transitory, changes in the distribution of human-population concentration and resource use by Native peoples should reflect such changes.

4. Late Holocene growth of the Native population in the Ballona corresponded to expansion of the salt-marsh habitat and probably to increased productivity in the Ballona. In fact, the shift between the late Millingstone and Intermediate cultural periods seems to have coincided with a decline in spring precipitation and resulted in the accelerated formation and expansion of the saltwater marsh in the western portion of the Ballona as the freshwater marsh declined in the eastern portion. It also corresponded with the beginning of significantly drier conditions east of the Sierra Nevada, in the Great Basin and the northern Mojave Desert.

5. The most-intensive occupation of the Ballona area (based on the concentration of radiocarbon dates) corresponded to one of the most dramatic wet episodes during the last 8,000 years: a cool, wet episode centered between 2200 and 1900 cal B.P. Biotic productivity probably peaked during this period.

Archaeological Pollen

1. Archaeological pollen samples from sites along the southern margin of the Ballona were of two types. One type was dominated by sunflower-family pollen with an admixture of saltbush-type pollen, which may reflect either poor preservation or an abundance of weedy plants in and around habitation or use areas.

2. Samples dominated by cattail pollen may simply reflect flooding of the habitation or use areas by pollen that blew across the site from the marshes to the north and west, or they may reflect actual use of cattail heads for food. In this case, the presence of immature cattail pollen suggested that pollen, as well as seeds, may have been eaten. The presence of both broadleaf- and narrowleaf-cattail pollen indicated that both may have been used by, or at least were available to, Native Americans. Ethnographically, there is no difference in the ways these two species of cattail were used. In addition, one does not appear to have been favored over the other. The major difference between the species is that broadleaf cattail (*T. latifolia*) usually does not grow as large as either narrowleaf (*T. angustifolia*) or southern (T. *domingensis*) cattail. Narrowleaf cattail dominated the cattail species in the marsh.

Analysis of Vertebrate Fauna

Justin Lev-Tov, Sarah Van Galder, David Maxwell, and Seetha Reddy
with contributions from Thomas Wake and Kenneth Gobalet

Introduction

The Ballona offers a record of 7,000 years of human occupation in an area rich in biodiversity. The local wetlands were attractive freshwater sources to species ranging from seasonally migrant birds to year-round residents such as mammals large and small—including humans. The nearby coastline offered a wealth of fish and shellfish resources, and the mixture of riparian, wetland, and bluff topography provided a wide variety of habitation situations, whether these were for short-term or for permanent use.

Despite the vast array of subsistence choices offered by these diverse habitats, stability and caution are the keywords in vertebrate exploitation throughout nearly the entire history of occupation of the Ballona. People lived near coastal resources but seldom exploited them to any great extent. Fish bones are rarely found in large quantities, suggesting either that fishing never played an important role in the local subsistence economy or that fishes played a role secondary to those of other animal classes. The Ballona people had seasonal access to many migratory birds but appeared to hunt very few of them, in either number or variety. Mammal remains show the same patterns repeatedly, with rodents outnumbering almost everything else in nearly all contexts. Although at least some of these, particularly burrowing animals like gophers, could have been intrusive and not related to subsistence, the overwhelming number of rodent bones suggests that people did indeed eat them on a routine basis. Apparently, large mammals such as deer were hunted only occasionally, perhaps on the basis of encounters rather than on organized hunting expeditions. Nevertheless, that situation appears to have changed, to a degree, sometime during the Late and Mission periods. Greater numbers of bones of deer and other hoofed mammals appear within Late and Mission period strata at several sites. Why, with the possible exception of the Late and Mission periods, was stability the rule in the Ballona? Why did a maritime culture, defined by a diet dominated by marine foods similar to those in the Northwest coast area, never take hold despite the proximity of the region to the shore? How did European contact affect the people of the Ballona and their subsistence economy? These are just some of the kinds of questions under consideration in this analysis. The scope of the study is enormous: more than 300,000 animal-bone fragments were analyzed, classified, and recorded, and this is only the tip of the proverbial iceberg; it is unlikely that even 10 percent of the total collection was studied, and actual taxonomic identifications were even more limited.

This chapter begins with a summary discussion of previous zooarchaeological research—conducted by both SRI and other researchers—in the region. Although this format immediately presents the reader with an understanding of the Ballona fauna as collected by humans long ago, both Chapter 1 (this volume) and Appendixes I.1–I.2 discuss the modern habitats of the area and, in general, species characteristic of each. Analytical methods are discussed after previous research, with particular emphasis on taphonomic indicators, as these play a great role in the analysis that follows. After the methods section, each site is discussed in turn, beginning with the sampling strategies employed, a discussion of control units and features, taxonomic and taphonomic trends, and any other intriguing patterns teased out of the data. Although this portion of the report is primarily descriptive and summary, interpretations are scattered throughout, and detailed discussions of faunal remains from all significant contexts are presented in accompanying appendixes. Sites are presented in the following order: LAN-193, LAN-2768, LAN-54, LAN-62, LAN-211, and the Runway Sites (LAN-1932 and LAN-2676, which are of poor cultural integrity and probably represent redeposited midden). Following the descriptions of each site is an analysis of trends through time, including habitat exploitation and taphonomic patterning. For additional information regarding the information presented in this chapter, please see Appendixes I.1–I.17 on the accompanying disk.

Summary of Previous Research

Considerable faunal analysis has been conducted within the Ballona, and distinctive local patterning has become evident (for recent summaries, see Maxwell 2003; Van Galder and

Ciolek-Torrello 2005; Van Galder et al. 2005). This section provides a summary of the previous analyses in the Ballona beginning with the lowland sites and continuing with those on the bluff tops. The summary is based on data derived from mitigation reports from sites on the bluff tops and in the lowlands near Playa Vista, as well as testing data derived from the Playa Vista sites themselves. Sites in the Ballona area can be classified with a simple, two-tiered approach: whether they are situated in the lowlands or on the bluff tops. A number of Ballona sites have been tested or excavated by Dillon et al. (1988), King (1967), Van Horn (1984, 1987a), and Van Horn and Murray (1985), as well as by SRI (Altschul, Homburg, et al. 1992; Altschul et al. 2003; Douglass et al. 2005; Grenda et al. 1994). All of these archaeological reports feature analyses of recovered faunal remains. There is some variation between sites located along the bluff tops and those located in the "lowland" areas of the Riparian Corridor and the lagoon edge. Bluff-top and lowland sites contain similar faunal collections; mammal remains dominate. Formerly, it was understood that bluff-top-site collections contained higher percentages of fishes, particularly lagoon fishes. However, that conclusion did not take into account the animal bones identified only to the class level; with those additional data, the two areas are, in fact, generally similar in the relative abundance of fish remains. An exception to this trend, however, is noticeable with respect to the Intermediate period, when, in fact, the bluff-top sites do feature significantly greater accumulations of fish elements relative to bones from other animal classes. Nonetheless, the comparison is difficult to make over the long span of human occupation of the Ballona, because no bluff-top sites with intact components dating to the Late, Mission, or Historical period have been excavated.

In general, the lowland Ballona sites feature large middens with animal bones from a wide array of species. Although some of these species indicate year-round occupation, some seasonal differentiation is also noticeable. One instance of this is some species of bony fishes (Osteichthyes) that generally come toward shore or even into freshwater during the cooler months of the year. Detailed summaries of faunal remains from each of the previously investigated Ballona-area sites may be found in Appendixes I.3–I.4.

Temporal Discussion

Sites from the Ballona date to the early and late Millingstone, Intermediate, Late, Protohistoric, Mission, and Rancho periods. Four of the five bluff-top sites have Intermediate components. LAN-64 has both an Intermediate and an early Millingstone component (Douglass et al. 2005; Van Horn 1987a). One sample from LAN-206 dates to the early Millingstone as well (Van Horn and White 1997a). Mammal remains dominate all of the excavated-site collections from the bluff tops and lowlands. Again, rodent elements, particularly those from pocket gophers, were the most common identifiable specimens. The collections from bluff-top and lowland sites of all periods were highly fragmented and noticeably burned. The sections below by period do not discuss the Hammack Street site (King 1967), as the data from this Rancho period site are not well understood.

Millingstone Period Sites

Three Ballona sites, LAN-62, LAN-64, and LAN-206, have Millingstone components (Stoll et al. 2003:14–16). The excavations at LAN-64 and LAN-206 yielded small faunal collections with 1,190 specimens; total weight of animal bone was just 107.3 g (Colby 1987a, 1987b; Salls 1988). The two small collections from bluff-top sites LAN-64 and LAN-206 were dominated by mammals, which accounted for more than 95 percent of both collections. Birds also contributed a small percentage to the collections at both sites. Reptiles and fishes (both Chondricthyes [cartilaginous fishes] and Osteichthyes) were present within LAN-206 deposits as well.

Intermediate Period Sites

Six of the lowland sites and four of the bluff-top sites discussed above contain Intermediate period deposits. Mammal remains, most of which are unidentifiable, dominate all of the site collections both on the bluff tops and in the lowlands. Rodent- and rabbit-sized mammals make up the bulk of the identifiable mammal collections from all sites. The large-mammal bones are highly fragmented at all of the sites. At LAN-193 and LAN-2768, artiodactyl bones showed the highest degree of fragmentation. Numbers of birds and reptiles are low at all sites but are slightly higher in lowland sites.

The degree of burn damage varies among sites. Faunal collections from LAN-61, LAN-62, and LAN-63 exhibit a high frequency of burn damage, ranging between 30 and 60 percent of the collections. Cairns (1994) reported that the large-mammal bones from LAN-206 are also burned. The other collections from Intermediate sites show only small percentages of burn damage (12 percent or less).

Fishes constitute a moderate percentage of collections at many of the Ballona sites. At bluff-top sites, including LAN-59, LAN-61, and LAN-63, fishes make up about 30 percent of the collections. By contrast, fishes constitute only about 10 percent of the faunal collections at lowland sites. Previously researchers believed that prehistoric human populations of the Ballona region followed dietary strategies that were distinct for upland and for lowland landforms (Maxwell 2003:164). Although it is true that bluff-top sites contain, on average, 20 percent more fish remains than lowland sites, the bluff-top sites still follow the same pattern, with mammal remains dominating the collections.

The remains of cartilaginous fishes outnumbered those of bony fishes at LAN-59, LAN-61 A, and LAN-61 B, as determined from Van Horn and Murray's (1985) excavations. Although SRI's studies at LAN-63 and LAN-64, with contexts dating to the early Millingstone period, indicate that bony fishes were the dominant fish type, previous studies at West Bluffs sites excavated during the 1980s suggested that specimens of cartilaginous fishes predominated (Salls 1987). Several analysts have studied the fish collections from the lowland sites (Maxwell 1998a; Salls and Cairns 1994; Sandefur and Colby 1992), whereas one analyst (Salls 1987) conducted the early studies from the bluff-top sites. Although prehistoric inhabitants of the bluff-top sites may have preferred processing cartilaginous fishes at some of the bluff-top sites, it must be noted that this discrepancy may have resulted from different excavation and analytical approaches used by researchers working on bluff-top vs. lowland sites and by the various faunal analysts who have examined lowland collections.

Late Period Sites

Although several lowland sites were occupied from the Intermediate period through the Mission period, only two, LAN-47 and LAN-62, have firmly defined Late period components. Again, mammal bones were the most abundant elements at both sites, and rodent remains dominated the identifiable specimens. Late period occupants of LAN-62 relied more heavily on fishes, particularly bony fishes, than did those at LAN-47. Twenty-eight percent of the animal bones from LAN-62 showed burn damage. Most of these (77 percent) were partially or completely blackened. The animal-bone collection was highly fragmented. Again, rodent bones were fairly fragmented, although less fragmented than bones of larger mammals. Twenty-two percent of the animal bone from LAN-47 showed burn damage. Less than 20 percent of the vertebrate-faunal collection from LAN-47 was identifiable, indicating a highly fragmented collection (Sandefur and Colby 1992).

Protohistoric and Mission Period Sites

Components of two lowland sites, LAN-211 and LAN-62, date to the Protohistoric and Mission periods. Although a Mission period component at LAN-61 is suspected, on the basis of the presence of 10 glass beads (Van Horn 1985:147–148), the deposit was not defined or discussed in detail. Faunal evidence from LAN-211 and LAN-1932 suggests that prehistoric peoples exploited a variety of animal resources in a pattern different from that seen previously. Mammal bones made up about 50 percent or less of the faunal collections—the lowest percentage for any lowland or bluff-top site of any period except LAN-59. Animal bones from LAN-211 were fairly fragmented, though less so than at other Ballona sites. Of the mammal remains, the pinniped elements were the least fragmented, whereas artiodactyl elements showed the greatest fragmentation. Only 15 percent of the animal bones showed burn damage (Maxwell 2003). Maxwell (2003) reported that the change in subsistence strategy from more focused to more generalized may be due to European contact, in that European diseases and establishment of Mission San Gabriel caused significant population loss and movements. Such changes would probably have broken down the traditional hunting-and-gathering lifeway, causing remnant native groups to take whatever foods were available, given breakdown of social structure and loss of labor. He also suggested that the Ballona inhabitants may have shifted their subsistence economy in order to trade for various resources. Of particular interest are the bird remains, as these were dominated by wing and shoulder elements; Brown (1989) suggested that these indicated that aboriginal people hunted specific species in order to obtain their feathers, although that interpretation was later questioned by Fenenga (1990).

Analytical Methods

As part of SRI's ongoing research in the Ballona, vertebrate-faunal analysis has been conducted at several sites (Cairns 1994; Maxwell 1998a, 1999a, 2003; Sandefur and Colby 1992). To maintain comparability and consistency, the same methods of identification, description, and analysis have been employed for all phases of the analysis. This approach allows for the recognition and investigation of changes as well as periods of relative stability within the Ballona. At the same time, this approach results in behavioral observations that go beyond sampling error or individual analysts' divergent approaches to reporting the same information. The details of this approach are discussed below.

Identifications

Analysis began with the identification of each specimen to the lowest possible taxonomic level, beginning with class and skeletal element. Even this gross level of identification proved impossible in a few cases because of the high degree of fragmentation of some pieces, leaving such specimens without recognizable landmarks, such as muscle attachments or articular surfaces. Specimens of this nature are described simply as "unidentifiable." Considerably more common was the situation in which specimens were distinguishable to the class level (such as "Mammalia") on the basis of animal-bone morphology, but the element was either unrecognizable or could be described only to a general form (such as "long-bone shaft"). Typically, specimens from this collection that could be identified to element and class were identifiable at least to the family level. Species-level identifications were made whenever possible; however, generic identifications were more common.

Formal identifications were made through several different comparative collections. Mammalian faunas were identified using in-house collections at the Redlands and Tucson offices of SRI. Although small, the SRI collection was adequate to handle the rodent- and lagomorph-dominated remains. The SRI collection also includes several examples of California sea lion, along with specimens of sea otter and dolphin, making it possible to identify many of the marine mammals encountered. Larger marine mammals were identified through the collection housed at the Natural History Museum of Los Angeles County (NHMLAC). Identifications were also conducted by means of additional reference collections, including those housed at UCLA; NHMLAC; the Zooarchaeology Lab at the Museum of Archaeology and Ethnology at Simon Fraser University (SFU) in Burnaby, British Columbia; and the Arizona State Museum (ASM) at the University of Arizona. A variety of osteology manuals were also employed, including those of Gilbert et al. (1996) for birds, Gilbert (1990) and Schmid (1972) for mammals, Olsen (1968) for reptiles and amphibians, and Hillson (1986) for teeth.

Avian remains were identified at the Zooarchaeology Lab at SFU. This collection is adequate for dealing with the fauna present, which is predominantly waterfowl; additional identifications were made using the large collection of NHMLAC.

Faunal remains that were neither mammalian nor avian were analyzed by specialists outside SRI. Reptilian and amphibian remains were identified by Dr. Thomas A. Wake at UCLA. The fish remains were identified by Dr. Kenneth Gobalet of California State University, Bakersfield, using that institution's large comparative collection.

Size Classes

Each mammal bone or bone fragment was assigned to one of five body-size classes (Table 168). These estimates are nonmetric and are based on "eyeballing" the specimen for robustness (i.e., thickness, density) and dimensions. Unidentifiable materials allow for overlap, and thus specimens may be described as "medium to large" and so forth. Nonmammalian fauna were also assigned to comparable body-size classes appropriate to their respective classes.

Taphonomy and Formation Processes

Formation processes (Schiffer 1976, 1987), including taphonomic factors, are well known for transforming archaeological collections, and the study of formation processes has played a significant role in the vertebrate-faunal analyses conducted thus far on the PVAHP (Maxwell 1998a, 1999a, 1999b, 1999c, 2000, 2003). Bar-Oz and Dayan (2003) have argued that intercollection comparisons are vital if taphonomic biases are to be assessed but note that few such studies have been attempted. "One possible reason for the dearth of such . . . inter-site taphonomic studies is that they require matching highly detailed research protocols on several different collections" (Bar-Oz and Dayan 2003:886). The PVAHP offers a chance to compare a number of sites from a single region, representing a considerable time depth, all analyzed by largely the same approach, and recording the same types of data. Here a variety of types of animal-bone damage and alteration are considered, with particular focus given to bone weathering, burning, and fragmentation. Other types of taphonomic damage, such as mineral staining, butchery marks, gnawing, root etching, and caliche coating were recorded whenever present but typically affected a much smaller proportion of the collection. Mineral staining was recorded only during the initial stages of the present study, as interpretations of this analysis have proved ambiguous in previous studies in the region. Taphonomic data were recorded for all terrestrial fauna analyzed, but only burning and butchery were recorded for fish bone—both possibly offer insights into processing methods.

Bone Weathering

The degree of weathering and animal-bone deterioration resulting from exposure to ultraviolet light and other elements reflects differences and similarities in the depositional histories of different specimens and collections, particularly with regard

Table 168. Descriptions of Size Classes Used for Playa Vista Faunal Remains, by Exemplary Fauna

Size Class	Mammals	Birds	Fishes[a]	Reptiles/Amphibians
Extra large	whales			
Very large	cattle, bison, horse, elk, porpoises and dolphins	condors	ocean sunfish, large sharks, tunas, swordfishes	
Large	deer, pronghorn, sheep, goats, pigs	geese, swans, pelicans, birds of prey	rays, smaller sharks, sheephead, mackerels	kingsnakes, rattlesnakes
Medium	canids, mustelids, otters, hares	chickens, turkeys, ducks, gulls	salmon, croakers, seabasses	alligator lizards, pond turtles
Small	ground squirrels, domestic cats, rabbits	songbirds, rails, plovers	surfperches, chubs, flatfishes, gobies	frogs, toads, garter snakes, glass lizards
Very small	rats, mice, shrews, moles	hummingbirds	herrings, sardines	salamanders

[a] Includes both bony fishes (Osteichthyes) and cartilaginous fishes (Chondrichthyes).

to the duration of surface exposure before burial. Throughout its work at Playa Vista, SRI has used the weathering stages outlined by Behrensmeyer (1978), as these provide a well-known comparative standard. The weathering stages employed in this analysis, Stages 0–5, were described by Behrensmeyer (1978:151) and therefore need not be repeated here.

Behrensmeyer (1978) advocated classifying animal bone within the most advanced weathering stage exhibited over a 1-cm^2 area. Lyman and Fox (1989) noted varying stages in a different fashion: if part of a specimen is in Stage 1 and another part is in Stage 2, it is described as Stage 1.5. Lyman and Fox (1989) argued that this procedure allows for a greater understanding of weathering variability, rather than obscuring data. The Lyman and Fox approach was employed throughout the Playa Vista project, because this method allows for greater descriptive flexibility.

There are no published descriptions of weathering stages for any nonmammalian species; thus, although weathering is frequently noted on the bones of birds, reptiles, and fishes, there are no criteria for describing these patterns. In this study, nonmammalian fauna are classified using descriptive stages similar to those used for mammals, as this allows for assessment of weathering damage to the entire collection, rather than just the mammalian portion. However, the approach for nonmammalian fauna was also binary: weathering was either present or absent. Thus, for nonmammalian bones, if weathering was present, it was recorded as being in weathering Stage 1.5, whereas minimally weathered nonmammalian bone was recorded as Stage 1. Stage 0, indicative of fresh animal bone with grease present, is rare in archaeological contexts.

Burning

Like weathering, bone burning has received considerable attention from researchers (Koon et al. 2003; Lyman 1994; McCutcheon 1992; Nicholson 1993; Stiner et al. 1995). Burning, however, is perhaps even less well understood than bone weathering, and its interpretation can be problematic, especially when deciding whether bones were intentionally burned or were burned as the result of being in the soil matrix as midden material when a hearth or other fire was lit (Bennett 1999). Koon et al. (2003) discussed morphological changes to animal-bone collagen that occur at temperatures too low to produce changes to bone coloration (180–220°C). For the present study, bone is classified as either unburned or burned. Burned bones are further classified into the following categories, which are not mutually exclusive:

Blackened: The entire specimen has been exposed to heat sufficient to turn it black, similar to charcoal. This is suggestive of exposure to low heat (240–440°C).

Calcined: The specimen has been exposed to heat (>440°C) sufficient to turn at least part of it white or gray, and the bone frequently takes on a chalky consistency.

Partial: Part of the bone is blackened, whereas other parts remain unburned. Partial blackening may result from partial exposure of the specimen, possibly during roasting or similar activities.

Cut Marks and Butchery

Cut marks have been the subject of considerable debate for the past 20 years (Behrensmeyer et al. 1986; Blumenschine and Selvaggio 1988; Bromage and Boyde 1984; Bunn 1981; Gifford-Gonzalez 1989; Potts 1988; Potts and Shipman 1981; Shipman 1986; Shipman and Rose 1984; White 1992). In the Playa Vista project materials, cut marks have been identified only macroscopically. Ideally, the study of cut marks may be used to understand butchering (Binford 1978, 1981; Brain 1981; Egeland 2003; Lyman 2005; Munro and Bar-Oz 2005), and thus the use of meat at a site. In historical-period contexts, butchery marks can be used to suggest whether a professional butcher was present in the area, whether home butchery was practiced, and, potentially, the ethnicity of the site's inhabitants. In the Ballona, cut-marked animal bone is rare before the time of European contact. However, after contact, butchery practices yielding cut marks on bone become more common, with both aboriginal butchery and European (and possibly Asian) butchery present. For example, testing at LAN-211 (Maxwell 2003) indicated the presence of European-introduced fauna—in this case domestic cow—that had been butchered in a fashion typically associated with Native American butchery practices (Binford 1981). LAN-211 also yielded a number of large fish vertebrae with cut marks suggesting butchery.

Mineral Staining

Staining of animal bone by groundwater is a common phenomenon in both archaeological and paleontological collections; however, as an archaeological formation process, this has received little attention (see Shahack-Gross et al. 1997), and the interpretation of stained bone is far from clear. The presence or absence of bone staining was recorded during the initial stages of analysis. Staining was distinguished from burning on the basis of color: stained specimens appear dark brown, and burned specimens blackened or calcined. The goal of recording such data was to recognize the presence of very recent intrusive specimens, on the basis of the assumption that recent bone would be less likely to be stained than bone that has been in the site for a longer period. This recording was discontinued after a large sample of bone had been analyzed.

Other Types of Taphonomic Damage

Traces of other types of formation processes—including gnawing by rodents or carnivorans, caliche (calcium carbonate) coating the bones, root etching, and water rolling—were all recorded when present; all were very scarce within the Playa Vista materials.

Quantification

The methods of quantifying vertebrate-faunal remains have undergone lengthy debate, beginning with Grayson's (1981, 1984) pioneering work and continuing through to the present (Abe et al. 2002; Pilgram and Marshall 1995; Ringrose 1993, 1995). Remarkably little has been resolved as a result of this discussion, save that minimum number of individuals (MNI), once thought to be an excellent quantitative measure for vertebrate-faunal analysis, now is seldom relied upon as the sole or principal measure of relative abundance. The present study employed the number of identified specimens (NISP), which includes all specimens that could be recognized; "unidentifiable" is thus a category included under NISP. It is worth noting that both shafts and articular ends are included in these totals; when possible, these are refitted. Rogers (2000) discussed the importance of including articular ends in order to assess carnivoran damage in animal-bone collections.

Sampling

The sheer volume of materials recovered over the course of a multiyear project such as the PVAHP makes the analysis of every specimen impossible. Throughout this project, a system of judgment samples has been employed, designed to ensure spatial and temporal coverage of each site while focusing on areas of particular research interest. This system was used during the early years of testing projects, and its success made it a logical choice for the more recent data recovery phases.

To provide a baseline understanding of the vertebrate fauna from each site excavated during data recovery, all of the materials from at least one control unit from each site or locus within a site (with the exception of Locus B of LAN-2768, where control units were analyzed) was selected for analysis. In many cases, multiple control units were examined in detail. Looking at multiple control units from each site provides insight into the localized variability, despite the use of judgmental rather than random samples (Mueller 1979; Nance 1983; Nance and Ball 1986; Schaeffer et al. 1986). However, the sheer volume of faunal material in many units and our research focus dictated a subsampling strategy, involving a combination of either selecting fewer control units or conducting detailed identification. Table 169 lists the control units from each site designated for detailed vertebrate analysis and compares these with control units for which only class-level analysis was performed.

Beyond the control units, research interests were focused on particular features and contexts. These required sampling of a different sort, again necessitated by the sheer volume of materials recovered. Because each context was unique, a single, standardized approach to sampling and subsampling was not feasible. Therefore, a variety of approaches were employed, including, as discussed below, sampling procedures drawn up for the human-burial area at LAN-62, as well as a large and dense midden encountered at LAN-211.

Human burials were plentiful at LAN-62, and faunal remains were frequently encountered in these deposits. However, as the burials themselves were dug into midden soil, it is highly unlikely that many of these remains were related to the burials in any but the most tangential fashion. Therefore, vertebrate-faunal remains were collected from the burials at LAN-62 only when their context and condition were deemed suitable for analysis: in other words, when the animal bones appeared to be in situ. Vertebrate remains with apparently strong contextual association were selectively collected from the burials and subjected to analysis. Because not all burials produced nonmidden vertebrate fauna with evident burial association, not all of the burials from the site were sampled for purposes of producing analytical samples. Thus, only some burials' faunal collections were studied.

A subsample of nonburial features from each site was chosen by the project principal investigators, and these were analyzed. Nonburial features are an important consideration for vertebrate-faunal analysis, as these can provide information on the relationship among faunal procurement and

Table 169. Control Units Selected for Analysis, by Site

Site	Control Units for Class-Level Analysis	Control Units for Detailed Vertebrate Analysis
LAN-193	11, 34, 117	21
LAN-2768, Locus A	8	2/22, 20/21, 3
LAN-2768, Locus B	502, 504, 509, 516, 523, 524	
LAN-54	30, 31	3, 11
LAN-62, Locus A/G	26, 119, 186, 306, 316, 609, 682, 853	141, 323/321, 1048
LAN-62, Locus C/D	534, 922, 970, 981, 998	937/560, 1000
LAN-211	119, 353, 359	120, 274

processing, refuse disposal, and other types of activities. The most impressive nonburial feature is the activity-area (Feature 1) block from LAN-211. This area produced a massive number of vertebrate materials, so many, in fact, that it required extensive subsampling to be manageable: the entire block was subsampled in a checkerboard fashion, such that only every other square was excavated. The faunal remains were sampled such that 1/16 of the materials were identified to species, and another 1/16 to the class level. Different strategies were applied to other feature blocks. For FB 3 from LAN-62 A, only individually recorded items were analyzed, whereas both items and a 1/8 sample of materials from FBs 4 and 7 were analyzed from the same site. Yet another approach (Feature 201 at LAN-62 C) involved subsampling materials by screen size, with 25 percent of the materials from the smallest screens (1/8 inch) analyzed, compared to 100 percent of the animal bones from the larger screens.

Chapter Structure

The remainder of this chapter is devoted to a summary of all faunal remains found during SRI's data recovery operations at the Playa Vista sites. Within the discussion of taxonomic relative abundance at each site, the data are summarized according to both spatial and temporal contexts. The reader is referred to summary tables and charts within this chapter for examination of broad trends, whereas more-detailed data are available in text sections with accompanying tables and charts in separate appendixes, each dedicated to a different PVAHP site. The exceptions to this are the detailed discussions of and data gathered from the Runway sites, LAN-1932 and LAN-2676 (no faunal materials were studied from SR-23), which are presented in the appendixes.

Vertebrate Remains from LAN-193

The faunal remains from all of the contexts at this site are very similar to one another. Differences among contexts are minor and due mainly to sampling decisions. Other differences are due both to depositional variation across the site and to sampling error.

Sampling Strategy

A comparatively large vertebrate-faunal sample was analyzed, numbering more than 45,000 fragments. The latter total constitutes almost 80 percent of the nearly 57,000 pieces of animal bone recovered during excavation of LAN-193 (Table 170; see Appendixes I.5.1–I.5.9). Given the large number of bones recovered and selected for analysis, SRI designed a sampling process with the aim of procuring a faunal collection representing all contexts across the site. Large collections from single contexts were routinely sampled using a splitter, a simple device constructed to divide a large bag of animal bones into four subsamples, in an unbiased manner. The contents of a single context (i.e., an excavation-unit level or feature) containing an estimated 100 or more animal bones were poured into this device. Afterward, one of the four separate quarters of this split sample was chosen at random for detailed study, which included taxonomic analysis to the most specific extent possible, element and portion assessment, and determination of whether any specimens displayed taphonomic (burning or weathering) damage or cultural modifications. Only the taxonomic class and taphonomic features of recovered elements were recorded on the remaining 75 percent, even when it may have been possible to identify the specimens further.

The faunal collection stems from animal bones collected within four control units, several nonburial features, two burials, and a feature block (see Appendixes I.5.1–I.5.9). The collection of bones from the feature block is divided into two distinct components: elements recovered during excavation of the features of the feature block, and the much greater number found within the many test units excavated adjacent to the features. The largest portion of the faunal collection

Table 170. Summary of Vertebrate Remains Analyzed from LAN-193

Context	NISP
CU 11	6,763
CU 21	4,550
CU 34	1,068
CU 117	1,957
Subtotal (CUs)	14,338
Burial Feature 2 (animal burial)	4
Burial Feature 101 (human burial)	5,434
Subtotal (burial features)	5,438
Nonburial Feature 7	79
Nonburial Feature 8	48
Nonburial Feature 100	53
Subtotal (nonburial features outside FB 9)	180
Nonburial FB 9 Feature 447	8,752
Nonburial FB 9 Feature 530	18
Nonburial FB 9 excavation units	16,603
Subtotal (nonburial FB 9)	25,373
Total	45,329

Key: CU = control unit; FB - feature block; NISP = number of identified specimens.

was found within the feature block, which, counting the features and excavation units together, contained more than half the total number of bones (approximately 25,000) recovered from this portion of the site. Of the remaining contexts (control units, burials, and nonburial features outside the feature block), the control units contained by far the most bones (approximately 14,000). More surprisingly, however, the two burials containing nonhuman bones (one an animal inhumation, the other a human burial) held far more bones than did the nonburial features: approximately 5,000 compared to nearly 200. Detailed discussion of animal-bone content from these various contexts is presented in Appendixes I.5.1–I.5.9, whereas summary discussions are included here, below.

Control Units

The first visible trend in the control units lies in the sheer densities of faunal remains estimated for the principal periods present: late Millingstone and early Intermediate. In all the control units, the Intermediate period levels produced far higher density estimates than did the preceding period's samples. It appears that the later occupation of the site was more significant, because of either lengths of stay or population size during that period.

In terms of what animals the population pursued in different periods, or whether there is evidence for differential disposal, one thing to consider is the importance of fishes. Fishes were present in low frequencies (2 percent of vertebrate remains recovered from the control units). CU 11 yielded a relatively high number of fish bones, with 261 bony and cartilaginous fish elements (about 69 percent of all the fish bones from the four control units [377 bones total]). CU 11 was in the center of the line of four such units, flanked by CU 21 to the west and CU 34 to the east. CU 21 and CU 34 did not contain nearly as many fish bones as CU 11. Thus, there must have been either a unique food-processing area located within the vicinity of this control unit or a discrete dumping area only touched upon by CU 11.

The control units with fully analyzed faunal collections (CUs 21, 34, and 117) do not reveal significant differences in taxonomic composition, with the exception of a higher frequency of fishes in the Intermediate period deposits (92 percent of all fish remains) relative to the late Millingstone period deposits (20 percent of all fish remains). In all units and throughout all the periods present (not including fill levels), bones of hoofed mammals are quite rare. Instead, it seems that Native Americans more often hunted or trapped smaller game such as rodents, lagomorphs, and turtles. All of these species were (before modern development) common taxa of the Ballona area. What remains unclear is the extent to which the prehistoric populations in fact sought, and ate, very small animals like mice and gophers, as well as animals like snakes that are difficult to process because of their large number of bones. These are the species one sees repeatedly, from control unit to control unit (and even from site to site within the PVAHP). Because of the uncertainty surrounding the reason for the animals' presence, it is difficult to gain very much insight into the population's diet from these contexts alone.

Burial Features

Three human burials and one animal burial were encountered during excavations at LAN-193. Two of the human burials contained no animal bones. Two burial features yielded faunal remains: burial Features 2 and 101. The animal burial (burial Feature 2) consisted primarily of horse bones, in addition to a few essentially unidentifiable fragments perhaps originating in the midden. This feature probably dates to the Mission period or later. The human burial (burial Feature 101) was prehistoric; the faunal collection from this feature probably was not associated with the burial but was from backfilled midden soils. Even at the nearby site of LAN-62, which contained many human burials with faunal remains, there was not a single burial containing more than approximately 200 animal bones. Within the small proportion of the latter context's itemized sample, none of the bones appeared to be special in the sense of having been culturally modified or having come from rare species. Therefore, there is no clear association between these bones and the human burial.

Nonburial Features

Features 7, 8, and 100 present the opportunity to examine portions of the site that the other contexts selected for analyses do not cover. Two of these three features, Features 7 and 8, were not, in fact, individual, discrete features but instead apparently were activity areas, made up of artifact concentrations spread over a large area (for details, see Chapter 5, Volume 2 of this series). Feature 100 was a rock cluster. Appendix I.5.1–I.5.9 summarizes the bone data collected for these three features.

FB 9 was another rich activity concentration and consisted of a large area, encompassing some 24 m^3 of material and several features. Only two of its features, however, produced animal bones, although most of the test units excavated in and around the features did contribute bones to the faunal collection.

The features and excavation units of FB 9 produced entirely similar faunal collections (see Appendixes I.5.1–I.5.9). This should not be surprising, given that the larger of the two features (Feature 447, a rock cluster) was located within the western half of FB 9, where most of the excavation units with large numbers of animal bones were located. Three of the excavation units (numbered 65, 66, and 71), in fact, are situated above Feature 447.

What these features and excavation units share, other than the fact that each context contributed many bones to the overall faunal collection from the feature block, is the previously described dual focus on both small mammals and aquatic fauna. Small mammals were the dominant taxa within each context where the bones were identified beyond the class level, whereas nonmammalian faunal remains were all from species with aquatic habitats. Obviously, the latter statement is true for the fishes, which in all contexts are entirely saltwater or estuarine species or at most spawn in freshwater, but this pattern also holds true for both reptiles and birds. The identified avifauna consists entirely of shorebirds and waterfowl, whereas the reptiles are dominated by the remains of a single, aquatic species, the western pond turtle. Therefore, other than a gross difference in the sheer number of faunal remains recovered from the eastern vs. the western half of the feature block, there are no detectable differences between the content of features and that of excavation units.

Summary of LAN-193

No major temporal differences in dietary emphases were noted between the late Millingstone and Intermediate period contexts at LAN-193. Small mammals were the primary animal foods, accounting for more than 90 percent of the faunal collection in both periods. Other animal foods, such as birds and reptiles, were supplemental sources and probably were obtained opportunistically. The percentage of fish remains increased slightly from the late Millingstone (3.6 percent of identified vertebrates) to the Intermediate period (5.6 percent of identified vertebrates).

Among the nonburial features, Feature 8 and FB 9 were dated to the early Intermediate. Feature 7 appears to have mixed contexts, with both early Intermediate and late Millingstone dates. Feature 7 yielded 79 bone fragments, all but 1 of which were completely unidentifiable. The early Intermediate deposits from Feature 8 yielded 48 unidentifiable bone fragments. The vertebrate-remains collection from FB 9 (features and excavation units) was also dominated by mammals (95.6 percent); fishes (1.8 percent), reptiles (1.5 percent), and birds (1.1 percent) were present in very low frequencies (see Appendixes I.5.1–I.5.9). Although it is possible that some percentage of the rodent remains were postdepositional, their sheer quantity suggests that they served as food, along with hoofed mammals, turtles, and fishes.

Reasonable evidence suggests that this site was occupied during the warm months of the year, whether spring or summer, or both. Possibly, the site was occupied more or less year-round, perhaps especially during the Intermediate period, when the relative amount of food debris seems much higher than in the preceding Millingstone period. Yet what is noteworthy is not which taxa are present within this collection, but which are missing. Why are large mammals, whether sea mammals or hoofed mammals, in addition to upland game birds, almost completely absent from this faunal collection? One wonders whether the Ballona sites, of which LAN-193 is a typical example, were warm-season encampments. Perhaps the same population moved inland and upland in autumn and in these places hunted pronghorn and deer intensively. It is also possible that in winter and early spring, when whales are closer to the shore and aquatic carnivorans colonize beaches in mating season, the human populations moved to the beachfront in order to take advantage of those animals. Therefore, possibly, rather than a specialized diet focusing on small game and spring/summer aquatic fauna, the population may have had a very generalized diet but moved between specialized camps that were located at the best times and places for hunting and trapping the particular animals characteristic of the locale.

Vertebrate Remains from LAN-2768

Loci A and B were the only two of the four loci at LAN-2768 that retained sufficient cultural integrity and site structure to warrant analysis. The site wraps around the eastern end of the bluffs. Locus A is situated at the northeastern corner of the site; Locus B sits at its eastern end. Excavations at these two loci yielded a faunal sample of moderate size (more than 50,000 specimens) from analyzed contexts that date to the Intermediate period. Approximately 90 percent of the analyzed faunal remains were recovered from Locus A (Table 171). The strata in Locus B have proved more difficult to date, but in general it appears that that portion of the site is contemporary with and later than Locus A. There appear to be subtle occupational horizons within the early Intermediate strata of Locus A (see Appendixes I.6.1–I.6.9).

Locus A

Faunal remains from this locus came from two contexts: control units selected at different areas in the site and a number of features of different types discovered during monitoring (see Appendixes I.6.1–I.6.9). Approximately 28,000 pieces of bone were recovered from Locus A analytical contexts; all but a small number were from the four control units. Mammals contributed the bulk of the animal bones recovered from each of the contexts, whether control unit or feature. Overall, the most important secondary source of animal protein was bony fishes, as determined simply by the numbers of bones per taxonomic class within each context. Overall, throughout this locus, mammals constituted 85 percent of the analyzed bone sample, as compared to bony and cartilaginous fishes, which together constituted 5 percent. Within the control units alone, however, deer and other artiodactyls (but not including introduced domesticates) made up about 4 percent of mammalian taxa identifiable beyond the class level, a greater abundance than in many other PVAHP contexts. No artiodactyl bones emerged from the features. Reptiles were somewhat more common than birds (2 vs. 1 percent) across Locus A. Nearly all the

Table 171. Summary of Vertebrate Remains Analyzed from LAN-2768, Loci A and B

Context	NISP
LAN-2768, Locus A	
CU 3	4,474
CU 8	12,158
CU 20/21	6,771
CU 2/22	4,404
Subtotal (CUs)	27,807
Nonburial Feature 3	13
Nonburial Feature 12	13
Nonburial Feature 18	65
Nonburial Feature 19	16
Nonburial Feature 20	5
Nonburial Feature 24	207
Nonburial Feature 25	1
Nonburial Feature 29	1
Nonburial Feature 30	20
Nonburial Feature 31	8
Subtotal (nonburial features)	349
Subtotal (LAN-2768, Locus A)	28,156
LAN-2768, Locus B	
CU 502	938
CU 524	1,838
Subtotal (CUs)	2,776
Nonburial Feature 113	137
Nonburial Feature 114	96
Subtotal (nonburial features)	233
Subtotal (LAN-2768, Locus B)	3,009
Total	31,165

Key: CU = control unit; NISP = number of identified specimens.

remaining 7 percent was made up of bone fragments unidentifiable to the class level. That pattern is certainly by far the most common on PVAHP sites, with few exceptions. Within this locus of LAN-2768, the dominance of mammals is most pronounced in the control units (84 percent of the sample) and less so within the features (66 percent). However, the lack of strong mammalian dominance in the features' faunal collections is undoubtedly due to their small sample sizes, rather than evidence of different food preparation, consumption, or disposal having taken place there.

The faunal collections from the four control units were, with the single exception of CU 8, all analyzed in their entirety and the bones identified to the fullest extent possible. All of the faunal remains found within CU 8 were examined, but identification went only as far as the level of class. Relative abundance of taxonomic classes in the control units is displayed in Figure 202.

During archaeological monitoring and excavation within Locus A, excavators identified 17 nonburial features. Ten of these features contained faunal remains. The faunal remains from Locus A provide a unique glimpse into what species were pursued and, by implication, which food-gathering methods the early Intermediate period population of this area employed to assemble the meat portion of their diets. Nearly all the information that can be discerned from this collection comes, however, from the control-unit samples, because the features' bone collections produced sparse samples and, therefore, few identifiable taxa. The first observation is that the bone collections, at least during Occupation Episode 3, are remarkably consistent across the four control units. The other occupational episodes also seem quite similar, both within each episode across the control units and through each control unit. In other words, no consistent changes are apparent through either time or space, with the exception that Occupation Episode 3 was, to judge by the much larger bone collections dated to this habitation, a more intensive occupation. That is, during Occupation Episode 3, this portion of the site must have been inhabited by either a larger population or one that stayed there for a longer period, or possibly one that for some reason exhibited different refuse-disposal habits.

Species exploited can be grouped into two general kinds: small terrestrial mammals and small fishes of the herring family. The terrestrial mammals probably were taken with traps and spanned a large size range that included a variety of rodents, rabbits, and hares. A smaller number and variety of reptiles were also collected, not only pond turtles, a staple food among Ballona populations for millennia, but also different nonvenomous snakes. Many of these species could be taxa included accidentally within the collections, given that many are burrowing species that may tunnel into and later die within archaeological deposits. Nonetheless, both their numbers and the consistency with which they appear in different contexts and on so many Ballona sites suggest that they were hunted for food. The large number of herring bones identified is quite unusual among Ballona sites, where they are normally present but in lower numbers. Here, especially during Occupation Episode 3, there seems to have been an organized and concentrated effort to fish for herring, possibly in the nearby Ballona Creek/Los Angeles River, if these were shad taken on their annual spawning runs. Such a scenario would equate to site occupation at least during the warm spring and hot summer months, perhaps longer. In any event, regardless of which herring species was or were fished, the large number of such bones is evidence of specialization early on in the (pre)history of the region, when most dietary profiles in fact suggest a much more generalized, broad-spectrum approach to foodways.

Most of the terrestrial as well as the aquatic species present within this locus of LAN-2768 are small animals that can be taken in quantity with nets, deadfalls, weirs, and traps, rather than pursued individually. Few bones of large animals, terrestrial or aquatic, appeared in this collection. Deer, pronghorn, sea mammals, and even carnivorans are quite rare here overall,

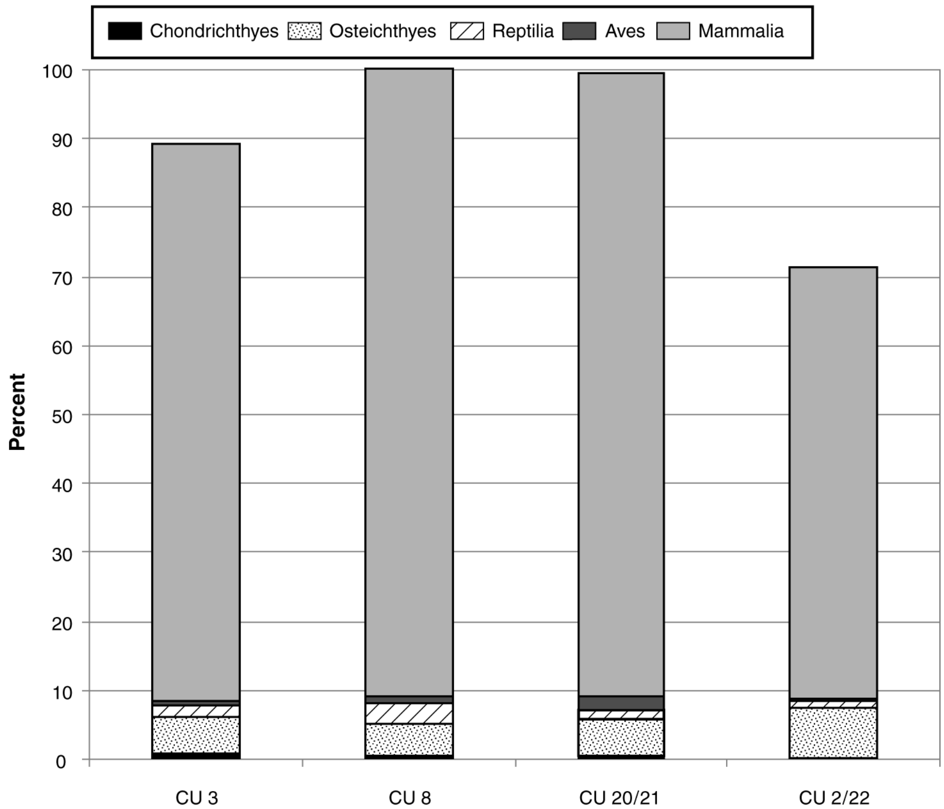

Figure 202. Vertebrate classes by period, from features at LAN-2768, Locus A.

as indeed they are in many PVAHP faunal collections. Those animals become more common, albeit not frequent, only within Late/Mission period contexts at two of the PVAHP sites. That suggests the development of a new hunting strategy, just before or during the time of European contact, that made the game animals easier to hunt successfully; greater demand by the Native American population; or environmental changes during the late Holocene that culminated in their being more widely available at this time. In any event, it seems unimaginable that the population was not interested in hunting large game. An alternative scenario might be that the residents settled this site specifically to exploit small animals in high numbers and therefore concentrated their time and efforts in doing so. If the herring were indeed shad, and the site was indeed inhabited during the summer, then there may be cool-month sites occupied by the same population elsewhere in the region, perhaps farther inland, where the primary animals hunted were the large-game species (deer, pronghorn, bighorn sheep, and carnivorans), which to a greater or lesser extent, depending on the species, decidedly prefer such habitats. Therefore, early lowland sites such as LAN-2768 could have been specialized, seasonally occupied camps.

Locus B

LAN-2768, Locus B, is located to the north of LAN-2768, Locus A, and encompasses a smaller excavation area. The analytical contexts include two nonburial features and two control units (see Appendixes I.7.1–I.7.4). Faunal remains from the control units and features include items and nonitems. The control units and the features date to the Intermediate period. The faunal sample for Locus B is small and includes approximately 3,009 bones (see Table 171). Most of this collection (92 percent; n = 2,776) was recovered from the control units. Interpretation of Locus B is made difficult by the small size of the collection, which limits the ability to detect species diversity, and by its relatively poor preservation. The sample from Locus B is much smaller and more fragmented than that from Locus A. This may relate to postdepositional disturbances, perhaps the same that made it impossible to obtain reliable radiocarbon dates from all but two of the original seven control units. Alternatively, the relatively sparse bone samples may mean, simply, that this portion of the site was not heavily used for either occupation or trash dumping during the early Intermediate period.

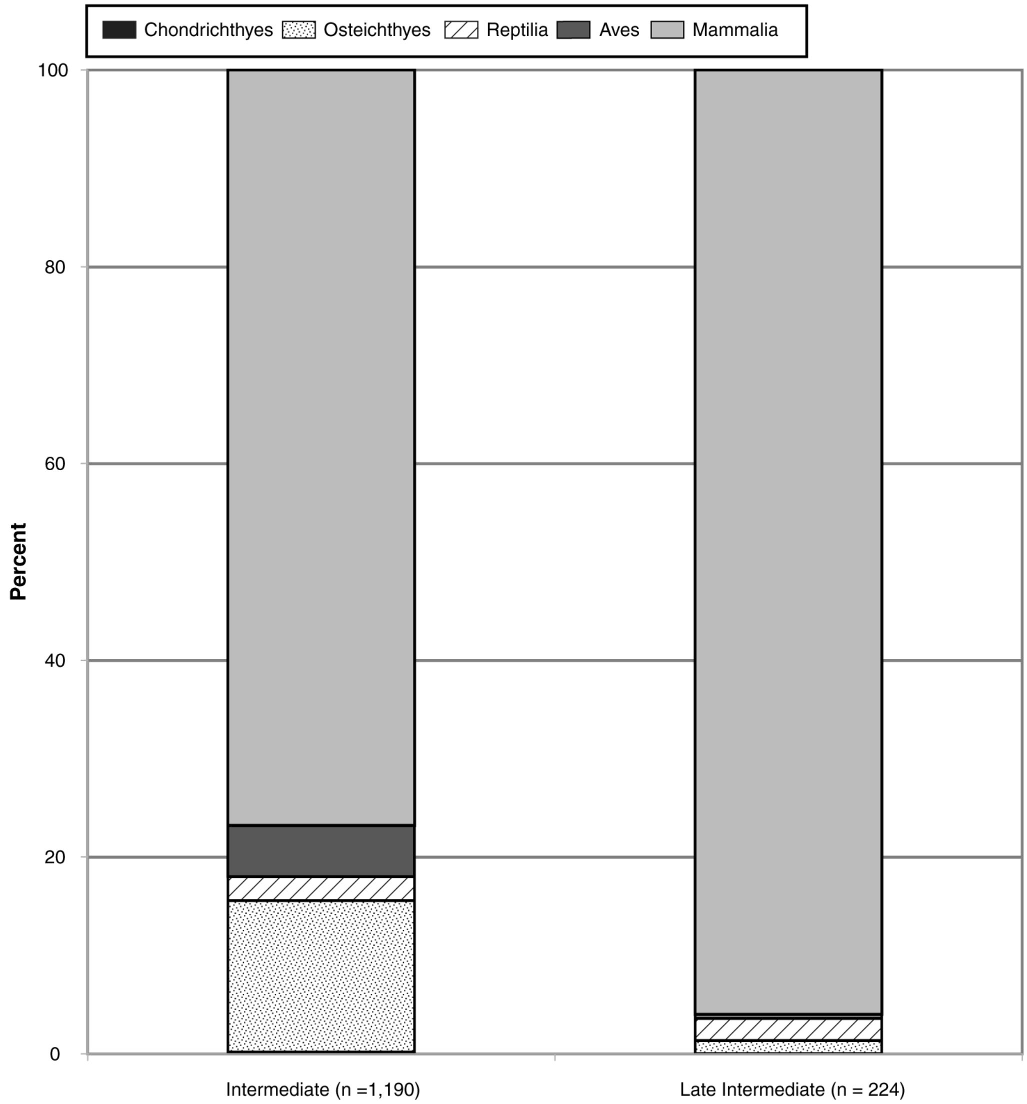

Figure 203. Vertebrate classes by period, from control units at LAN-2768, Locus B.

The population's diet during the Intermediate period (the stratum from which come most of the bones in the control-unit samples) follows the archetypical pattern seen within most contexts of PVAHP sites. That regimen is one in which rodents and other small mammals were far and away the principal meat suppliers, whereas larger mammals such as carnivorans and hoofed mammals appear to have been hunted only on occasion and to have served as supplementary food sources. In addition to obtaining mammalian meat, the site's population invested varying amounts of time and energy in fishing (Figure 203). In the features, fish remains are present at 25–50 percent of the mammal bones' estimated density (number per cubic meter), but in the control units, the density of fish bones is less than 15 percent of that of the mammals. Each of the other taxonomic classes (amphibians, reptiles, and birds) was outnumbered by mammals by volume ratios of 10:1 or greater.

Summary of LAN-2768

The site's overall summary necessarily rests mainly on data derived from Locus A, as this is the larger and more fine-grained sample available. Comparisons between the two loci are hindered both because Locus B contains a comparatively small and poorly preserved bone collection and because Locus A may date somewhat earlier. Locus B contains no strata definitively dated to the early Intermediate period. Instead, its levels date either generally to the Intermediate period or specifically to the late Intermediate period. Still, some general comparative statements are both warranted and necessary. The two loci are different in terms of species diversity: the large samples from Locus A exhibit a much broader array of taxa within all classes than the small samples from Locus B. To be sure, that is a matter of sample size rather than of discrete populations practicing focused vs. diffuse hunting strategies.

In fact, other than diversity patterns, the two loci share the same basic taxonomic pattern: most contexts demonstrate that small mammals were dietary staples and that the main supplement was bony fishes.

The fine-grained taxonomic data supplied by the Locus A contexts do not demonstrate an essential pattern starkly different from that provided in summary fashion by the bone collection from Locus B. However, the multitude of bones identified to taxonomic groupings lower than class do aid in understanding, at least for the early Intermediate period, what habitats were most and least often frequented by hunters and fishers. Perhaps the most surprising result of faunal analysis from the control units in Locus A was that various species of pelagic fishes consistently appear within each occupational episode of each unit. Pelagic fishes are, in general, rare within the faunal collections of PVAHP sites, yet here there are at least a few bones in all the control units from species like barracuda, jacks, mackerels, and species in the herring family. Bones of species in the herring family are by far the most common among the identified fish specimens. Although some members of that family are anadromous and therefore could have been caught while migrating upstream to spawn, most species stay in deeper offshore waters and only occasionally school near the shore. It is very difficult to identify those fishes to the species level, but their sometime riverine habitat is interesting, given the variety of small game identified and the possibility that the faunal array from LAN-2768 may display the signs of seasonally differentiated hunting.

Other fishes identified, however, demonstrate that ancient fishers plied aquatic zones closer to land, including the Ballona estuary and the ocean waters along the shore. Species of shallow, calm water include the various skates, rays, and some of the bony fishes such as flounders. Along the shoreline, a number of other fishes—croakers, sheephead, gobies, señorita, and other species—were taken, possibly with hook and line. Also calling the estuary home, of course, were the various waterfowl and shorebirds identified in the control-unit collections, along with pond turtles. But it was not just the various aquatic zones that supplied the population with their meat. To judge from the broad array of mammalian taxa present, nearly every habitat was exploited at least to some degree. If the rodents and snakes are food remains, then hunters probably set traps along rocky outcroppings and in sandy soils for these burrowing animals. They may also have hunted rabbits and hares with either projectiles or nets in (possibly) the upland prairies, and in riparian woodlands they may occasionally have taken a deer.

In fact, hoofed mammals, probably all deer save the identified (and intrusive) domesticates introduced by Europeans, are unusually common within the control units of Locus A. Deer and related mammals frequently are present within the large Mission period collections at LAN-211 and LAN-62 but outside those contexts are quite rare. Therefore, their relatively high numbers at this site remain a mystery, but, together with the presence of the pelagic fishes, present an unusual dietary picture. To be sure, the mainstays of the population's diet were very much the regular ones: namely, an abundance and broad array of small mammals probably caught with traps. Yet, at the same time, two other, directionally opposite food-gathering components existed: namely, pelagic sea fishing to the west and pursuit of deer in riparian habitats to the north or in the prairies to the south and east. Taken together with other hunting and fishing endeavors, the pursuit of pelagic fishes and large upland game must have required considerable scheduling and other forms of organization in order to make use of so many habitats, possibly at the same time. Alternatively, it could imply the existence of regional trade networks already present at this time, in which the population of LAN-2768 traded locally procured game or other goods to peoples living farther east or south, for deer carcasses, and perhaps also to Channel Island populations, for fish of deeper waters. A further possibility might be that a palimpsest of seasonally differentiated hunting and fishing expeditions was encountered: for example, if pelagic fishes were taken in the warm-month spawning season, when they were closer to shore, and large game was hunted in another season, perhaps during the cool months, when time could be spared from hunting seasonal game. It is certainly intriguing that the collection at this site, the Playa Vista site farthest from the ocean, contained more remains of offshore fish species than did the collection from LAN-193. In any of these hypotheses, whether it was complex scheduling, trade networks, or seasonal variability that led to the taxonomic array encountered, it appears that already by the early Intermediate period, the population of the Ballona area had attained an in-depth knowledge of their ecological setting.

Vertebrate Remains from LAN-54

In all, 14,663 animal-bone fragments were recovered from this site, out of which more than 13,000 bone fragments were analyzed, although only a subsample were identified below the class level. Vertebrate remains from 4 control units and 11 nonburial features at LAN-54 (3 rock clusters, 6 artifact concentrations, and 2 pits), primarily from late Millingstone and early Intermediate contexts, were analyzed (Table 172; see Appendix I.8.1–I.8.11). Feature 33, one of the pits, is however at least partly Historical period in date and contains bones of domesticated mammals. The bulk of these vertebrate remains came from feature contexts, rather than control units. Indeed, 87 percent of all bone fragments originated in features, including 10,215 identified specimens from Feature 33 alone.

The collection consisted primarily of unidentifiable mammal remains (approximately 90 percent). The identifiable specimens demonstrate the presence of a variety of rodents, but the burrowing pocket gopher (*Thomomys* sp.) is by far the

Table 172. Summary of Vertebrate Remains Analyzed from LAN-54

Context	NISP
CU 3	247
CU 11	1,421
CU 30	24
CU 31	20
Subtotal (CUs)	1,712
Rock clusters (late Millingstone period) Features 1 and 23	119
Rock cluster (early Intermediate period), Feature 7	339
Artifact concentrations (early Intermediate period), Features 12, 13, 16, 19, 29, and 36	961
Pit (unknown age), Feature 24	225
Pit (Historical period), Feature 33	10,215
Subtotal (features)	11,859
Total	13,571

Key: CU = control unit; NISP = number of identified specimens.

predominant taxon. Fish remains, mostly from bony fishes, are relatively common in many contexts—frequently ranging from 10 to 20 percent of any given unit or feature—but are found in lower frequencies (5.8 percent) in Feature 33. Reptiles typically consist of a variety of nonvenomous snakes; gopher or pine snake is the most abundant in most contexts. This fact, combined with the prevalence of gopher remains in many units and features, strongly suggests postoccupational intrusive materials. Bird remains are found in low quantities and, when present in larger numbers, are dominated by waterfowl, the pattern typical for the entire PVAHP. Larger-bodied mammals are rare in most contexts, with the exception of Feature 33, which yielded a variety of larger mammals, including pronghorn, deer, dolphin, and California sea lion. Bones from domesticated cattle were also found in the upper levels of the feature, which contains early-twentieth-century material.

Control Units

Most of the bones recovered from the control units were mammalian, with the typical Ballona pattern of small terrestrial mammals such as rabbits and rodents predominating (Figure 204). Unusual mammalian taxa include pronghorn, sea lion, and possibly beaked whale (see Appendixes I.8.1–I.8.11). The nonmammalian taxa are dominated by fishes (16 percent), with an emphasis on lagoon or estuarine cartilaginous fishes, mainly rays, skates, and angel sharks, and nearshore bony fishes such as surfperches and longjaw mudsuckers; pelagic species include herring, requiem sharks, Pacific mackerel, and other mackerels but account for less than 1 percent of the vertebrates. Overall, fishes were uncommon in comparison to other animal classes. They accounted for less than 10 percent of the entire bone collection from the site. Reptile remains are also rare in relation to the other classes, and only typical local species, especially pine snakes, are present in significant numbers. Birds constitute only 3 percent of the collection and consist largely of waterfowl such as pied-billed grebe and coot, as well as other marsh-dwelling species.

In general the relatively small faunal collection from the control units paints a subsistence picture in which the population foraged locally through the different habitats in and around the Ballona Lagoon, hunting, fishing, and collecting game seemingly on an encounter basis, not specializing in certain species or habitats. Occasionally, however, the inhabitants either went on long-distance hunting trips or procured meat via trade with other groups of people living in surrounding areas. Such economic decisions apparently account for the bones of pelagic fishes and whale (if not scavenged from a beached individual), as well as, possibly, the pronghorn, although the latter species may also have formerly inhabited the prairie areas not far from the Ballona.

Nonburial Features

Faunal remains from 10 nonburial features were analyzed (Figure 205; see Appendixes I.8.1–I.8.11). A few bones of European-introduced domesticated mammals were recovered from Feature 33, which clearly has prehistoric deposits mixed with refuse from the first decades of the twentieth century. With the exception of Feature 33, there are no apparent differences in the distribution of vertebrate classes by feature type. Although the sample size is relatively small (only 10 features), there is a pattern wherein fishes were more heavily exploited during the early Intermediate period relative to the Millingstone period. Birds also appear to have been more intensively hunted in the early Intermediate period. Two patterns related to change over time (late Millingstone to early Intermediate) emerge from the feature data: decreased exploitation of mammals and increased fishing. Overall, however, interpretations of the patterns in the data from the features at LAN-54 are limited by the small sample size.

Summary of LAN-54

This site produced a substantial collection of animal bones, but the collection was unevenly distributed across the site. Most of the faunal collection is from Feature 33, a feature with mixed context (Late period and Historical period) (see Table 172). In general, the fauna resemble the standard array found on Ballona-area sites: a predominance of terrestrial small-mammal taxa with a secondary importance of aquatic fauna, both fishes and birds (see Appendixes I.8.1–I.8.11). As is typical for most southern California sites, most of the specimens analyzed could not be positively identified beyond the class level. Most of the collection, whether from features

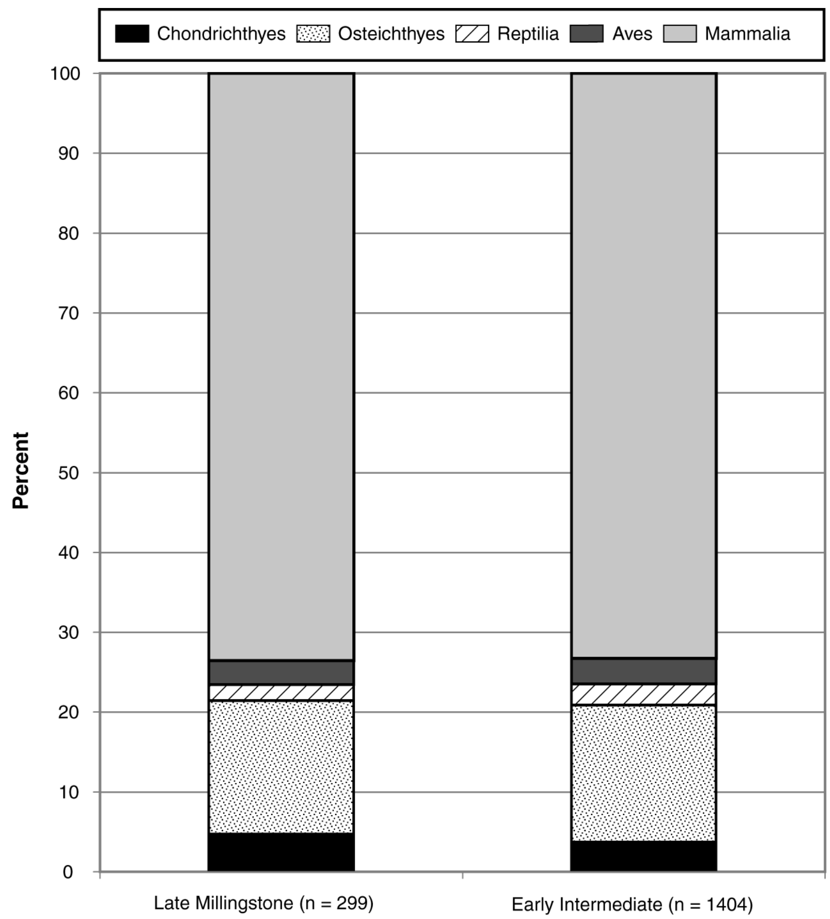

Figure 204. Vertebrate classes by period, from control units at LAN-54.

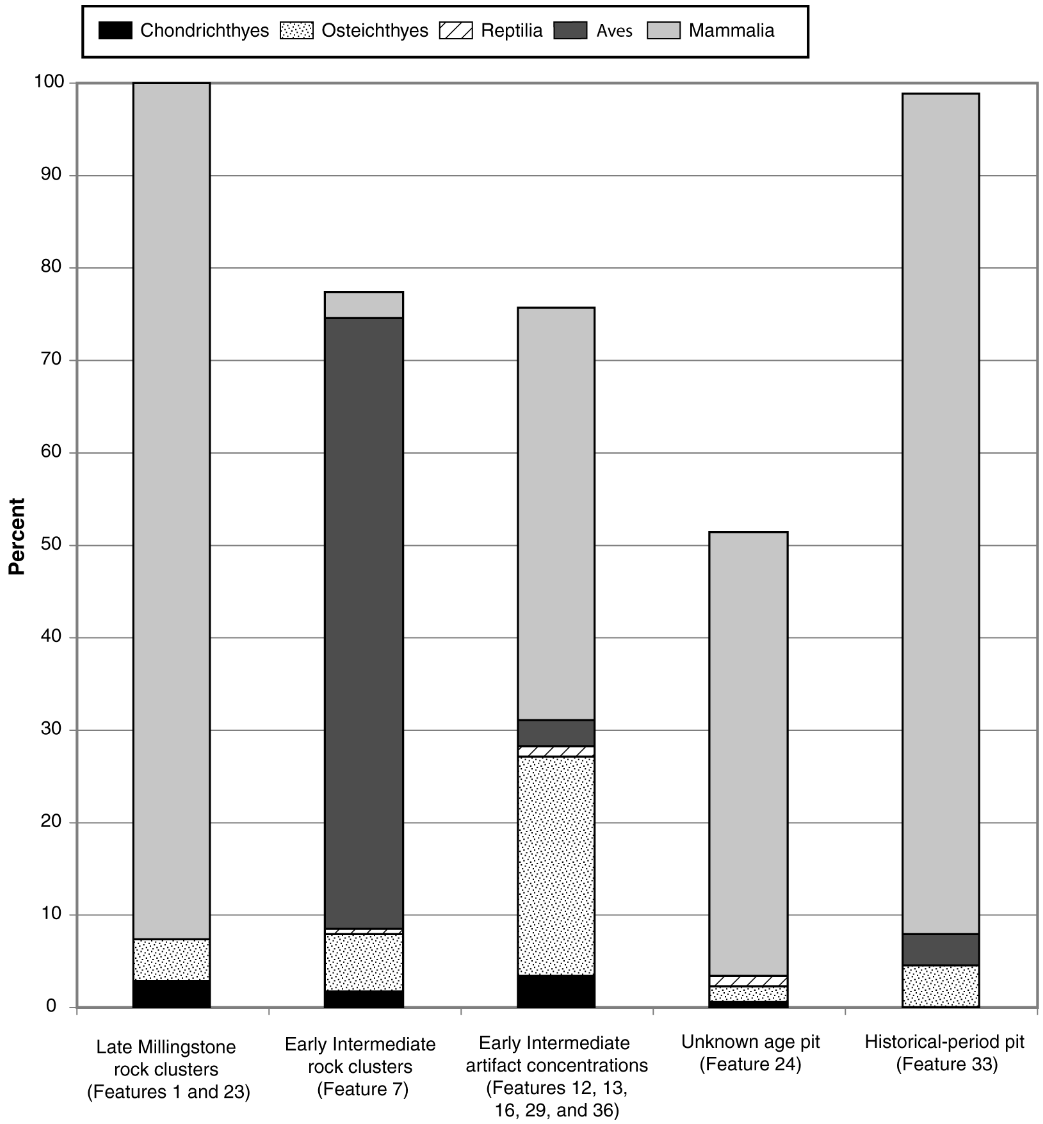

Figure 205. Vertebrate classes by period, from nonburial features at LAN-54.

or from control units, could be described only as unidentifiable mammal. Fishes constitute only a small proportion (less than 10 percent) of the analyzed collection. Most of these elements came from bony fishes, although there is an inherent bias in comparing relative frequencies of bony and cartilaginous fishes, because the latter have few elements that ossify and thus preserve in the archaeological record. Avian bones are less frequent finds than those of fishes, but that is a common pattern for Ballona-area sites. Reptile remains are surprisingly infrequent in comparison to those found at other PVAHP sites, constituting less than 1 percent. Were it not for the relatively large number of rodent remains, it would be tempting to attribute the small percentage of reptiles to a low level of postdepositional disturbance.

Mammals dominate the faunal remains recovered during excavations at LAN-54 (90 percent of all the bones), as is typical of lowland Ballona sites. The presence of both cottontails and jackrabbits suggests that the LAN-54 inhabitants hunted in both the more heavily vegetated and the more open environments preferred by these taxa, respectively. Carnivorans are surprisingly common, with more than 20 canid specimens present. Most of the canid remains were recovered from a single context (Feature 33); for the most part, these were phalanges. These remains could be either remnants of a canid-skin cloak or a similar item, or carnivoran paws that were of ritual importance and were collected and deposited in this feature.

Although more than 1,100 fish remains were analyzed, most could not be identified beyond the class level. Cartilaginous fishes were relatively infrequent in the LAN-54 collection, with only 85 specimens present (7.4 percent of the fish collection). At LAN-54 during the late Millingstone and early Intermediate periods, cartilaginous fishes were not a significant part of the economy. The overall paucity of these remains suggests a pattern in the lowlands different from the pattern that Salls (1988) suggested for the faunal collections from two bluff-top sites excavated by Van Horn (1987a). Van Galder et al. (2005), however, more recently came to a contrary conclusion concerning the prevalence of cartilaginous fishes at the bluff-top sites. They argued, on the basis of faunal remains from excavations conducted by SRI (Douglass et al. 2005), that cartilaginous fishes were in fact relatively scarce (no more than 6 percent of the sample).

In terms of bony fishes, although they were relatively common, most could not be identified below the class level. Herrings, shads, and sardines were the most abundant, and these tiny fishes are fairly common on later prehistoric sites in southern California. Fifty specimens of Pacific barracuda, a common predatory fish in California waters, were also recovered. This fish could have been obtained through either fishing in the kelp beds or trading with islanders.

Vertebrate Remains from LAN-62

LAN-62 is a large, complex site which produced a very large collection of faunal remains, necessitating sampling across the different contexts. More than 200,000 vertebrate remains were analyzed from contexts at the site (Table 173). Most of these remains were from Locus A/G, which encompasses the densest midden deposits and the burial area. Only 19,000 bone fragments were from Locus C/D contexts. The analytical contexts from the loci include control units, excavation units, burial features, and nonburial features. Of these four contexts, the excavation units yielded the largest number of bones: more than 117,000 (of which 91,638 were analyzed) (see Table 173), or 57 percent of the entire animal-bone collection.

Sampling Strategy

Within each locus, all control units and some excavation units and features were selected for analysis. From human burials, only animal bones labeled in the field as items—faunal remains that excavators thought probably were directly associated with the interments rather than with the surrounding midden matrix—were analyzed.

Locus A/G

Excavations at LAN-62, Locus A/G, produced the largest portion of the faunal collection from any of the loci at the site, numbering nearly 186,000 analyzed pieces of animal bone from a total sample of 201,844 fragments recovered (Table 174; see Appendixes I.9.1–I.9.18). This collection is both large and diverse. These analytical contexts included 5 control units, faunal items from 254 human-burial features (Tables 175 and 176), all faunal remains from 4 animal burials (Table 177), and 9 excavation units from across the site. In addition, animal bones were studied on the basis of samples recovered from nonburial features in the burial area, which included 21 artifact concentrations, 32 rock clusters, 16 pits, 3 activity areas, and 1 thermal feature. Similar types of nonburial features were examined from sitewide contexts: namely, 3 artifact concentrations, 5 pits, and 1 activity area. In addition, faunal samples were examined from the excavation units and nonburial features within the spaces defined as FB 3 (Mission period), FB 4 (Intermediate period) and FB 7 (Millingstone period).

These diverse contexts contained an impressive number of animal bones, totaling nearly 186,000 fragments; the two largest contributing contexts were the excavation units and the burial area (see Table 174). In general, and in nearly all contexts, most of the bones were those of mammals. Most of these were not identifiable to species, but by far the greatest number came from small mammals of the size of rabbits or smaller. FB 4 was the only context where mammals did not dominate. Somewhat surprisingly, bony fishes were much more prevalent than mammals, outnumbering mammals 56 to 33 percent. Alongside the many small-animal bones are those of larger ones: deer and even aquatic mammals such seals, sea lions, and whales.

In general within LAN-62, Locus A/G, in addition to mammals, both cartilaginous and bony fishes were important elements of the peoples' diet. The fishing focus clearly centered on shallow-water species that may have dwelled in the Ballona Lagoon. These species were mainly cartilaginous fishes such as guitarfish, other rays, and skates, as well as angel sharks. In addition, more than 100 herring bones were identified; depending on the species, these fishes may or may not come into estuarine and freshwaters to spawn. Other fish species identified are typical of shallow coastal waters; these include drums, mudsuckers, and sheephead. Similarly, the range of bird species demonstrates a hunting focus on shorebird or marshland species, such as ducks, rails, and gulls. Reptiles and amphibians are generally uncommon, although a number of species of nonvenomous snakes and lizards were identified. The most common reptilian species identified, perhaps in part because its remains are easier to recognize than the bones of other reptiles, is the western pond turtle, which is restricted to wetland environments similar to those that the Ballona once supported.

Control Units

The control units together present an interesting, if limited, window into dietary change over time within LAN-62, Locus A/G specifically, and perhaps the Playa Vista area in general (Figure 206). All the control units are dominated

Table 173. Summary of Vertebrate Remains Analyzed from LAN-62, All Contexts and Loci

Context	NISP
LAN-62, Locus A/G	
CUs	
CU 26	9,904
CU 141	15,528
CU 323/321	12,605
CU 853	1,192
CU 1048	1,546
Subtotal (CUs)	40,775
Burials	
Human burials (items only)	1,828
Animal burials (items only)	527
Subtotal (burial features)	2,355
EUs	
EUs across site	64,139
EUs analyzed by Wegener and Shelley (2004)	27,499
Subtotal (EUs)	91,638
Burial area	
Burial area (items only)	24,931
Burial area (nonburial features)	6,471
Subtotal (burial area)	31,402
Sitewide features	
Nonburial features (sitewide)	10,209
Subtotal (sitewide features)	10,209
FB 3	
EUs (items only)	25
Nonburial features	5,036
Subtotal (FB 3)	5,061
FB 4	
EUs (items only)	6
Nonburial features	4,001
Subtotal (FB 4)	4,007
FB 7	
EUs (items only)	4
Nonburial features	455
Subtotal (FB 7)	459
Subtotal (LAN-62 Locus A/G)	185,906
LAN-62, Locus C/D	
CUs	
CU 937 (Locus C)	6,898
CU 970 (Locus D)	218
CU 981 (Locus D)	344
CU 998 (Locus D)	525
CU 1000 (Locus D)	1,278
Subtotal (CUs)	9,263
Features	
Animal burial Feature 201	6,412
Animal burial Feature 675	2,545
Rock clusters (Features 520, 521, 540)	736
Subtotal (features)	9,693
Subtotal (LAN-62, Locus C/D)	18,956
Total	204,862

Key: CU = control unit; EU= excavation unit; FB = feature block; NISP = number of identified specimens.

Table 174. Summary of Vertebrate Remains Analyzed from LAN-62, Locus A/G

Context	NISP
CU 26	9,904
CU 141	15,528
CU 323/321	12,605
CU 853	1,192
CU 1048	1,546
Subtotal (CUs)	40,775
Human burials (items only)	1,828
Animal burials (items only)	527
Subtotal (burial features)	2,355
EUs across site	64,139
EUs analyzed by Wegener and Shelley (2004)	27,499
Subtotal (EUs)	91,638
Burial area (items only)	24,931
Burial area (nonburial features)	6,471
Subtotal (burial area)	31,402
Nonburial features (sitewide)	10,209
Subtotal (sitewide features)	10,209
FB 3	
EUs (items only)	25
Nonburial features	5,036
Subtotal (FB 3)	5,061
FB 4	
EUs (items only)	6
Nonburial features	4,001
Subtotal (FB 4)	4,007
FB 7	
EUs (items only)	4
Nonburial features	455
Subtotal (FB 7)	459
Total	185,906

Key: CU = control unit; EU = excavation unit; FB = feature block; NISP = number of identified specimens.

Table 175. Summary of Taxonomic-Class Abundances within Burials at LAN-62, Locus A/G

Class	Number of Burials	Percent Total Burials	NISP	Percent Total Vertebrates
Chondrichthyes	27	10.3	38	2.1
Osteichthyes	30	11.5	32	1.8
Reptilia	10	3.8	12	0.7
Aves	87	33.3	164	9.0
Mammalia	235	90.0	1,474	80.6
Unidentifiable	39	14.9	108	5.9
Total	261		1,828	

Key: NISP = number of identified specimens.

Table 176. Human Burials at LAN 62, Locus A/G, Grouped by Number of Taxonomic Classes Present

Number of Taxonomic Classes per Burial	Number of Burials	Percent
0 classes (unidentifiable bones)	2	0.8
1 class	155	61.0
2 classes	62	24.4
3 classes	29	11.4
4 classes	6	2.4
Total	254	

Table 177. Vertebrate Fauna from Animal Burials at LAN-62, Locus A/G (Items Only), by Feature

Class	Taxon	Common Name	NISP
Feature 307			
Chondrichthyes	Chondrichthyes	cartilaginous fishes	1
Osteichthyes	Osteichthyes	bony fishes	1
Reptilia	Reptilia	reptiles	2
Aves	Aves	birds	2
Mammalia	Carnivora	carnivorans	1
	Canidae	coyotes, dogs, foxes, and wolves	5
	Canis sp.	dogs or coyotes	10
	Pinnipedia	fin-footed mammals	1
	Mammalia[a]	mammals	224
Subtotal			247
Feature 642			
Chondrichthyes	*Torpedo californica*	Pacific electric ray	1
	Urlophus halleri	round stingray	1
Osteichthyes	Osteichthyes	bony fishes	4
	Clupeidae	herrings	15
	Atherinidae	silversides	1
	Embiotocidae	surfperches	4
	Scomber japonicus	Pacific mackerel	1
Reptilia	Squamata	snakes, lizards, and worm lizards	1
	Elgaria multicarinata	California alligator lizard	1
	Pituophis/Masticophis sp.	racer (snake)	113
Aves	Aves	birds	89
	Oxyura jamaicensis	ruddy duck	1
Mammalia	*Thomomys* sp.	pocket gophers	7
	Canis sp.	dogs or coyotes	11
	Mammalia	mammals	30
Subtotal			280
Total			527

Key: NISP = number of identified specimens.
[a] Includes a single whale bone.

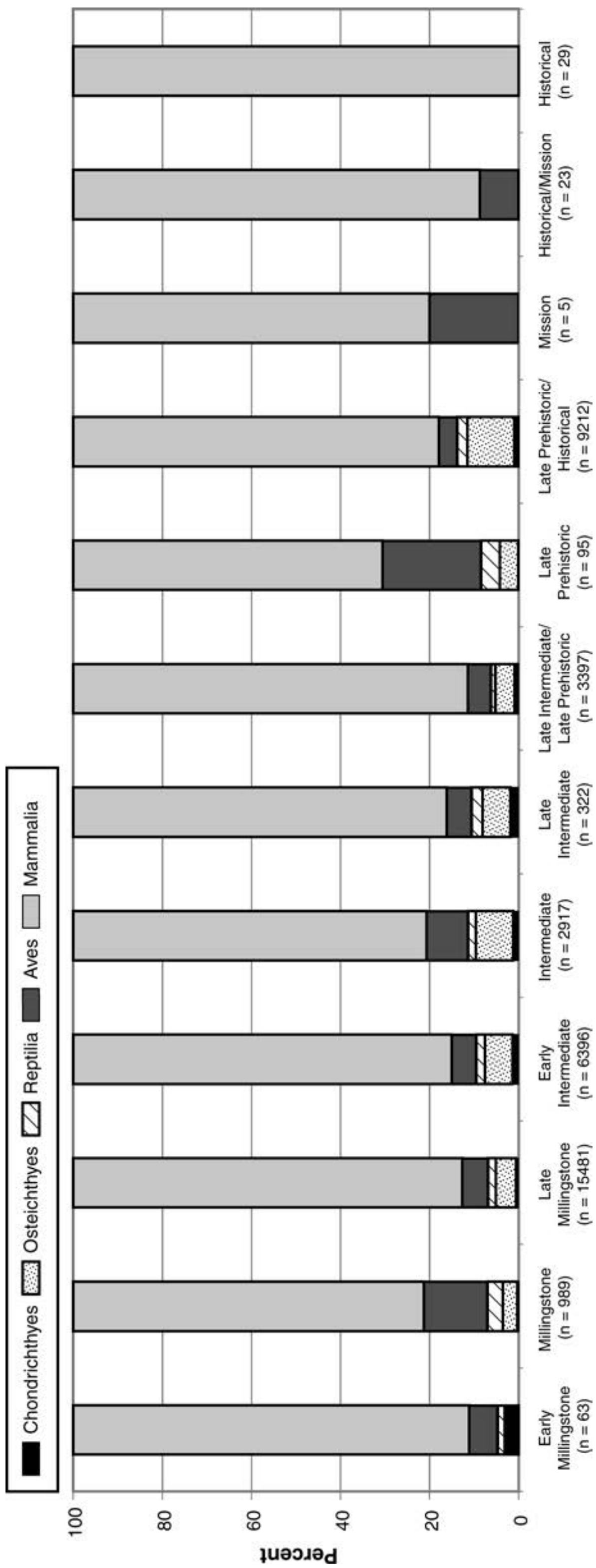

Figure 206. Vertebrate classes by period, from control units at LAN-62, Locus A/G.

by the bones of terrestrial mammals; aquatic mammals are very rare, contributing just 4 bones in all: 1 sea otter bone, a single element from a sea lion, and 2 dolphin elements (see Appendixes I.9.1–I.9.18). For the most part, fishes, birds, and reptiles played only supplementary, or perhaps seasonal, dietary roles. Nonetheless, some animals may have held value beyond their numbers: for example, turtles prized for their shells, useful as rattles, and birds for their colorful feathers. In some of the units, namely CUs 323/321 and 26, which are located on the northern margin of Locus A, there is a noticeable trend over time, in which fishes (both bony and cartilaginous) become the most important food source after mammals, numerically dominant over birds and reptiles. Although this trend does coordinate well with current hypotheses concerning the evolution of the Ballona Lagoon and the surrounding area, which became increasingly silted in, marshy, and dominated by freshwater over time (see Volume 1 of this series), other control units produced contrary evidence. In fact, CU 1048, in Locus G, largely displays the opposite pattern, a decrease in the importance of fish over time, whereas CU 141, situated adjacent to FB 3 in the center of Locus A, displays no consistency along these lines, as fishes show change in relative importance from one period to the next. CU 1048 differs further from the other control units in that birds, rather than fishes, are the taxon of secondary importance in nearly all the unit's strata. Still, caution is needed in the interpretation of the latter unit, as there are two signs that there may have been extensive mixing at least down to the Intermediate stratum. The first, more -ertain demonstration of intrusive material is the opossum bone, as this species was introduced to California approximately a century ago (Jameson and Peeters 1998). The second—and by no means certain—sign is the presence of the 14 artiodactyl bones. Of these, 8 elements were identified as deer. The rest could either be native hoofed mammals or domesticates introduced by Europeans. Relatively large numbers of hoofed-mammal bones most often are present in Late and Mission period levels and seldom are present in earlier ones.

Human-Burial Features

If the approximately 1,200 animal bones found with 254 human-burial features are in primary depositional contexts, then two distinct purposes governing animal contributions are apparent: ritual depositions of significant animals/animal parts and food donations for some sort of afterlife concept. Still, the caveat must be kept in mind that these conclusions are only relevant if it can be shown that these animal bones were wholly or purposefully placed into the graves, rather than tossed in along with soils during the pits' backfilling with artifact-bearing midden soils. The first notable characteristic of this faunal collection is the contrast in species diversity between the avian fauna, diverse for the sample size (see Table 175), and the mammalian fauna, which lacks variety. This holds true even though most of the mammal bones were taxonomically unidentifiable. Taphonomic processes should have affected mammal bones less, given that mammals generally have more-robust bones than do birds, and therefore mammalian species diversity should not be significantly truncated by preservation issues (see Appendixes I.9.1–I.9.18).

The contrast in species diversity is possibly related to ritual behavior, in that the feather banners and other paraphernalia related to mourning ceremonies observed by early ethnographers required a relatively diverse array of fowl to create. By contrast, the mammals present may have been donated as food for the dead, and therefore no special attention to diverse arrays of species was brought to bear on the donated carcasses. Furthermore, carcass-part selection seems to have been in play with regard to the mammalian fauna, as the hindlegs and feet are the most common remains of hoofed mammals (probably all deer), which were presumably donated as food. By contrast, the body-part distribution of carnivoran elements indicates a ritual function not related to food for the dead, in that the dominance of skulls and cranial elements (including teeth) appears to have some kind of symbolic significance, e.g., the partial mountain lion maxilla found in burial Feature 162 (Figure 207). The taxonomic array from the human burials did not include many unusual animals other than the mountain lion, but perhaps noteworthy are the remains of sea otters (3 elements), 10 bones of seals and sea lions, and 15 bones classifiable only as Cetacea (whales, dolphins, and porpoises). Only one unusual avian species, the brown pelican, was identified in the burial contexts. Brown pelicans, though common along the southern California coast, are quite rare within the faunal collections generated by the PVAHP project. No unusual bony fishes came to light in the burial contexts, but a single tooth of a salmon shark was recovered. This is the only instance of that species, which is most common in, but not limited to, offshore waters (Love 1996:54).

Animal-Burial Features

The two animal burials encountered within this portion of LAN-62 Locus A/G were rather similar to one another (see Appendixes I.9.1–I.9.18) in terms of total number of bones and the fact that each apparently was a canid burial. The collection from Feature 642, situated just north of FB 4 outside the densest portion of the burial area, was more diverse in taxa present than the centrally located Feature 307 (adjacent to FB 3 within the main burial area). This difference does appear to be attributable simply to greater sample size in the former feature (see Table 177). Nonetheless, most of the identifiable bones in both features were from canids, indicating that this was the primary, if not the only, reason for the pits' excavation. Excavation notes for both of these features indicate that the partial canid skeletons were found still articulated. These two features also contained bones of other species, including, within Feature 642, 7 pocket gopher bones (though these could be commensal in origin;

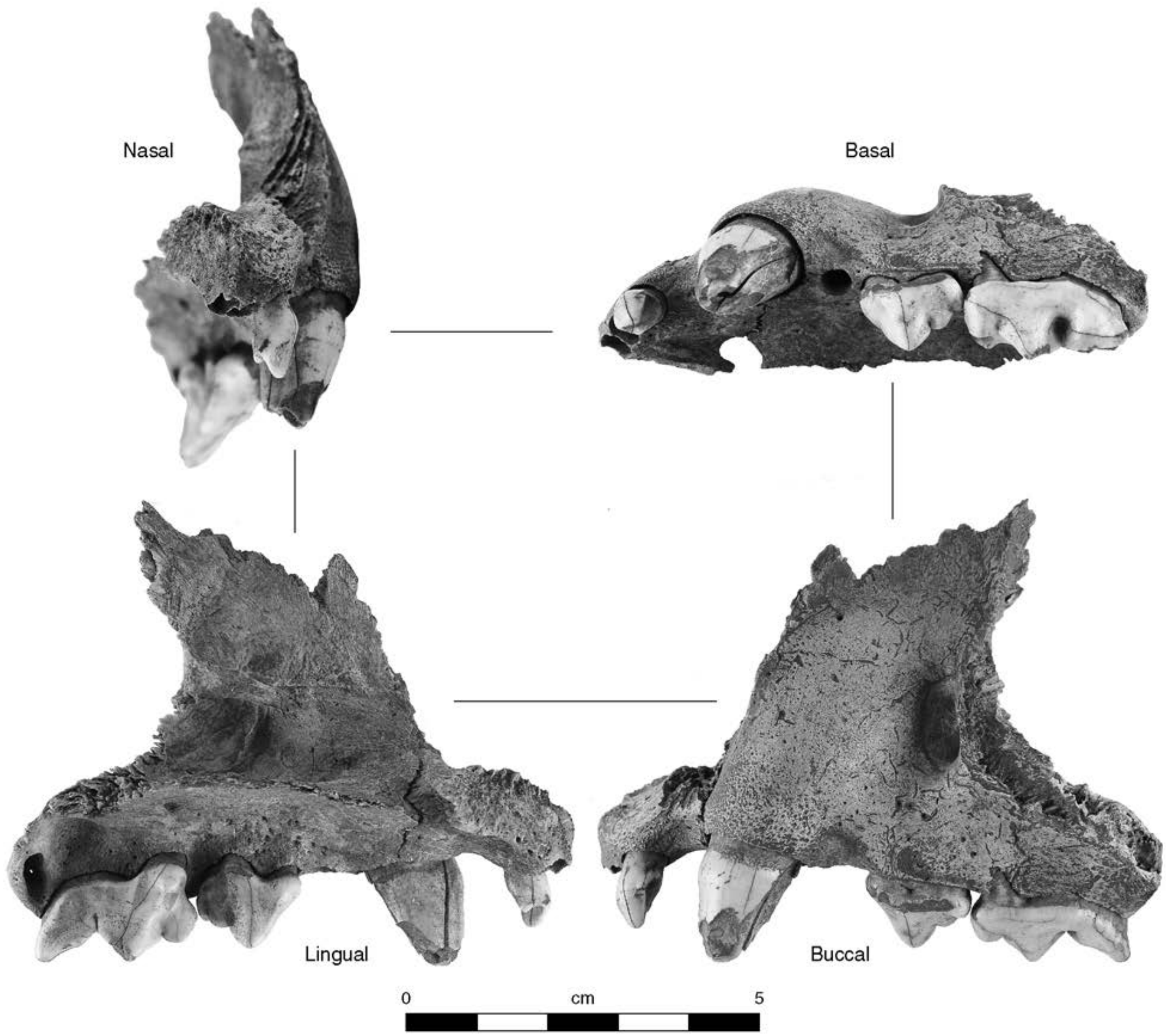

Figure 207. Four views of a partial maxilla of a mountain lion from human Burial Feature 162 at LAN-62, Locus A/G.

commensals are animals attracted to human living areas but not in themselves used as food by humans). Aside from the canid bones, Feature 307 contained a single (unidentifiable) whale bone, perhaps a grave marker, in addition to 2 unidentifiable bird bones. Feature 642 also contained 90 bird bones, all unidentifiable save a single bone from a ruddy duck, as well as a number of cartilaginous and bony fish elements. Despite the presence of other species, the feature probably is a burial, given that an intact canine skull (Figure 208) and its mandible (Figure 209) were recovered along with other skeletal elements from the same individual canine.

Body-part representation for mammal and bird elements identified (see Appendixes I.9.1–I.9.18) shows little distinctive patterning, although this may be due to the small sample size. Canids and, to an even greater extent, birds are represented by too few bones to reliably assess the questions of element patterning and whether certain elements were selected and others not. The apparent canid burials were incomplete skeletons; parts of the skeletons were presumably lost or redeposited during continued use of the site for subsequent human burials.

It is intriguing that both animal burials in this area of the site are canids. The burials have in common the purposeful interment of two originally (presumably) whole dogs within a human burial area that also contained several additional dog/coyote skulls other than those in these features. Beyond the fact that burials are, de facto, ritual in nature, they may shed some light on Gabrielino mourning rituals. Possibly, dogs were such important cosmological symbols or personal possessions that they were buried either near their owners or perhaps in a more generalized ritual, a donation for the sacred space and not associated with any single individual.

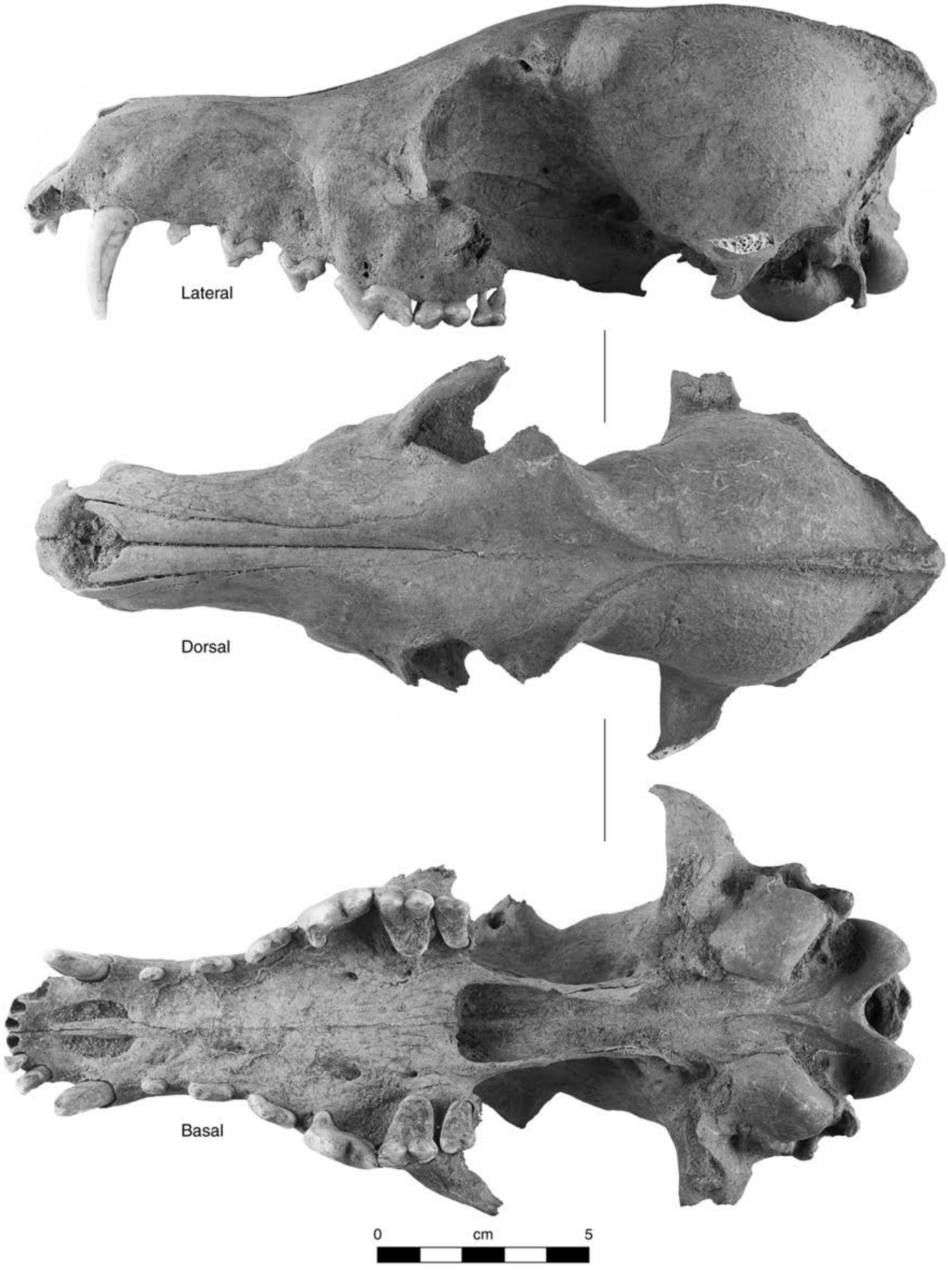

Figure 208. Three views of a canine skull from animal burial Feature 642 at LAN-62, Locus A/G.

Figure 209. Basal view of canine mandible from Feature 642 (the base of the skull shown in Figure 210).

Additional Excavation Units

Wegener and Shelley (2004) previously analyzed faunal remains from 10 additional excavation units located across LAN-62, Locus A/G. The full report of this analysis, complete with tables and figures, is contained within Appendixes I.9.1–I.9.18. Therefore, only a summary of that work is presented in this section. This faunal analysis involved slightly more than 77,000 animal-bone fragments drawn from 10 sampled excavation units and a single fully analyzed one. In general, the study found that mammals were the most important vertebrates taken for food, although fishes apparently increased in importance relative to mammals later in time.

Surprisingly, given the Ballona Lagoon and the marsh environment surrounding the site, fishes were not taken in large numbers, or at least relatively few fish bones were recovered. Those fishes present included the usual array (for sites in the area) of skates, small sharks, and bony inshore fish such as surfperches. Wegener and Shelley (2004) also mentioned that a few tuna bones were recovered, indicating at least occasional open-sea-fishing expeditions by the Native Americans living there. Recovered fish remains usually were present in higher densities within the upper levels of the excavation units, dated generally to the Late period. That scenario stands in contrast to the environmental reconstruction of the Ballona previously proposed by SRI's paleoenvironmental research initiatives in the Playa Vista area, which suggest the stabilization of these lowlands by the Late period, in the form of a freshwater lagoon that was greatly reduced in size relative to its state during the Intermediate period and that was surrounded by marshes (see Volume 1 of this series). Perhaps the smaller lagoon/estuary forced Native Americans to fish more frequently along the shore of Santa Monica Bay, and therefore the relative abundance of fishes actually increased by the later periods.

In terms of stratigraphic patterning, it appears that the site was more intensively occupied later in time. With the exception of a single square, EU 233, located in the south-central portion of the main excavation area, each of the test pits demonstrated a decline in the concentration of artifacts in relation to depth: the deeper the level, the fewer artifacts recovered. EU 233, located just outside the main burial area to its south, showed the opposite pattern. This anomaly may be explained by extensive disturbance, human or natural. Another chronological pattern is that of a broadening spectrum of hunted, gathered, or trapped fauna during the Intermediate period. In levels from that period, both the number and the diversity of faunal remains (including shellfish, mammals, fishes, and birds) increase, a broadened subsistence base possibly developed, as Wegener and Shelley (2004) hypothesized, to support a larger population at the site and in the area.

Despite the attractiveness of the latter scenario, it must be pointed out that the overall diversity of species identified is rather low, including only 5 fish, 1 amphibian, 3 reptile, 4 bird, and 20 mammal taxa. The low taxonomic richness may be attributable to either poor preservation or an actual lack of interest by the human population in exploiting a wide range of species (especially avoiding reptile, amphibian, and fish taxa). The latter explanation, however, seems to contradict the widely held idea that the Ballona region was more heavily populated during the Intermediate period than before it; population increases normally cause new and wider arrays of food to be sought. Perhaps a better explanation is poor preservation brought on by postdepositional disturbances, human and animal. Furthermore, no vertebrate comparative collections were available during their analysis; therefore, at least some bones must have been identified only to higher taxonomic categories when they might have been identifiable to lower categories.

Burial Area

The burial-area fauna may be seen as two sets of collections that contrast in terms of species content and frequency: that of burial items and that from the various nonburial features (Figures 210 and 211; see Appendixes I.9.1–I.9.18). The collection of items from burial features is, first of all, much larger than the collections from the three other types of features (rock clusters, artifact concentrations, and pits) added together. Excavation units in the burial area produced nearly 25,000 animal bones collected as items only (that is, larger bones visible to excavators and thought to be food offerings rather than general midden debris). All together, the features contained only about 6,500 pieces of animal bone, collected both as items and nonitems (from sieving). Despite the bias in collecting only items from the burial-area excavation units, that collection is much more diverse in species content, perhaps because of its much larger sample size. This collection of animal bones also differs from the discrete nonburial features' collections in terms of the balance between large and small fauna. Whereas the faunal remains from the nonburial features are nearly all from small taxa, the burial items include a larger number of bones from carnivorans, deer, and sea mammals. This observed difference in scale may again be purely an artifact of collecting all visible bones as items, a bias toward larger elements and larger species.

Burial-Area Items

The burial items contained a few elements of special interest, including one bone each of a bear, a bobcat, an eagle, an ocean sunfish, and a pig, as well as two bones from pronghorn. All of these bones were recovered from excavation units and a feature within the south-central portion of the burial area, a space measuring approximately 7 by 5 m. With the exception of the pig and the sunfish, these bones probably relate to burial ritual, as these animals held ritual significance for the Gabrielino. Pigs (especially males) have large teeth and may have been mortuary offerings; they were obtained from the mission and the ranchos as payment for labor. Ocean sunfish are rare in archaeological collections; their bones tend not to preserve. Presence of this deepwater but surface-floating fish underlines the Native Americans' seamanship skills, and indeed their general interest in deepwater fishing. On another tack, it is worth mentioning here that, in contrast to the taxonomic array of fauna from burials discussed previously, this collection of burial items contains a number of snake and lizard bones. Their absence in one burial context vs. presence in another again raises the questions whether snakes and lizards were food items at all and, if so, whether they were nonetheless banned from certain contexts such as meat donated for the dead.

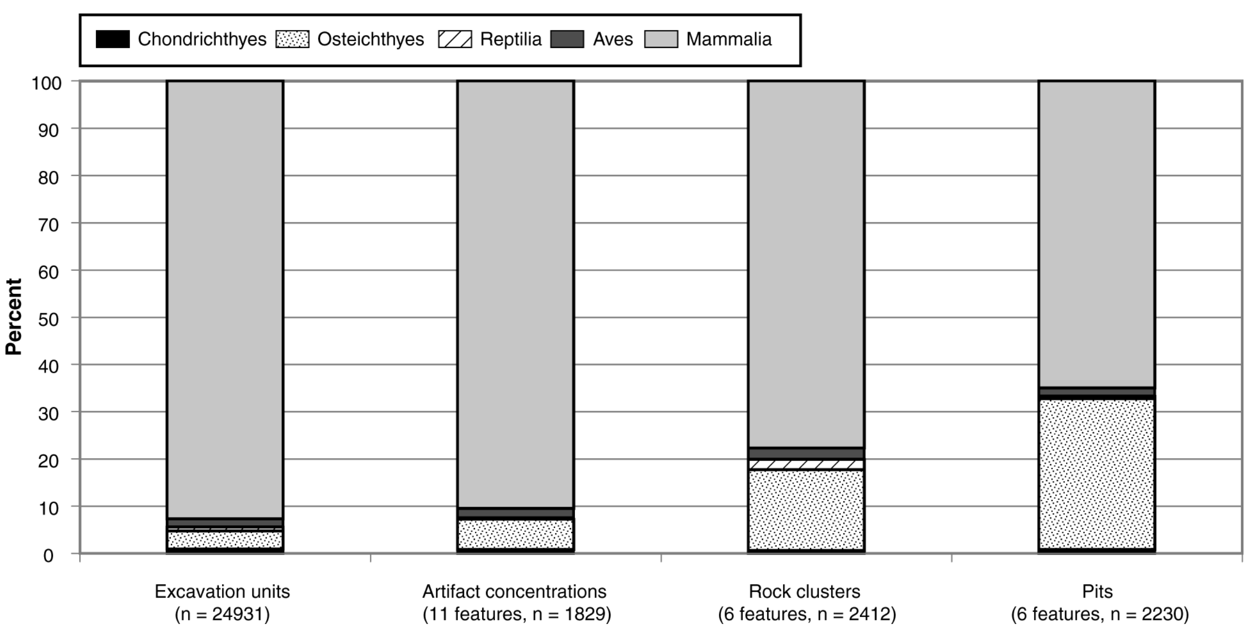

Figure 210. Vertebrate classes from burial-area contexts at LAN-62, Locus A/G.

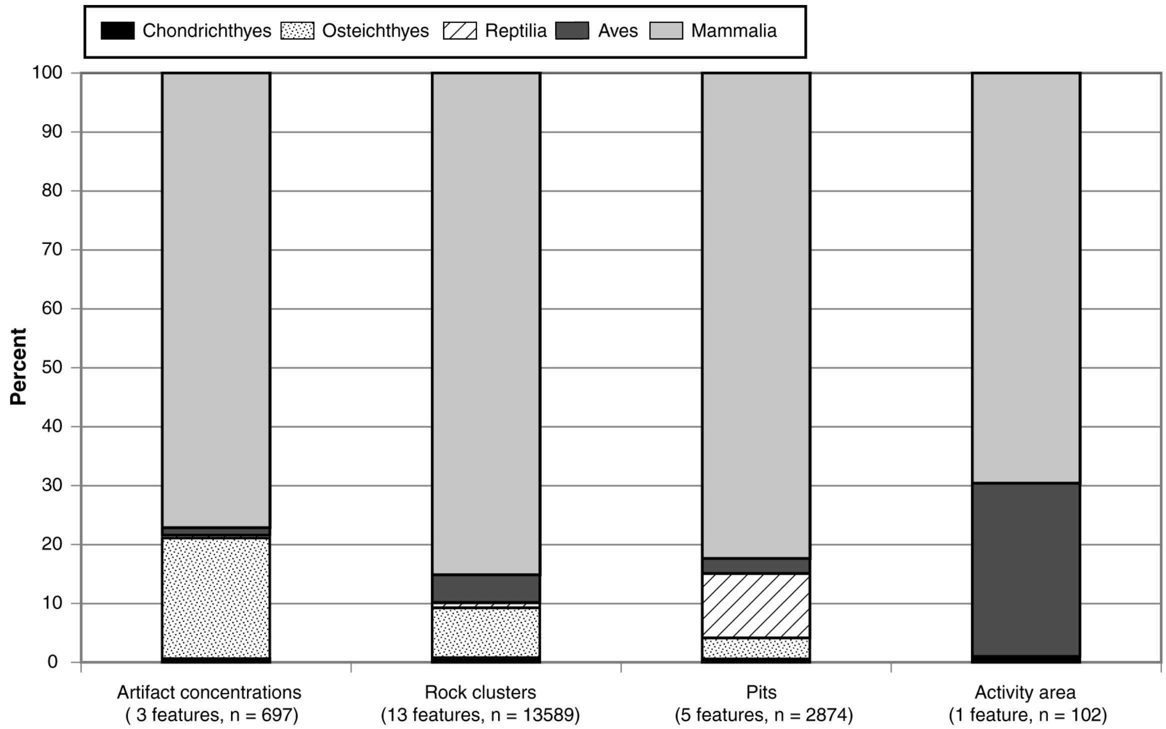

Figure 211. Vertebrate classes from nonburial features at LAN-62 Locus A/G.

Burial-Area Nonburial Features

The feature groups (artifact concentrations, rock clusters, and pits) are all broadly similar in taxonomic content, consisting mainly of small mammals and bony fishes. The strong similarities may be due to the fact that, in general and with the exception of certain rare species, the entire midden's contents are homogeneous. Alternatively, most of the features were found clustered together in the central-western portion of the excavation area. Birds and reptiles are present as well, but in relatively small numbers, and few were identifiable. Most of the reptile remains may well be from commensal species, although the turtle remains, at least, probably represent the remains of meals. Identified birds are nearly all waterfowl, the most common avian taxa overall in Ballona-area collections. In general, the nonburial features appear to contain a large number of small taxa, whether birds, fishes, reptiles, or mammals. If most or at least a substantial portion of the recovered faunal remains were within primary depositions at the time of excavation, then it is reasonable to speculate that many of these small features were constructed as food preparation or storage installations, and specifically for cooking or preserving small animals.

Sitewide Nonburial Features

The four groups of nonburial features situated across LAN-62, Locus A/G (pits, rock clusters, artifact concentrations, and activity areas), held widely differing numbers of animal bones and, therefore, densities (see Figure 211; see Appendixes I.9.1–I.9.18). Density estimates could not, however, be calculated for the artifact concentrations; therefore, the collections are best compared either specifically, by taxon using numbers of identifiable specimens, or broadly, by use of estimated volume per cubic meter by taxonomic class, but leaving out the artifact concentrations. Overall, throughout all the features, large mammals are rare; artiodactyls, canids, and sea mammals contribute a total of 35 bones (4 percent of identifiable mammals). Instead, mammalian remains are dominated by rodent and/or lagomorph bones, which make up 92 percent of identifiable mammals. The lone exception to this pattern is the 18 whale bones from the pit features, which constitute 1 percent of all faunal remains from those contexts (4 percent of identifiable mammals). Aside from mammals, the most numerous class of animal in these features is fishes. Fish bones are especially frequent within the artifact concentrations (21 percent of all faunal remains from the two artifact concentrations), perhaps an indication that Feature 356, located some 10 m east of FB 4, had the specific function of preparing fish for consumption or storage. A final observable phenomenon is that bird remains are relatively scarce in the two artifact concentrations and, to a lesser degree, the pits. Bird bones are more numerous in the rock clusters than in other types of nonburial features, taking up the third place, by count, behind mammals (87 percent of analyzed bone fragments) and fishes (9 percent of the specimens). These features, many of them probably hearths or hearth cleanouts, may have been designed for cooking, in which case it makes sense that birds, as well as fishes and mammals, are present in large numbers. Probably the single most interesting aspect of the various collections from these different contexts is the abundance—or scarcity—of hoofed-mammal remains. Artifact concentrations and pit features contain few such remains. On the other hand, the large collection from the rock clusters contains a moderate number, including several pig bones.

Feature Block 3

From FB 3, an area related to mourning ritual, the faunal remains—both those collected as items and those collected from nonburial features (five artifact concentrations, three rock clusters, one thermal feature, and four pits)—totaled approximately 11,000 animal-bone fragments. These consisted of common species, for the most part: various large and small rodents, lagomorphs, canids, and deer as well as (mainly) unidentifiable reptiles, fishes, and birds (Figure 212; see Appendixes I.9.1–I.9.18). Three specimens do, however, stand out: a bovid element and 9 whale bones. The bovid element stands out among all the wild-animal remains as a symbol of changing circumstances for the Gabrielino. It symbolizes the connection of domesticated fauna to the Spanish and their introduction to California of a different way of life and, specifically, food production. In marked contrast are the whale bones, which mark the continuity of traditional ritual practices. As discussed in Chapter 4 (this volume), whale bones at this site were found almost exclusively within the burial area. The Old World domesticate placed into a Gabrielino ritual context demonstrates that the meeting with the Spanish missionaries and ranchers may not have engendered, at least at first, disaster for the native community. Instead, some of the newcomers' introductions appear to have been readily incorporated into some of the most sacred aspects of Gabrielino culture.

If these few interesting bones are left aside, larger-scale patterns are observable. One pattern is the relatively small number of bone items (n = 25) recovered from FB 3, and still relatively small when nonburial features are included (approximately 5,000 specimens). When density figures are examined for the nonburial features within FB 3, it is clear that all contexts save the pit features held fairly sparse collections of bones, ranging from about 400 to 5,000 bones per m^3. The situation is different with the pit features, however, which have much higher bone concentrations (more than

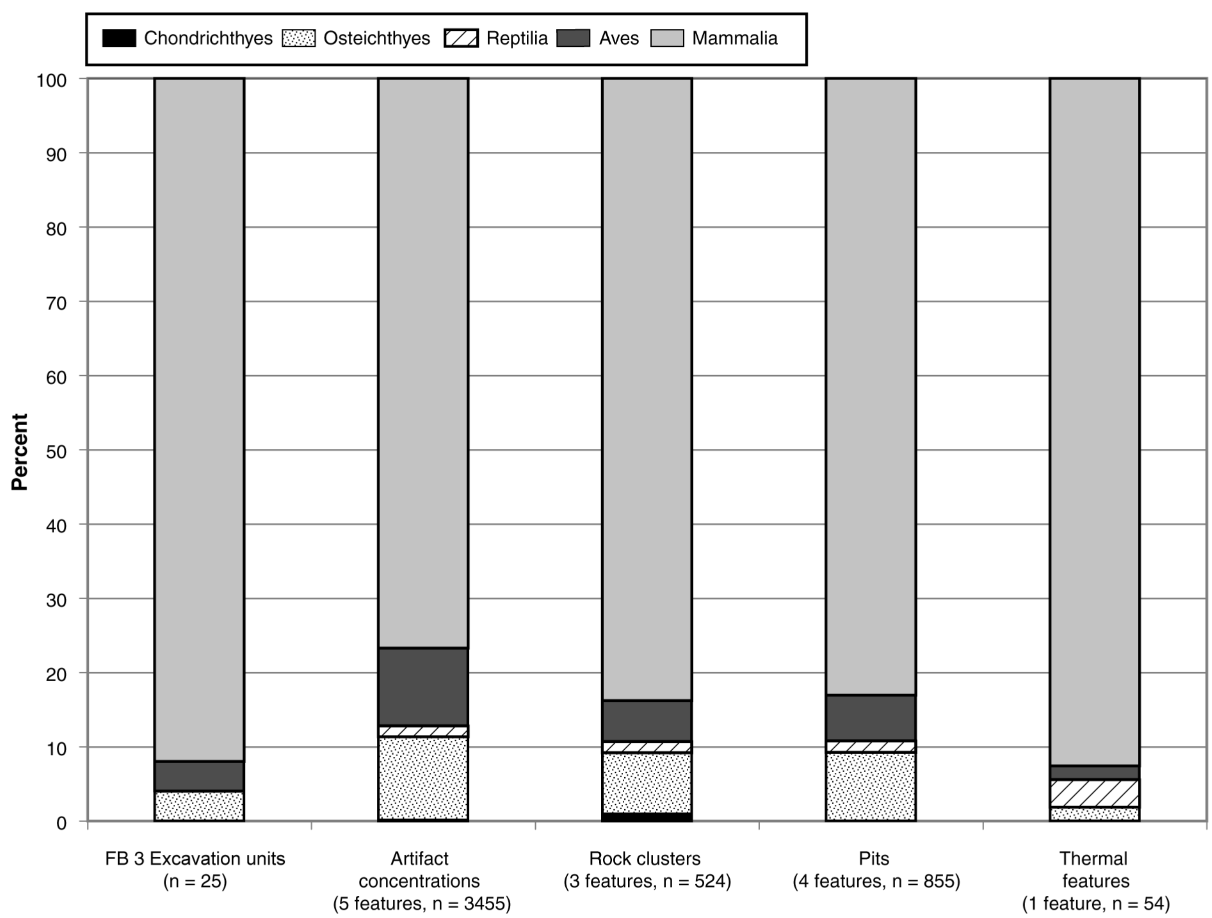

Figure 212. Vertebrate classes from FB 3 contexts at LAN-62, Locus A/G.

9,000 bones per m^3). The contrast suggests that, if the pits are contemporary with the burial ground, perhaps they were purposely designed to hold donations for the dead or various items left from ceremonies such as feasts. Other aspects of the collections are not necessarily ritually connected—for example, the more or less equal abundance of fish and bird remains, which probably simply reflects the importance of the Ballona Lagoon and its immediate surrounding areas.

Finally, it is worthwhile to note small numbers of some animals, along with larger-than-usual numbers of others. Turning to the latter subject first, numbers of deer, or at least artiodactyl, bones apparently are greater within this feature block and its nonburial features than elsewhere at the site, with a total of 37 cervid elements (14 percent of bones identifiable to class or higher taxonomic categories; 26 percent including elements identified only as Artiodactyla). Although deer are more numerous, small species that may or may not have been food items—rodents and reptiles—are not as common in this context as they are elsewhere at LAN-62, Locus A/G, constituting just 4 percent of identifiable and unidentifiable bones. The reason for the discrepancy is unclear but may have to do with either ritual "cleanliness," keeping away invasive species, or, as suggested earlier in this chapter, food taboos enacted for certain rituals or ritual contexts. Within this feature block, then, evidence from faunal remains for rituals is not strong; the best evidence comes from the whale bones and the unequal distribution of bones within different types of nonburial features.

Feature Block 4

The principal difference visible in the faunal remains from FB 4, an Intermediate period feature block that includes excavation units, two artifact concentrations, six rock clusters, two activity areas, and one pit feature, is the inclusion of a much greater proportion of fishes than elsewhere within the site (Figure 213; see Appendixes I.9.1–I.9.18). From a total collection size of 11,050 bones, the contribution of fishes is 25 percent; mammals make up 69 percent of the collection.

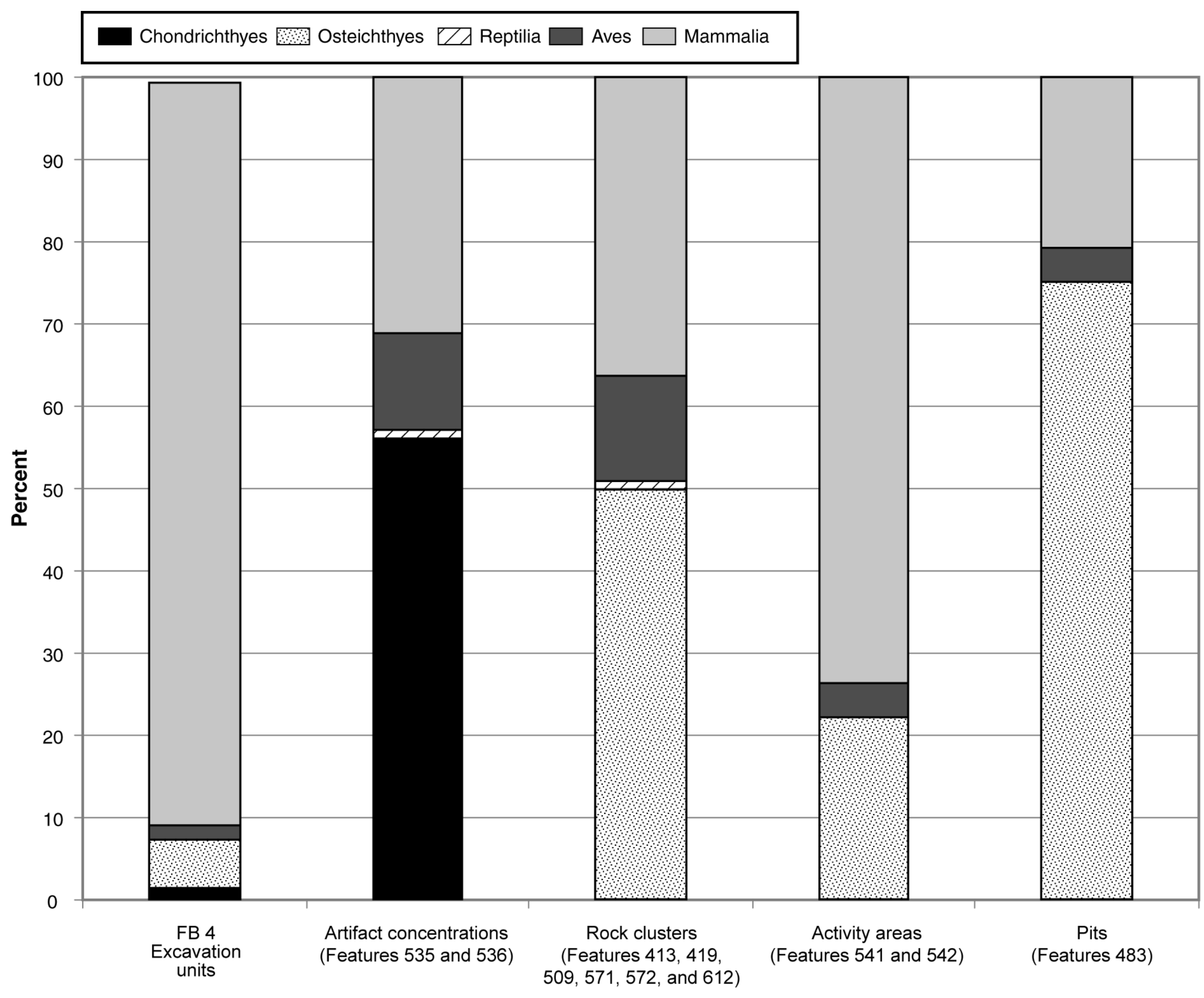

Figure 213. Vertebrate classes from FB 4 contexts at LAN-62, Locus A/G.

This is a remarkable phenomenon because no other contexts within LAN-62, Locus A/G, display anything other than a pattern where mammals dominate, usually followed rather distantly by either bony fishes or birds. The inclusion of whale bones, a sea lion bone, and a dolphin element adds evidence to the hypothesis that during the Intermediate period the population targeted more-aquatic food sources than either previously or subsequently. Nonetheless, these data must be interpreted with caution. The whale bones may have intruded downward from the later human burials above. A large sample of bones was recovered from a single excavation unit, although the sample was of limited value because of the small number of identifiable bones within it. The next largest sample excavated from within FB 4 came from refuse pits, which, as excavators noted, were packed with shell. Nonetheless, the whole area may have been specially designated for seafood preparation, cooking, and/or disposal during the Intermediate period and therefore may not be representative of the population's diet as a whole. In addition, one cannot ignore the potentially large disparity (but one that is difficult to calculate with any confidence) between the amount of meat contributed by large herbivores like deer (of which considerable remains were found within this feature block) vs. that contributed by the modest-sized fishes most common at the site.

Feature Block 7

Most of the mammal bones from the excavation units and features (consisting of four rock clusters) belonging to FB 7, a Millingstone period feature block, are rodents; other identified taxa are represented by only a handful of bones. Nevertheless, the large sample of animal bones recovered—nearly 31,000 elements—was for the most part not identifiable to levels more specific than class, which makes it a difficult collection to interpret (Figure 214; see Appendixes I.9.1–I.9.18). Clearly, within this early period, the population already looked to nearby aquatic environments for a large proportion of their animal food. One can see evidence of this phenomenon not only with respect to the abundant fish remains present but also with respect to the avian species identified. Most of the bird taxa are aquatic in adaptation; therefore, the same may be true for the unidentifiable bird bones. Further evidence is the nearly equal numbers of bird and fish bones present in the very large sample extracted from the excavation units. The Millingstone dietary evidence (if the current collection is representative) suggests that the population pursued a diet divided between aquatic and terrestrial fauna. If the inhabitants took in most of their protein from small terrestrial animals, they nonetheless relied on their aquatic surroundings for a substantial supplement to their land-based food sources.

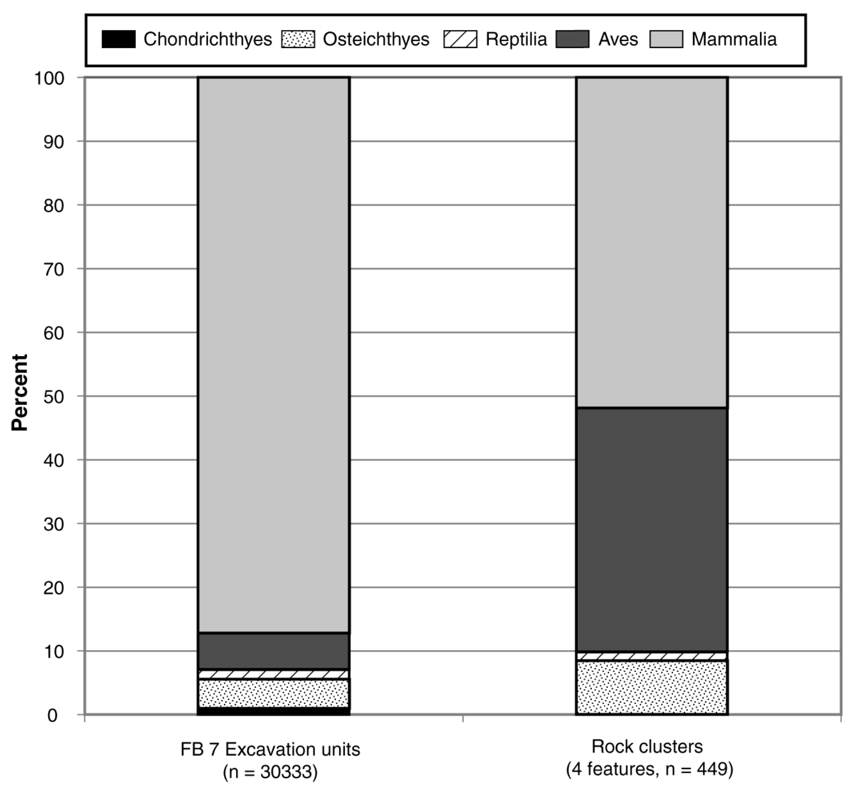

Figure 214. Vertebrate classes from FB 7 contexts at LAN-62 Locus A/G.

Summary of Vertebrate Remains from LAN-62, Locus A/G

The immense faunal collection from LAN-62, Locus A/G, contained a standard array of taxa for sites in the area but also contained both unusual species and surprising relative abundances of animal classes (see Appendixes I.9.1–I.9.18). The control units showed a diverse avifauna, dominated by waterfowl and supplemented by shorebirds and wading birds. Generally, the control units demonstrate that reptiles and birds were merely supplementary food sources in comparison to the dominant position of mammals (Figure 215). In two of the control units, fishes became more numerous over time in comparison to classes other than mammals. Within other contexts at the site, most noticeably within FB 4, it is clear that fishes were an important source of food. How important is unclear, given that most fishes were unidentifiable because of the inherent difficulty of identifying their skeletal remains as well as the tendency of these remains not to survive postdepositional processes well.

Reptiles were recovered from the control units; therefore, the absence of snakes and lizards from the burial features is interesting. Other contexts (for example, the nonburial features across the site and within the feature blocks) contained lizard and snake remains, though generally in smaller quantities than within the control units. Thus, it is possible that the absence of snake and lizard bones from the burial collection is the reflection of a ritual ban on the inclusion of these species as food offerings for the dead. Inherently interesting and attractive as this thesis may be, other possible explanations should be considered. One possibility is that, for the most part, snakes and lizards were not consumed at the site but instead are commensal taxa, burrowing in the ground after rodents or seeking shelter. In that scenario, the animals' bones would be accidental inclusions where they are present; their absence from the burial area possibly was the result of greater care taken of the area by the population, or even the frequent burning activities that took place there. Nonetheless, the latter explanation does not account for the fact that, during the nearly two centuries after the site was abandoned by the Gabrielino before it was sealed by fill, reptiles never returned and never happened to die within the burrows. Therefore, it is more likely that snakes and lizards were consumed outside the burial area.

The burial fauna may have other ritual markers within it: namely, the inclusion of rare species such as owls and cormorants, and perhaps other birds hunted for their feathers. Evidence for the latter is certainly not strong: neither wing elements nor species having particularly large and impressive feathers are abundant in the collections. However, the number of bird bones within the burials is higher than in many of the other contexts. In any event, the presence of the bones of other species, such as carnivorans, would provide much more direct evidence for ritual behavior. In fact, the burials yielded a relatively large number of carnivoran bones; most were from canids, but also included was the partial skull of a bobcat, an extremely rare animal within this site. Further, most of the carnivoran bones were skull elements, as mentioned earlier perhaps a cosmological link with visible

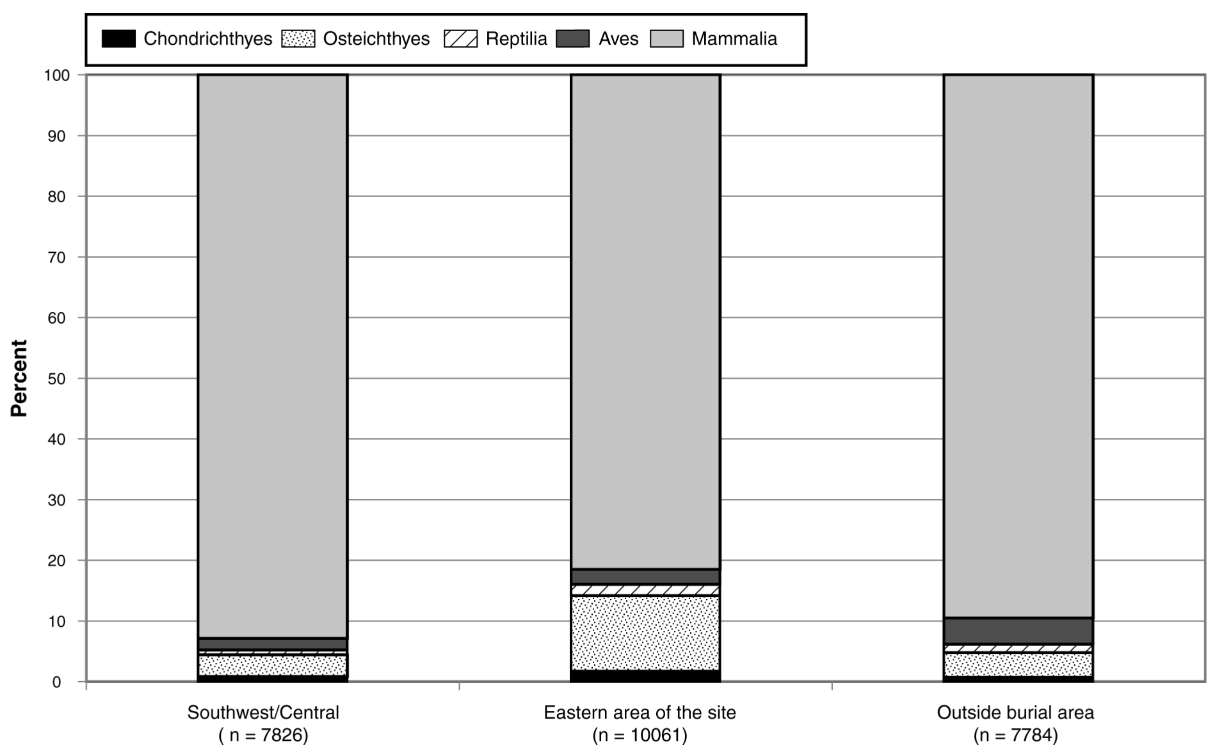

Figure 215. Vertebrate classes from excavation-unit clusters at LAN-62, Locus A/G.

ferocity emphasizing the deceased individual's characteristics such as virility or bravery. The related contexts of the mourning feature and the fauna from the human burials must also be considered in the discussion of evidence for ritual fauna. Fauna from the mourning feature FB 3, aside from inclusion of several whale bones, does not appear strongly related to ritual. Instead, it is the uneven distribution of bones in those features that stands out. Most of the faunal remains from that feature block came from pits.

Comparison of the Late/Mission period faunal remains from the mourning and burial areas vs. those from the portions of the control units dated to a similar time may also prove instructive in deciding whether any special patterning exists in the ritual areas. In each of the four control units with complete chronostratigraphy, the emphasis, first of all, on small mammals is clear. Large mammals, whether hoofed, clawed, or aquatic, are rare inclusions. Only a handful of deer and canid elements were identified in the units, in addition to a single whale bone (see Appendixes I.9.1–I.9.18). Within the general midden area, as represented by faunal remains from the control units, there appears to be an abundance of small-mammal taxa, most noticeably lagomorphs, and pocket gophers. By contrast, the burial-area collections contained a relatively large number of bones from aquatic mammals, carnivorans, and hoofed mammals (see Appendixes I.9.1–I.9.18), although the small mammals common in the control units are also common in the burials. The three animal burials that date to the same era are harder to interpret. Burial is, of course, a ritual behavior by definition; therefore, the burial of an animal makes those remains special. Nonetheless, the species of animals that the Gabrielino decided to bury are worthy of consideration, given that two of the three animal burials contained a partial canid skeleton. In general, an emphasis on large land and sea mammals is visible in all contexts with large faunal collections in the burial area and the larger faunal samples from within the feature blocks (see Appendixes I.9.1–I.9.18). Most remarkable is the inclusion in these contexts of bones from seals, sea lions, whales, and dolphins. The absence of seals' and sea lions' bones from the control units may indicate that these animals were consumed or used mainly during ritual feasts. A dolphin vertebra found in EU 649 (just outside the burial area) displays a cut mark across its dorsal surface (Figure 216), indicating that at least sea mammals smaller than whales were indeed hunted and not just scavenged as skeletons on the beach for raw material. Because whale bones were used for grave markers, it appears most likely that the population scavenged beached whales opportunistically, caching the bones until needed. The much greater number of whale bones in the burial areas, and their near absence from the control units, can be read as evidence either that the whales were scavenged for ritual purposes or that they were, after all, hunted and their bones saved for markers and other uses.

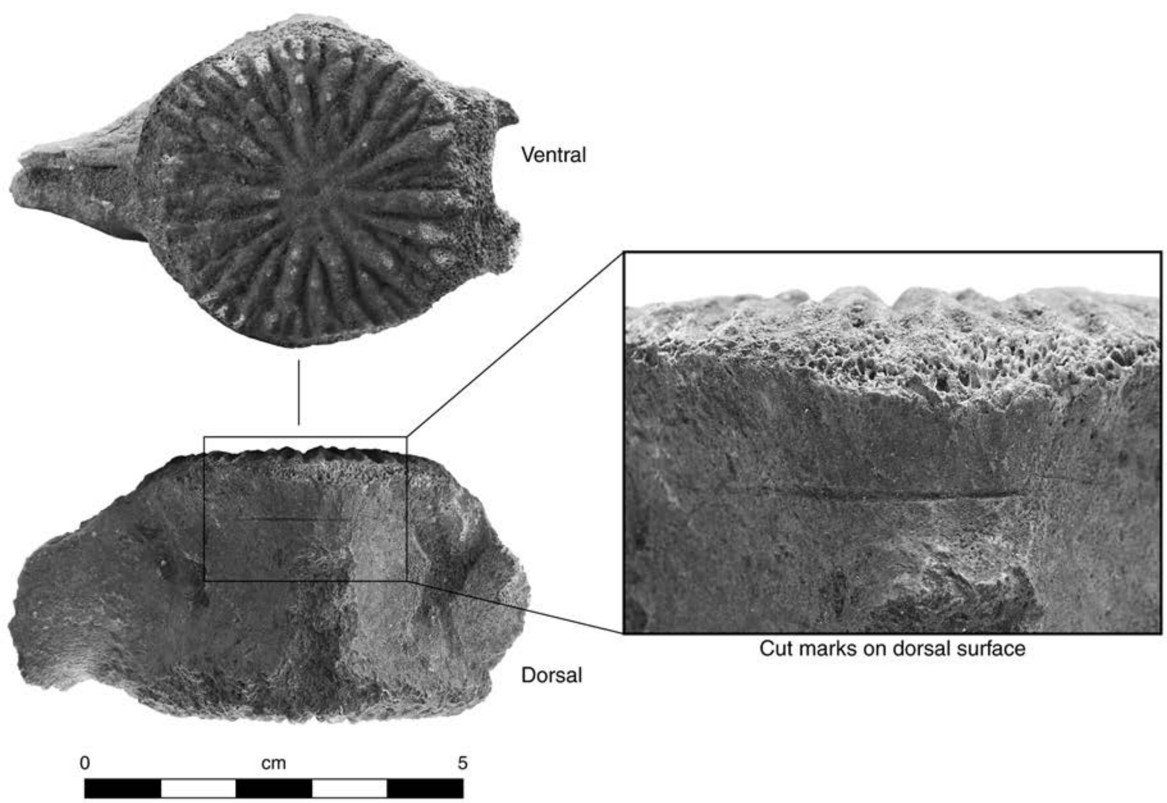

Figure 216. Two views and a close-up of a juvenile dolphin lumbar vertebra from EU 649 at LAN-62, Locus A/G.

In general, then, there are compelling reasons to believe that at least the makeup of the portions of the mammalian faunal collection from the Late and Mission period contexts was influenced by mortuary needs. Differences between contemporary areas connected and not connected with burials have been documented in mammalian remains as well as reptilian bones. What has not been addressed so far is the distribution and relative abundance of fish and bird species. It is difficult to assess differences in taxonomic representation of fishes between burial and nonburial contexts, because fishes are uncommon throughout the large number of human burials as well as within the various features of FB 3. However, fish bones were found in large numbers in nonburial features from the burial area. Taxonomic differences in fishes between the burial-area features and the control units is not apparent; inshore species are prominent in both areas, but closer examination is rendered impossible by the fact that relatively few piscine taxa could be identified among the bones recovered from the control units. Therefore, no consistent or visible differences in the distribution of fish remains across the site are apparent.

Domesticated mammals from the Old World were incorporated into the faunal collection from LAN-62, Locus A/G, in very small numbers. Not counting a horse burial from this site, which is apparently much more recent, three horse bones were identified, as well as two bones from pigs and one each from a cow and a sheep or goat. Each of these bones came from a separate location; one pig bone came from an excavation unit in the southwest-central area of the burial ground. The other pig bone was excavated as an item from the burial area, whereas the Bovidae element came from one of the pit features within FB 3. Despite these finds, animals introduced by Europeans were not a regular dietary component for this population during the Mission period. This evidence contradicts contemporary Spanish accounts of Native Americans in the area stealing cattle (e.g., Mason 2004:22). One wonders if the pig remains were received in trade or as a ration from a ranch, rather than being stolen. With only two pieces of bone (one an isolated tooth and the other a partial mandible), it is not possible to answer that question. The mandible, interestingly, was recorded during excavation as an item in the burial area; therefore, there may be a burial association.

Temporal differences in diet at LAN-62, Locus A/G, do not appear with any consistency across the dated portions of the site. Fish bones dominate the faunal collections from many of the nonburial features within FB 4, which dates to the Intermediate period. The same pattern, however, is not discernible within contemporary levels of the control units, where fishes account for only a very small proportion of the faunal remains. Thus, with the exception of FB 4, fish bones are not more common during the Intermediate period than in other periods. Similarly, bird bones are especially abundant in excavation units in FB 7 (see Appendixes I.9.1–I.9.18), which dates primarily to the Millingstone period, but that pattern does not repeat itself in other Millingstone contexts. Both the relatively abundant avifauna in the Millingstone period excavation units and the impressive number of fish bones in the Intermediate period FB 4 apparently relate not to temporal differences in dietary strategy but either to some taphonomic process favoring the preservation of those taxonomic classes or to those areas having been specialized processing areas, or dumps from such areas located elsewhere. Therefore, with the exception of a few animals introduced by Europeans and the relative abundance of sea mammals, there are no significant temporal differences apparent in the use of fauna at Locus A/G.

The lack of temporal differences may be real, or it may be a product of the investigative method adopted. One can question the utility of the "taxonomic approach" to analyzing hunter-gatherer diets. In that approach, one must implicitly assume that hunting, trapping, and fishing parties targeted specific taxa or types of animals: for instance, mammals, birds, or fishes. Hunters using such a strategy presumably went out specifically in search of, say, deer or other large land mammals and ignored other hunting opportunities that presented themselves while the hunters pursued their original targets. That scenario seems unlikely. Certainly, it is possible that hunting and fishing parties were sometimes organized to seek specific fauna, but it seems much more likely—or at least worth considering—that hunters would have been more opportunistic. Fishing was less discriminate, and all fishes that could be hooked or trapped were exploited. Similarly, hunting parties in the Ballona area could have been organized to be equipped for hunting both large mammals and smaller mammals or birds that could be found in the area. The categorization of diet by taxonomic groupings certainly provides insights into dietary habits writ broadly: for example, land vs. sea, or even avoidance of entire classes of animals. However, organizing the data according to habitat might more closely reflect how people obtained their food. Ecozones, after all, exist on the landscape—sea, marsh, forest, and field. Each of those habitats is filled with species from the diverse groupings created by modern biologists, but taxonomic boundaries—hunting only mammals one day, birds the next—were not necessarily observed by the Gabrielino or other hunter-gatherers, as Binford (1980) pointed out in his study of hypothesized types of forager organization.

Locus C/D

Loci C and D of LAN-62 contained a relatively small collection of animal bones (see Appendixes I.11.1–I.11.8) compared with Locus A/G. All of the five features in this portion of the site that contained animal bones—three rock clusters and two animal burials (one immature deer and one horse)—were selected for full and complete analysis of all material recovered. The five control units in this area of the site contain levels dated to the Millingstone, Intermediate, and Late/Mission periods (primarily the last). The control units were sampled differently from the features. Although three control units were excavated in Locus C, it was believed that a single large one, CU 937, would be sufficiently representative of the area to make full analysis of the remaining two unnecessary. Animal bones from the other two Locus C control units, CUs 534 and 922, were identified to the general taxonomic level of class. The remaining four control units lie in Locus D of LAN-62. In addition to examination of the animal burials and control units, discussion of a small bone sample from the rock clusters within Locus C is included. These rock clusters principally contained mammal bones (mostly unidentifiable), followed by bony fishes, reptiles, and birds. Among the remains of identifiable species present were 3 bones of lagomorphs (1 from a hare) and 1 element each from an artiodactyl and an American wigeon, in addition to 10 rodent bones. The sampling procedure for Locus D was different, in that four control units were fully analyzed, which included detailed examination and identification of all bones recovered from those contexts. No features were discovered in this area. Despite the fact that Loci C and D were considered distinct areas of the large site of LAN-62 during excavations, the data from the two areas are combined here, in order to provide a better overview of the dietary evidence for this portion of the site without breaking the data up by arbitrary spatial designations.

The combined loci, C and D, together produced nearly 19,000 specimens that were analyzed (Table 178). What is unusual about these loci is that the control units contained fewer animal bones (approximately 9,200 fragments) than did the features, which held approximately 9,700 pieces of bone. The two largest bone collections emanated from Locus C: CU 937 (slightly fewer than 7,000 bones) and deer burial Feature 201 (some 6,400 elements). Clearly, the principal reason for the fact that the features contain so large a sample of bones in relation to the control units is that burial Feature 201 produced so rich a collection. The large size of that collection is very unusual for any type of feature and especially an animal burial, and the reasons for its having contained so dense and large an aggregation of bone are explored below, in the detailed discussion of the feature's contents.

Table 178. Summary of Vertebrate Remains Analyzed from All Contexts at LAN-62, Locus C/D

Context	NISP
CUs	
CU 937 (Locus C)	6,898
CU 970 (Locus D)	218
CU 981 (Locus D)	344
CU 998 (Locus D)	525
CU 1000 (Locus D)	1,278
Subtotal	9,263
Features	
Animal burial Feature 201	6,412
Animal burial Feature 675	2,545
Rock clusters (Features 520, 521, 540)	736
Subtotal	9,693
Total	18,956

Key: NISP = number of identified specimens.

Control Units

The control units together show remarkable similarity in their contents, in both the horizontal and the vertical senses (see Appendixes I.11.1–I.11.8). There are no significant differences among these units, between Locus C and Locus D, between the eastern and western portions of Locus D, or from period to period. CU 998, located at the northern tip of this site adjacent to LAN-211, contains perhaps the sole distinctive temporal component, as its Late and Mission period levels do in fact appear to fit the precedent for that period's faunal collections even though collections of similar ages in the other units do not fit the precedent but do match each other.

Perhaps the most interesting aspect of the collections from the control units is what the samples lack (Figure 217). Fish bones are generally absent from these faunal collections, whether the Millingstone sample of CU 937 (located in the far west, in Locus C) or the Late/Mission period collection from CU 998 (the easternmost control unit, in Locus D). Even though there is some evidence for fishes and other aquatic animals (the occasional bones of whales, waterfowl, and turtles), it is comparatively sparse: aquatic taxa make up just 4 percent of the total number of recovered bones in the control units. Several hypotheses could be generated as possible explanations for the phenomenon. Most simply, for whatever reason, the population of the site rarely fished. Yet that would be surprising, given the site's general proximity to the Ballona Lagoon, Ballona Creek, and the ocean. In fact, it is clear that they ventured into the marshes, the lake, and even the ocean at least on occasion, given the presence of waterfowl, whales, and turtles in the collections. Perhaps a more plausible explanation is that fishes were processed for consumption either in a separate area, where they were filleted, or by food-preparation methods that so thoroughly altered the bone that little of it was recovered. Given the highly fragmented state of the mammal bones, that is certainly a possibility.

Animal Burials

As stated above, the animal burials consisted of a horse and an immature deer. In addition to standard taxonomic analysis of the burials, body-part representation for the horse, deer, other mammals, and birds was examined (see Appendixes I.11.1–I.11.8). Other than the fact that the deer skeleton appears to have been largely intact, little or no distinctive patterning is

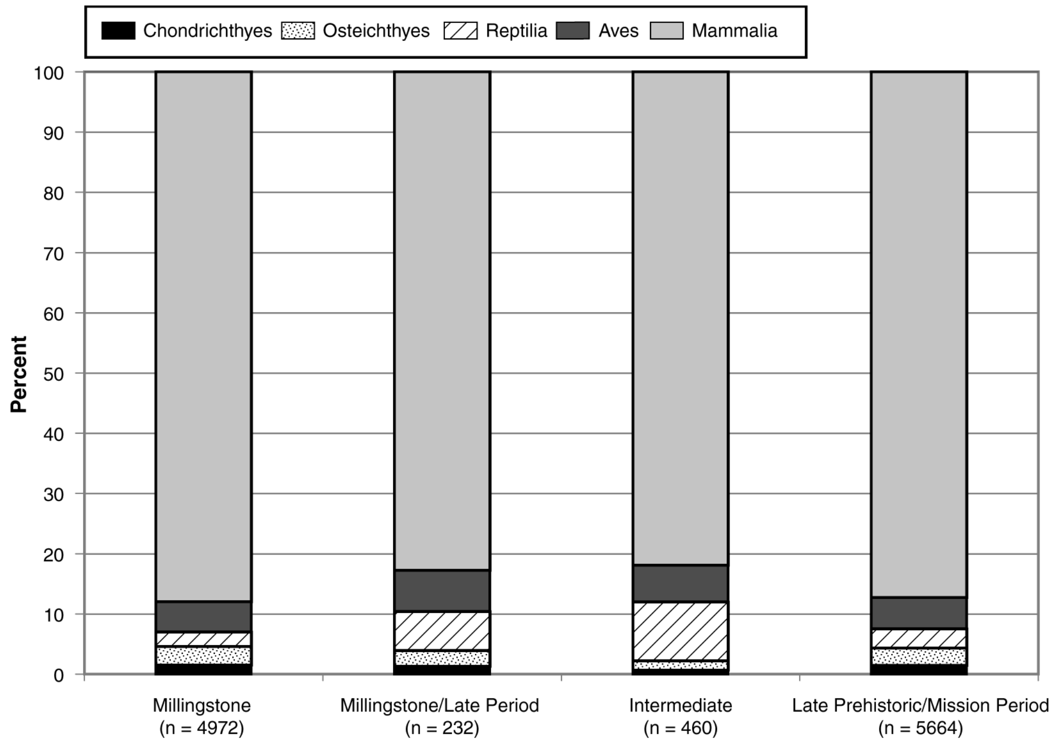

Figure 217. Vertebrate classes by period, from control units at LAN-62 Locus C/D.

apparent. When the deer-bone distribution based on the elements recovered from burial Feature 201 alone is examined, however, there are few cranial elements. This is consistent with the excavator's observations, which indicate that the deer was not complete at the time of excavation. In addition to the fact that the deer was placed, articulated, into this deep pit, the sparseness of cranial elements may be another clue that the people who buried it were carrying out a prescribed ritual. Still, if the animal's head had been removed before burial, there should have been no cranial elements at all. Consistent with the lack of cut marks, the presence of several skull elements, including teeth, may be further evidence that the skull was taken from the skeleton after the animal was buried and had been reduced to a skeleton. In the process, a few teeth and other skull elements fell off, remaining with the postcranial elements in the pit. Given that very few identifiable avian elements were recovered from burial Feature 201, it is not possible to discuss body-part representation. Similarly, the horse skeleton (burial Feature 675) could not be assessed because it was not complete.

Perhaps instead of two animal burials within LAN-62, Locus C/D, there was just one. Burial Feature 675 apparently was a complete horse skeleton, but it was not necessarily buried in the strict sense of having been placed into a burial pit that was dug specifically for it. Rather, its carcass may have been dumped in a marshy area and later covered over by filling initiated by Hughes Aircraft Company. This horse skeleton appears to have been buried as the result of a process quite different from, and probably later in time than, the horse burial found at LAN-193.

Summary of Vertebrate Remains from LAN-62, Locus C/D

The first subject of discussion with respect to LAN-62 is the general distribution of bones between features and control units and between Loci C and D. As mentioned at the start of this chapter, it is highly unusual for there to be nearly equal numbers of bones from features and from control units. Table 178 demonstrates that the particular context that contributes the most to this unusual situation is burial Feature 201. The large size of the pit, combined with the placement of a nearly intact deer skeleton, account for this anomaly. Yet what is also interesting is that CU 937 contains the greatest number of bones for any control unit at these loci. Perhaps not coincidentally, both CU 937 and burial Feature 201 (situated some 50 m apart) are located with Locus C, evidently an area richer and significantly less disturbed than Locus D. Surely, part of this pattern is also the result of sampling decisions, as when it was decided to examine only a single control unit from Locus C, as opposed to four within Locus D. Despite the relatively small sample from Locus C, the contents of the collection demonstrate a real difference between the two loci. Locus D appears to have been truncated by modern earthmoving operations, which undoubtedly impacted the Late and Mission period levels the most and reduced their sample sizes significantly. Only one unit, CU 1000, contains levels predating the Late and Mission periods. The Intermediate period stratum in CU 1000 yielded 464 bones, a count similar to the Intermediate period frequencies at LAN-62, Locus A/G (see Table 174; see Appendixes I.13.1–I.13.7) and LAN-211 (Table 179; see Appendix I.10.18). What adds to the difference is that the control units of Locus D, unlike those within Locus C, contain almost no materials from levels dating before the Late and Mission periods; within CU 937 in Locus C, the Millingstone period deposits contain far more bone fragments and register a far higher density than do the Late and Mission period deposits.

Other than the sheer amount of bone material in the two different loci, there appear some taxonomic differences, although the possibility exists that these were created or accentuated by the disturbances. One such difference is the relative importance of fishes: they are relatively common as a secondary resource within the Millingstone period collection of CU 937, but they appear to decrease in abundance through time in that unit. Fishes are scarcest within Late/Mission period levels in comparison to other taxonomic classes and to their densities in the Millingstone levels. Fishes are relatively rare throughout the control units of Locus D, both in Intermediate and in Late/Mission period levels. CU 937 in Locus C contains 5 percent fish bones alone, whereas fish bones from the four control units of Locus D together made up only 2 percent of the total sample. Although it cannot be said for certain whether the discrepancy is due in some way to the disturbances or to actual dietary differences, it is noteworthy that Locus D contains, nearly exclusively, Late and Mission period deposits. In CU 937 of Locus C, the Late/Mission period is also the period that produced a low density of fish bones. The paucity of piscine elements in Locus D probably is a dietary rather than a taphonomic pattern. Birds, namely various species of waterfowl, are the most common class after mammals throughout the levels of CU 937 in Locus C, whereas avifaunal elements are comparatively scarce in every Locus D control unit.

Both content and density of fauna are in general agreement between the control units and features of Locus C/D. Leaving aside burial Feature 675 (the horse burial), burial Feature 201 and the three rock clusters all contained large numbers of mammal bones. Other than the deer skeleton in burial Feature 201, the pit contains the normal range of species found elsewhere in the Locus C midden—large numbers of mammal bones and lesser but still impressive numbers of birds and fishes. Probably, the pit was excavated through the midden soils, perhaps for the express purpose of burying the deer, and was backfilled with the soils containing abundant refuse. Therefore, other than the deer skeleton itself, this feature's faunal collection is not representative of discrete activities such as food storage or hearth cleanouts. This feature, with its large number of bird and fish bones, seems most like the Millingstone levels of Locus C, as represented in CU 937. With respect to the rock clusters, again the pattern seems most similar to that of the Millingstone

Table 179. Vertebrate Remains Analyzed from LAN-211 Burial Contexts (Items), by Feature

Class	Taxon	Common Name	NISP	Volume (m^3)	Density by Class
Burial Feature 27					
Mammalia	*Odocoileus* sp.	mule deer or white-tailed deer	5	0.22	—
	Mammalia	mammals	9	—	—
Subtotal			14	—	63.6
Burial Feature 33					
Chondrichthyes	Rajiformes	skates	1	0.12	8.3
Osteichthyes	Osteichthyes	bony fishes	1	—	8.3
Reptilia	Colubridae	nonvenomous snakes	1	—	8.3
Aves	Anseriformes	waterfowl	1	—	191.7
	Falconiformes	diurnal birds of prey	1	—	—
	Aves	birds	21	—	—
Mammalia	Rodentia	rodents	207	—	2,083.3
	Sciuridae	squirrels	1	—	—
	Sylvilagus sp.	cottontails	3	—	—
	Talpidae	moles	1	—	—
	Mammalia	mammals	36	—	—
Subtotal			274	—	2,283.3
Total			288	0.34	847.1

Key: NISP = number of identified specimens.

period levels of CU 937. Relatively few reptile bones were recovered from these features, but the relatively high number of fish bones suggests a parallel to that early stratum.

What is most visible across LAN-62, Locus C/D, is change over time in diet, a pattern that also may explain the differences between Loci C and D. Fishes apparently decline in importance at some point after the Millingstone period, possibly as early as the Intermediate period (as represented by faunal remains from that stratum within CU 1000), but clearly by the Late and Mission periods. Fish remains decline somewhat in abundance by the Late/Mission period (2 percent) as compared to the Intermediate and Millingstone levels (4 percent). To what can the decline of fishing be attributed? Possibilities include the gradual infilling over time of the Ballona, which was a small estuary largely closed off from the ocean and surrounded by extensive marshes by the Late and Mission periods, as opposed to its early existence as a largely open bay with much more marine water flowing into it (see Volume 1 of this series). That geological transformation would, over millennia, certainly have affected which and how many fish species frequented it, but there is little doubt that the Ballona would nonetheless have provided a rich fishing area even in estuarine form.

Another possibility is a cultural rather than an environmental shift of some kind. SRI (Stoll et al. 2003:16–17), accepting the earlier hypothesis of Van Horn (1987a), has previously proposed that during the Intermediate period the Ballona area was occupied by a westward-moving population originating in the desert—a population that may have been familiar with estuarine/lagoonal foods but perhaps not equipped with effective means of fishing for nearshore or deepwater fishes. Alternatively, or perhaps in complement to the latter hypothesis, it has been noted that in many Late/Mission period faunal collections from Ballona-region sites, the number of bones from large mammals, mainly deer but also including pronghorn and a small number of domesticates introduced by Europeans, increased to impressive numbers. In earlier periods, deer and pronghorn remains usually constitute no more than a handful of bones, whereas (bighorn) sheep are absent. Therefore it is possible that changes in dietary preferences or hunting styles brought by the (hypothesized) immigration of desert dwellers to the coast are responsible for the decline of fishing. It is also possible that dietary shifts after the visible Intermediate period are economic changes brought on as a result of European contact: perhaps, as elsewhere in North America, European (and, later, American) demand for furs and hides and concomitant Native American interest in acquiring European trade goods encouraged hunters to spend more time hunting large game and less time fishing. Although the bones of hoofed mammals (most of which are probably deer) were found in every control unit, only the Late and Mission period stratum of CU 981 contains more than a few bones of those animals.

Interpreting the Vertebrate Remains from LAN-62

The faunal collection produced by excavations at the four loci of LAN-62 is considered here along four interpretive axes: spatial, temporal, ritual, and seasonal. LAN-62 lends itself well to each of these realms of interpretation, especially the first three, because of the site's size, depth, and nature. That is, the site is the largest, in terms of physical boundaries, of any of the PVAHP sites. In addition, it contains deep deposits that span the occupational sequence from the Millingstone through the Mission period. In addition, the large burial ground necessitates that we consider ritual behavior while attempting to explain the observed patterns in the faunal collection. Finally, as with all the PVAHP sites, it is important to try to delineate season(s) of occupation on the basis of the faunal remains.

Spatial Trends

LAN-62 is very long, measuring more than 1 km from Locus A to Locus D. This provides the opportunity to compare, by period, variation in fauna present and their relative abundances (densities) across the site, from the western end (Locus A) to the eastern end (Locus D). For the analysis of spatial trends, the control units, selected to gain knowledge of spatial variation across the site, are the most appropriate context to examine.

Locus A/G

Within Locus A, the control units demonstrate strong reliance on terrestrial mammals, principally small animals like rodents, rabbits, and hares, but there are also small but consistent numbers of larger fauna, such as canids and deer (see Table 173; see Appendixes I.13.1–I.13.7). These control units also demonstrate that, after mammals, fishes were the most abundant taxonomic classes. Bony fishes are much more common than cartilaginous fishes, but that comparison may well be misleading, considering the skeletal-structural differences between these two classes. The importance of fishes as a food source supplementary to mammals appears to necessitate qualifications related to both time and space. Within the control units of Locus A, the trend is that the number of fish remains increases over time. However, within the control unit (CU 1048) in Locus G, admittedly a small sample compared with the excavation units of the same locus, neither are fishes the most important source of animal protein after mammals, nor does their relative abundance increase through time. There, birds are generally much more prominent than fishes in each stratum, and no evidence demonstrates an increase through time in fish bones of either or both taxonomic classes.

Locus C/D

Eastward, in Locus C, the sole control unit excavated (CU 937) also does not display the strong supplementary role of fishes that is visible in Locus A (see Appendixes I.16 and I.17). Here, birds vary from a strong secondary source of food after mammals, in Millingstone levels, to a weak secondary source, nearly tied in estimated density with reptiles and fishes, in mixed prehistoric and Late and Mission period levels. Indeed, what is most interesting about this unit is the unusually important role played by birds throughout the periods present in the unit. It is certainly not surprising that hunting birds could have played an important economic role, and there is an interesting resemblance in this respect to CU 1048 in Locus G, where birds are far and away the most important secondary resource throughout the prehistoric period, from the Millingstone through to the Late period. In fact, CUs 937 and 1048 seem to show no significant changes in the relative importance of broad taxonomic groups. The lack of change over time with respect to CU 1048 becomes unclear at the contact period, as the sample sizes in the Historical period strata are miniscule and some of the levels are disturbed, plowzone contexts. CU 937 has a fair-sized sample from the Late and Mission periods, and its profile demonstrates continuity with the earlier periods so strongly that it does not even display the characteristic (if slight) shift toward hunting large game animals that is seen in many other contemporary contexts at LAN-62.

The control units located farther east than CU 937 in Locus D do not display the same rank order of vertebrate classes but, similar to the control units already discussed, also contain no evidence of change over time. Three of the four control units located in Locus D—all but CU 1000—contain stratified material only from the Late and Mission periods; therefore, there are no other periods to compare them with. However, CU 1000 contains an Intermediate period stratum in addition to that dating to the Late and Mission periods. Both strata in that control unit display the following rank order: mammals > reptiles > birds > small numbers of bony and cartilaginous fishes. The remaining three control units in Locus D do not show quite the same patterning as does CU 1000. Instead, each contains relatively small collections (considerably fewer than 1,000 bones) that are completely dominated by mammalian taxa, either rodents—especially pocket gophers—or mammals that could not be further identified.

General Spatial Observations

Spatially, the pattern of mammalian dominance is consistent. Within that broad taxonomic grouping, rodents apparently were most often captured and eaten, although how one evaluates the meat contribution of many rodents vs. a few deer is, naturally, a more difficult question, and one impossible to address on such a scale. In any event, little dietary consistency exists across the site when one moves beyond the aforementioned pattern. Three of the remaining five animal classes—birds, reptiles, and bony fishes—competed for the secondary dietary role. Here, however, the caloric contribution of cartilaginous fishes may be severely underestimated, given that their skeletal biology places them at a numerical disadvantage when compared to the higher organisms. Amphibians are the other taxonomic class scarcely present. Although frogs and toads must have been available for adept hunters and trappers to take in the marshes where they evidently hunted birds and fished, these animals apparently were not favored dietary staples. The amphibian remains may be commensal, rather than dietary, as these animals are generally attracted to water-filled pits, often becoming trapped and dying there (Whyte 1991).

As one moves north and then east across the site, starting in Locus A, the secondary and tertiary protein sources varied. In Locus A, bony fishes contribute the greatest density to the control-unit deposits after mammals. In Locus G, birds take over that supporting role. Within Locus C/D, well to the east of Locus A/G, the pattern in part remains the same and in part changes: CU 937, the westernmost control unit of that area, continues the trend in which birds remain secondary to mammals. Yet in most of the control units of that locus, to the east of CU 937, reptiles are present in densities greater than those of either birds or fishes. Examining the site overall, the trend is that, as one moves eastward, fishes assume a less prominent dietary role than do birds and reptiles. The abundance of reptiles is as great as or greater than that of birds within the easternmost control units. The eastward trend away from fishes or, conversely, the westward trend away from reptiles and birds probably is not connected to the relative distance of loci from the Ballona Lagoon. Differences in distance between the western deposit layers bearing an abundance of fish bones and the eastern ones with an abundance of reptile elements are not great. Instead, these differences probably do not reflect dietary variation over space but rather relate to the different settlement patterns in the site's eastern and western areas. The western portions of the site were settled more intensely and over a longer period, creating collections that are much larger and thus more likely to be diverse.

Temporal Trends

The temporal dimension at LAN-62 is at least as important to examine as the spatial dimension. To consider change over time, however, contexts other than control units must be considered in order to obtain larger samples from more representative contexts. LAN-62 offers a number of excavated and analyzed contexts to choose from, including three feature blocks (each dated to a different period) and features, along with surrounding excavation units within the burial area. Nonetheless, inclusion of the feature blocks complicates matters, in that each was delineated to mark areas where specific activities were carried out. This is especially problematic for FB 3. If the identification of this area as a Mission period mourning feature is correct, then this was a locus of ritual activity related to the adjacent burial ground. It, therefore, may contain a faunal collection shaped by mortuary requirements. FB 4, on the other hand, dates to the Intermediate period. It designates an area in which various domestic activities were concentrated and therefore may provide a better comparison with the control units. Another group of features, all rock clusters, constitutes FB 7, which also relates to domestic activities during the Millingstone.

Late and Mission Periods

The ritual aspect of the FB 3 faunal collection is most evident in the recovered whale bones in the artifact concentrations, as opposed to other features and the excavation units. On the other hand, the particularly high density of faunal remains in the pit features of the feature block also may signal that the area was used for some special purpose, possibly disposal of mourning feasts. Although the latter context does not contain the bones of particularly rare species, such as one might expect in a feast, they do contain a relatively large number of deer and hoofed-mammal bones when compared to features within FB 3. Overall, the feature block's various contexts display little uniformity vis-à-vis the rank order of taxonomic classes observed elsewhere at the site, within contemporary contexts. To be sure, mammals are consistently the dominant class of animals, as they are at every site in the PVAHP. The remaining taxonomic classes, other than amphibians, which are absent from all features and units, vary in their prominence but never form a significant secondary food source. Thus, among the small number of bone items collected from the feature block's excavation units, only a single bird and a single fish bone were identified. Although the individual features contained within FB 3 have larger and more-diverse collections, the contribution of fishes, birds, and reptiles is neither impressively large nor consistent: Within the artifact concentrations, fish and bird bones appear with nearly the same frequency, whereas reptiles are rare. Among the rock clusters, fishes (bony and cartilaginous together) outnumber birds by nearly 2:1, and reptiles again contribute relatively little. In the pit features, fishes are more abundant than birds, making up around 25 percent more of the sample than avifauna. Each of those taxonomic classes is much more abundant than reptiles, though all, even added together, are nonetheless a minority in comparison to the voluminous number of mammal bones recovered. Finally, the contributions of these taxonomic classes to the small but dense bone collection from the area's sole thermal feature display a different pattern, such that reptiles are the most important group of animals after mammals and outdistance both birds and fishes (tied with each other) by a ratio of 2:1.

In sum, then, FB 3's collections are marked by an extremely high density of mammal bones in combination with variable but generally very low densities of other taxonomic classes. Two taxonomic patterns of particular note are the high number of hoofed-mammal and/or deer elements in some of these contexts and the consistently low number of reptile bones across the feature block. These patterns in part agree and in part differ from those established in the control units of the various loci. During both the Late and the Mission periods, reptiles consistently rank among the scarcest taxonomic classes (1 percent of all bones from FB 3), a situation similar to that of the feature blocks dating earlier, where reptiles constitute less than 1 percent (FB 4) and 1 percent (FB 7). On the other hand, the presence of hoofed mammals and deer varies considerably. Within the control units across the site, these animals are rare throughout the long occupation of the site. In some features and feature blocks, such as portions of FB 3, however, deer and related mammals become relatively common during the later periods of occupation.

Other Late and Mission period contexts include the southwest and central group of excavation units and the surrounding burial area. The animal-bone collection from these excavation units contains a high proportion of fish bones, mainly from bony fishes, followed by bird and then reptile bones. Within the general, ungrouped excavation units from the burial area, mammalian remains consist principally of rodent species but also include a number of larger-bodied taxa, including carnivorans and hoofed mammals. Although there are unusual species among them, such as a bobcat and a bear, most of the animal bones are from common animals—canids and deer or other hoofed mammals—which here are present in significantly higher numbers than in most other contexts at the site. Amongst the hoofed-mammal bones are two particularly interesting specimens: a sheep and a pig bone. The inclusion of large-bodied animals not only marks the collection as post contact (sheep and pig) but also suggests that a newfound desire for large game animals gripped this population. That new hunting orientation could perhaps have been inspired by the sudden availability of domesticates introduced by Europeans and/or an interest in obtaining European trade goods in exchange for animal hides. In any event, there is certainly, at the least, a coincidence in the timing of contact and the significant numbers of bones of large game animals.

The faunal remains for this context also suggest a strong interest in fishing, as bony and cartilaginous fish elements combined total substantially more than 1,000 bones. With a single odd exception, all the fish bones are from species that certainly could have been captured either in the Ballona itself or within a short distance from shore. However, because most of the fish elements could not be identified beyond class or subclass, it is impossible to determine the primary fishing habitat exploited during the Mission period. The sole exception to the nearshore fish species identified is a single element from an ocean sunfish, a rare and huge species that dwells at a considerable distance out to sea. Birds and then reptiles fill out the remaining order of taxonomic classes within this context. Thus, in several respects—the prominence of large-bodied mammals and the importance of fishes—this collection has parallels to that from FB 3, yet it differs from those from other portions of the site, such as Loci C/D and G, where fishes were not nearly so numerous.

Intermediate Period

In terms of contexts dated to the Intermediate period, it is possible to choose from portions of a number of control units, as well as FB 4. The faunal collection from the latter feature block is made up of items from a number of excavation units contained within this block and all bones recovered from the individual features found within those excavation units. The feature block lies within, but underneath (lower levels of) the central area of Locus A. All the control units of Locus A/G also contain strata dating to this period, whereas only a single control unit in Locus C/D has an Intermediate period stratum. In order to construct the temporal comparison more easily, the Intermediate period is discussed in general and not divided into subperiods such as early Intermediate, late Intermediate, and (general) Intermediate.

What is more striking about the contents of these control units is the variety of avian species present, mainly various waterfowl such as ducks, coots, and grebes. Although these birds are native to the Ballona area (with the exception of the snow goose; a single bone from the bird is present in a late Intermediate stratum of CU 141), the array of species present is remarkable. It suggests that, in contrast to the pattern observed among the mammal remains, which indicate that hunters focused on certain game such as lagomorphs, gophers, squirrels, and woodrats, bird hunting was more of an opportunistic enterprise. The presence of the snow goose, a species now rare in southern California and the Pacific coast in general (Peterson 1990:40), may underscore that point. That bird may have been an unlucky vagrant in the Ballona that was shot on sight by a hunter. Most of the control units also contain large numbers of fishes and reptiles. Among the reptile remains in the control units of Locus A/G, in addition to the remains of the ubiquitous snake species, are significant numbers of pond turtle elements. By contrast, pond turtle elements are rare at Locus C/D.

The only contexts other than control units to have revealed Intermediate period strata are those within FB 4. That feature block, however, produced relatively small numbers of animal bones, especially in terms of items collected from the excavation units (only six elements total). Although all the feature deposits contained quite dense concentrations of animal bones, the actual number of specimens in artifact concentrations is rather small, a few hundred, which undoubtedly impacted the diversity of the overall sample. Nonetheless, other groups of features produced larger samples, which offered a better overview of these deposits. Both the excavation units and the rock clusters held deposits intriguing for their taxonomic content. The faunal collections from both of those contexts contained small numbers of bones from sea mammals: whales, dolphins, and sea lions. In addition, a single bobcat bone emerged from the items collected in the excavation units, whereas a relatively large number of deer and hoofed-mammal elements (the latter probably are also from deer) were recovered from the rock clusters. In most other contexts within the PVAHP, where more than a few deer bones are present, the deposits date to the Late and Mission periods; therefore, the presence of so many in an Intermediate period deposit is surprising. Bobcat bones are rare in all the PVAHP sites, and only two others have been discovered at LAN-62. One comes from the burial area and is probably Late or Mission period in date, whereas the other was found within a stripping unit to the west of the main excavation area of Locus A. All three of the identified bobcat bones are femora. The two specimens from outside FB 4 are both modified, the ends grooved and snapped off and the remaining shaft ground down and polished, presumably in order to manufacture whistles. Although the example from FB 4 is not culturally modified, it may have been cached as raw material for bone tool production. The coincidence in element selection is at any rate noteworthy.

More remarkable in the taxonomic content of FB 4's component contexts is the prominence of fishes. Although fishes clearly were an important resource during the Intermediate period (to judge from the role secondary to mammals that they played in many of the control-unit deposits of this period), FB 4 presents quite another story. In three of the five contexts in FB 4, fish remains actually are present in much higher densities than mammal bones, outnumbering the latter by two or more to one. It is, therefore, all the more unfortunate that none of the fish bones was identifiable, as, without more-specific identifications, what fish were sought after and from which habitats they were taken cannot be ascertained. As determined from the recovery of a single element of a cartilaginous fish from FB 4, capture of bony fishes apparently was more prevalent than capture of cartilaginous fishes. In general, however, the remains of cartilaginous fishes do not preserve well, and the lower frequency could be related to the taphonomic differences. Capture method may also be a determining factor in the higher frequencies of bony fishes. Bony fishes were captured through use of weirs and nets, which allow for the harvest of larger quantities of fish, whereas cartilaginous fishes (sharks and rays) were captured with harpoons and spears.

An overview of the faunal collections from the three principal contexts dating to the Intermediate period shows distinct contrasts among them. The control units of Locus C/D, for instance, contain relatively little in the way of fish remains and instead are filled with the bones of pocket gophers, squirrels, and other small game, in addition to a much sparser distribution of bird and reptile elements. The control units situated in Locus A/G also contain impressive numbers and arrays of small-mammal taxa, certainly dietary mainstays, but also show that fishing was an economically important and viable means of acquiring meat. Yet the features belonging to FB 4 demonstrate the considerable importance that fishes had as a source of food, their numbers dwarfing both the numbers of fish remains in the control units and even the density of mammal bones, almost always the dominant taxonomic class, in the feature block.

Beyond fishing and trapping small mammals, hunting waterfowl apparently was a common practice. Although bird bones do not generally appear in nearly the same densities as those of fishes and, occasionally, reptiles, hunting birds may have held value beyond supplying meat. Birds in general and waterfowl in particular may have been held in high esteem for the feathers that the carcasses could provide. Feathers would have been needed for decorating objects, for rituals, and to make warm clothing or even hunting decoys.

Carnivorous animals may have held some kind of ritual significance, perhaps associated with their hunting abilities, or may have been hunted for their fur. Presumably, bobcats were not hunted simply so that craftspeople could manufacture flutes from their femora, but rather this was a by-product of the interest hunters otherwise had in it. Other carnivorans, such as coyotes and bears, were symbolically important animals to the Gabrielino (Bean and Smith 1978); the bobcat may have been significant in this way as well.

Millingstone Period

Millingstone period deposits were encountered in each of the control units of Locus A/G, as well as within CU 937, located farther east, in Locus C. No Millingstone material appears in any of the Locus D control units, however. Beyond the control units, three other contexts produced contemporary deposits. One of these was FB 7, which is situated near the western end of Locus A/G, to the north of the main burial area. FB 7 produced bones from both excavation units and rock clusters. The rock clusters contained a small collection of slightly more than 450 fragments. Luckily, however, the two other contexts, both of them groups of excavation units, held larger samples. A pair of late Millingstone excavation units located outside the main excavation, to its west, had more than 7,800 pieces of bone within them. The excavation units within FB 7 produced a very large and taxonomically rich collection of animal bones, numbering more than 30,000 pieces. In this discussion, as above in the Intermediate period summary, the early, late, and general Millingstone period designations are not differentiated but are discussed as a whole.

The strata from this period in the control units of LAN-62, Locus A/G, and LAN-62, Locus C/D, demonstrate that mammals were the most important taxonomic group by far. Beyond this expected result, most of the units show that birds were significantly more important than were fishes or, for that matter, reptiles. The exceptions to this pattern are found within two or three units: CUs 26, 323/321, and, arguably, 937. In these control units, birds and fishes either are present at essentially or nearly the same densities. It may not be a coincidence that all three units that have equal frequencies of bird and fish bones are located outside the burial area at Locus A. CU 323/321 lies to the north and west of that area, CU 26 lies directly north, and CU 937 is in Locus C, well to the east. The argument here is not that different groups of people were pursuing different subsistence strategies, but rather that dumping habits may have been more erratic in the peripheral areas and so may not be as representative of daily life as the site's central portion (if indeed it was the central area as far back as the Millingstone period).

The taxonomic profiles of the control units are also largely consistent, although the larger bone collections demonstrate greater species diversity than do the smaller samples. Among mammals, the collections contain mainly small taxa such as squirrels, pocket gophers, and other rodents. Rabbits and hares, as well as rare finds of canids and aquatic mammals, essentially round out that portion of the dietary picture. Although this faunal array is entirely predictable on the basis of other contexts at this and other sites, the avifaunal collection is somewhat more unusual. The control units, first of all, produced a sample remarkable for its diversity. Approximately 20 species of birds, nearly all of them water adapted, were identified within these contexts. Although the collections contained a wide array of ducks and some geese, in addition to grebes and loons, the more interesting aspects were (1) the inclusion of species infrequently found and (2) for a couple of common species, the high number of identified bones. Among bird species that do not usually appear in PVAHP samples but do appear in Millingstone period levels of the control units are belted kingfisher, great blue heron, California gull, birds of prey, and gallinaceous fowl. All of these species were characteristic of the Ballona or the upland prairie environments above it (for example, the gallinaceous species). Yet it is rare to find them in the faunal collections of the PVAHP sites. At least some of these birds—for instance, belted kingfisher and great blue heron—might have been hunted more for their feathers than for their meat. In terms of common species present in uncommon quantities, the coot stands out in that as many as 20 elements of that species were identified, 13 within a single context, CU 141, located in the west-central area of LAN-62, Locus A/G.

The fish remains demonstrate a mixed fishing strategy, hunting angel sharks and skates (which would have been taken with harpoons) and bony fishes like surfperches, herring, and sheephead (which would have been captured with either hook and line or nets). Also noteworthy is the relative abundance of cartilaginous fishes. In most of the control units, counts for these organisms are equal to, or not far below, the density estimates obtained for reptiles. That is certainly a contrast to samples from the succeeding Intermediate period, in which, as explained above, those fishes were rare. Also remarkably high is the density of turtle elements, which are frequent finds in some of the control units, especially CU 141 and CU 323/321, which together (all periods) contained 150 turtle elements (7 percent of identifiable bones). The taxonomic array within the control units gives the impression of a population well adjusted to their aquatic surroundings, as the people clearly found a wide variety of taxa to hunt, trap, or fish.

The isolated control units to the west of the main excavation area (CUs 853, 321/323, and 306), as well as CU 119 located within FB 7, contained samples similar to those from the rest of the control units at LAN-62 in both the variety of identified taxa and the rank-order relationships among the taxonomic classes. The same is true for the rock-cluster features within FB 7 itself. The dominant mammalian fauna consists of the usual plethora of rodent and lagomorph taxa (gophers, squirrels, rats, mice, rabbits, and hares); the last two taxa are especially—and unusually—prominent. By contrast, large-bodied mammals such as deer, carnivorans, and aquatic mammals are very rare. Like the control units across the site, isolated excavation units and CU 119 (located within FB 7) demonstrate that, after mammals, birds were the next-most-important group of animals pursued by the Millingstone period hunters. As in the control units across the site, these other contexts display a wide variety of species, and again mainly waterfowl and related birds. Most of these—the various species of dabbling ducks and rails—are common in such environments. Other avian species present in the collections are much less numerous, either because the people chose not to hunt them often or did not regularly forage in environments where those taxa would most often be encountered, or because the species possibly were not common in the area. Seasonality is an additional possibility to explain the low numbers of birds of prey and gallinaceous birds, as well as the few goose bones identified. The bean goose (*Anser fabalis*) and snow goose elements identified probably came from vagrant birds; these are species that do not live in the area but occasionally fly in when off course or, in the case of snow geese, on their way to wintering grounds in Mexico (Peterson 1990:40). Rounding out the dietary picture in these contexts were large numbers of fish bones, (nearly all unidentifiable), as well as a much smaller number of largely unidentifiable reptile elements. Despite the fact that the fishes were nearly all unidentifiable, their numbers (as compared to birds in other contexts) suggest that, as in the control-unit contexts, fishes played an important supplementary role in the Millingstone period diet.

Overall, the faunal collections dating to the Millingstone period are remarkable for their consistency across space and different contexts. It is clear that mammals dominated the collections, but it is also demonstrable that the people did not live by eating gophers and similar small mammals alone. Their diets were very much supported by hunting birds, their secondary source of meat in terms of numbers of fragments or calculated densities per context, as well as taking much more than the occasional fish presumably brought fresh from the river, creek, estuary, or ocean to the encampment. Even if fishes were neither the primary nor the secondary source of meat, when the faunal collection is examined as a whole and as a representation of habitats frequented for obtaining food, it is absolutely clear that the Ballona was key and that the people knew its fauna well. After all, most of the birds from these collections are species that spend their lives in aquatic habitats. In order to take so many of those birds, the hunters would have headed west to the marshes and open waters that existed at this time. Therefore, the people of the Millingstone period, perhaps even more than the inhabitants in the succeeding periods, displayed a strong tendency toward the use of coastal and aquatic habitats for meat.

Season of Occupation

A further insight from this collection of bones concerns the season(s) in which this area was occupied by its human population. To determine season of occupation, the best clue at hand among the faunal remains is the avifauna. Most of the ducks, as well as the rare species of geese, are migratory. They summer in Canada or the northern United States and winter in southern areas, in some cases as far south as Argentina but usually not farther than Mexico. Waterfowl would have been most abundant during a season other than summer, assuming that the climate then was more or less as it is now, with mild, wet autumns and winters and hot, dry springs and summers. The waterfowl migrations occur in spring and late summer/autumn, in different directions. Therefore, the human population may have lived at this site during either of the migration seasons, or even both. On the basis of the birds alone, however, it is also possible that the population stayed there only in the winter, as many ducks and geese winter as far north as southern California.

To narrow down the season of occupation, fauna other than waterfowl must be considered. Other taxa that aid in determining the season(s) in which people dwelled at LAN-62 include aquatic mammals and reptiles. Whales, dolphins, and porpoises are most often observed along the California coast in winter or spring; seals and sea lions establish breeding colonies along the coast in the spring months. Therefore, these species would have been easiest to hunt during these seasons, although they could have been taken farther out at sea or, in the case of seals and sea lions, on one of the Channel Islands. Nonetheless, bones of such animals are quite rare throughout the site, with the exception of the burial and other ritual areas, which featured unmodified and modified pieces of whalebone frequently used as grave markers (see Chapter 3, this volume). There is some question, though, whether the Native Americans of coastal California obtained such items by regularly hunting whales, by dispatching beached individuals, or even by scavenging the carcasses of dead animals washed up on the shore.

A remaining line of seasonality evidence is the collection of reptile bones from the site's various contexts and periods. Many reptile species, despite the relatively warm winters of southern California, hibernate during the winter, snakes—but not turtles—among them. The ubiquitous snakes of the faunal collections, assuming they are food remains and not commensal, would not have been available to the human populations in winter, unless they actively sought out the snakes' hibernation burrows and collected the sleeping or drowsy snakes. Finding the burrows of hibernating snakes would not have been an easy task. Instead, it is more likely that the snakes were caught in the warm months between spring and fall. If account is taken of all the available evidence, from waterfowl, aquatic mammals, and snakes, a springtime encampment seems the most parsimonious site type, although one cannot rule out much longer stays, two seasons or even longer, given the palimpsest of midden sites such as this one.

Ritual Aspects of Faunal Remains

Portions of the huge faunal collection recovered from LAN-62 were found within ritual contexts. The context was the 254 human interments sampled in addition to 3 animal burials (see Table 177). It may also be useful to examine animal bones recovered from the burial area. The final relevant sample of faunal remains was collected within FB 3, which may be a ritually demarcated space for mourning. With the exception of a single animal burial discovered in Locus C, all the ritual contexts fall within the confines of Locus A. All contexts with ritual connotations either are undated (in the case of at least 1 animal burial) or presumably date to the Late/Mission period.

The large faunal sample stemming from the sampled interments yielded no definitive and recognizable spatial patterning. For the analysis, burials were grouped in two different ways in order to explore whether consistent differences exist among these groups and, if so, whether spatially distinctive clusters of burials could be delineated. The burials do appear to fall naturally into groups according to how many animal-bone items were recovered from each: 1–5, 6–11, and 12–23 bones. However, they do not form spatially distinct clusters. Similarly, when the burials are grouped together according to how many taxonomic classes of animals were included among the bones found within the grave fill, there are again certain numerical groupings: one or two classes only in most cases, sometimes three, and only rarely four (none contained all six classes of vertebrates found at the site: mammals, birds, reptiles, amphibians, bony fishes, and cartilaginous fishes). Nonetheless, no spatially discrete clusters of burials grouped by number of taxonomic classes could be identified from burial-area maps. Obviously, the act of burial is a ritual in itself, but if the burial ground had an organizing principle—for example, grouping by lineage, particular skill, or status—it could not be determined from this aggregation of data on faunal remains.

Distinguishing ritual requirements from "background noise"—in this case, animal bones finding their way into graves via backfilled soils originating in the surrounding midden—is a difficult task, requiring more than just spatial analysis. Possibly, the rituals of burial and the associations of the deceased required—or prohibited—the donation of specific taxa or body portions to the grave. Perhaps most revealing might be the remains of avifauna included in the graves, as these bones could once have held, and been selected for, plumage instead of meat. Most of the bird taxa included are, not surprisingly, aquatic birds of various species, including ducks, gulls, and shorebirds. Some of these birds are either scavengers or fish eaters, unpalatable at least to modern Euroamerican tastes. Beyond their value as food, however, some of these birds have beautiful plumage (e.g., great blue heron and certain duck species), and they may have been hunted for feathers instead of, or in addition to, meat. If these birds were selected specifically for feathers, the bias must be visible in the relative abundance of skeletal elements. Wing elements, which support the large and decorative flight feathers, ought to be more prevalent than other bones of the body. However, the evidence for such a pattern is unconvincing. Approximately 20 percent of a bird's skeleton consists of wing elements, whereas about 38 percent of the avian elements from burials were wing bones. But the bird-bone sample is small (n = 164 bones), approximately 13 bird species were identified in that sample, and wing elements probably are more resistant to taphonomic processes than are other parts of the skeleton (Fenenga 1990). The only likely link between birds and ritual in the context of the graves themselves appears to be a single barn owl bone; raptors are generally rare within PVAHP sites and have well-known ritual/totemic associations.

Like the owl bone, the remains of relatively large numbers of canids and other carnivorans, including badger, sea otter, sea lion, raccoon, bear, and mountain lion, could have a link to ritual. Also intriguing is that carnivoran species, more than other mammalian taxa, have a high number of whole or partial cranial elements in the collection, including two complete coyote/dog skulls, a mountain lion maxilla (see Figure 207), and the partial skulls or canine teeth from several other canids and a raccoon. The mountain lion was apparently old at the time of death; its remaining incisor is heavily worn, and the canine features what is probably an antemortem tip breakage with resultant enamel loss. It may be that an older, less dangerous animal was hunted. The absence of some species is as interesting as the presence of others. Reptiles, though common throughout the assorted contexts of LAN-62, are relatively rare in the burial fauna, which contains only pond turtle as the representative of this class.

Bone items collected from burial-area excavation units were both numerous and diverse. In general, the collection contained aquatic animals (a variety of fish species and waterfowl). More interesting is the inclusion of bones from a bobcat (a femur carved into a flute) and a bald eagle. These, like the other carnivoran and owl bones cited above, may relate to funerary rites and may hold some clue to deceased persons' status, lineage, or even societal role. Several animals that are not commonly found at southern California coastal sites were recovered from nonburial-features; these include pronghorn, whales, and pig. The whale bones may have been used for grave markers, whereas both pronghorn and pig may simply be food remains, whether buried with the dead or tossed in as backfilled refuse from the midden. Pigs (especially boars), in addition to meat, also have impressive canines, which may have led to the animal's selection for a funerary rite.

The collection of bones from FB 3 contributes only a small sample to the otherwise impressively large array of faunal remains recovered from the various ritual contexts at LAN-62 (see Table 173). Perhaps most striking about the entire collection from this area is the scarcity of animal bones from constituent excavation units. Whereas burial-area excavations produced many thousands of animal bones, excavators working in FB 3 recovered a total of just 25 from the individual excavation units. Although the number of elements from the various FB 3 features was greater (approximately

5,000) than that for the excavation units, most of these elements came from artifact concentrations containing dense bone deposits. The uneven distribution of bones may relate to ritual activity; perhaps, because of its repeated use as a ritually sacrosanct area, the mourning feature was not filled with the same amount of daily detritus as were other areas. Bone-filled features such as the artifact concentrations may slightly predate the establishment of the mourning area. In general, this sample gives no reason to suggest that the area is anything other than a less dense portion of the general midden making up LAN-62. For the most part, neither faunal collections from the various constituent features nor items from the excavation units reveal any ritual connotations. An exception may be the nine whale bones among the few bone items from the excavation units; these might have demarcated the boundaries of this apparent ritual area.

Two of the four animal burials at LAN-62 lie within the human-burial area, and both interments were for canines, probably dogs. Fifteen canine elements were found within burial Feature 307, located approximately 2 m east of FB 3 and just within the burial area. The feature as a whole contained a collection of some 250 animal bones. Other than the canid bones, the remainder are probably a random assortment of fish, bird, reptile, and mammal bones and probably derive from midden soils. The excavation notes for the burial indicate that the dog bones were found clustered, but disarticulated, in a pit located beneath two human interments. The notes also record that some of the bones featured signs of burning as well as cut marks. In fact, only one of the bones, the pelvis, displayed butchering marks. That phenomenon is discussed in Chapter 4 (this volume), but suffice it to say here that that scar is situated on a bone and in a place where anything other than removal of meat, presumably for consumption, would have been likely. Because the canine skeleton is incomplete and disarticulated and bears a butchering scar, it may not be a burial in the traditional sense of the word. Instead, the skeletal remains may have been consciously deposited in the small pit as an offering of food to accompany one of the two humans interred above. Alternatively, trash from a single meal of dog meat may have been tossed into that pit. It is also possible that these are the remains of a secondary burial, the animal first having been laid out in the air for the flesh to decompose, and then the bones cleaned (perhaps at that point the cut mark was inflicted) for burial in the ground. The other canine burial, burial Feature 642, was also discovered as a partial skeleton. This feature lies well outside the burial area, approximately 4 m to the north of FB 3, in a stripping unit. Unlike burial Feature 307, however, this skeleton (represented by 11 bones) bore no butchering marks, and the bones were found articulated. Therefore, this is surely an actual burial, even though it was discovered well outside the burial area and it contains an even larger collection of noncanid bones (nearly 300) than did burial Feature 307.

Burial Feature 201 was a large, deep pit dug into the eastern extension of the LAN-62 midden, in Locus C. Unlike the two preceding burial features, this pit contained no canine bones. Instead, it was apparently dug to inter a juvenile deer. Most of the deer's skeleton was recovered articulated within a lower level of the pit. Most of the deer's skull, as well as its hyoid, was missing at the time of excavation. After the deer's burial, the pit was evidently backfilled with midden soils, creating a large faunal assemblage in association with the feature.

Vertebrate Remains from LAN-211

LAN-211 dates principally to the Late and Mission periods, with some late Intermediate and Intermediate period deposits. Excavations here produced a very large and taxonomically rich collection of faunal remains well in excess of 100,000 pieces of bone. The analytical contexts at the site include control units, excavation units, and features within FB 1 and excavation units and features outside FB 1. FB 1 is a large block of features consisting of a large occupational surface that dates to the Mission period and contains several rock clusters, hearths (pits with oxidized walls), a pit, an activity area, and artifact concentrations.

Sampling Strategy

The analytical contexts were five control units, excavation units outside FB 1, and excavation units within FB 1, as well as nonburial features. Features selected for analysis were located both outside and inside FB 1. In addition to the nonburial features, three burial features were also excavated. Only two of the burials, however, contained faunal remains. Individual bones ("items") as well as bulk collections were recovered from the analytical contexts, resulting in samples from each context based on systematically and intuitively collected specimens. Summary data from these contexts are presented in Appendixes I.12.1–I.12.16.

The excavation units from within FB 1 yielded the most vertebrate remains—more than 70,000 elements (see Appendixes I.12.1–I.12.16). The five control units produced a rich collection, numbering more than 25,000 elements and dating mainly to the Late and Historical periods. By contrast, most of the nonburial features and both burials (see Table 179) contained only small samples of bone, numbering from 4 bones in a single feature to approximately 3,000 in a series of rock clusters outside FB 1. A number of hearth features within FB 1, however, contained a comparatively large bone sample of around 13,000 specimens.

Given the extreme richness of LAN-211's bone deposits, a postexcavation method of sampling for analysis was developed. It was decided to analyze all of some contexts and portions of others, and still other contexts were analyzed only to a basic level, such that bones were not identified past the taxonomic level of class, even when preservation allowed for more-specific designations. Vertebrate remains from three nonburial features (a rock cluster and a hearth outside FB 1 and an additional hearth within FB 1) were analyzed only to the class level, and these data are not addressed in this chapter. Of the five control units, only one collection, from CU 120, was examined in its entirety. Only one-quarter of the collection from each of the remaining four control units was analyzed. The 25 percent samples were derived through the use of a splitter, where the contents of each bag of bones (when four or more bones were present within it) were randomly and evenly separated into four equal portions. The nonburial features were handled differently; some of the samples were examined only to class, whereas others were examined to the most specific taxonomic level possible. Faunal collections from both burial and nonburial features, however, were not sampled but were examined in their entirety.

The general area of FB 1 yielded an extremely rich sample, from both the excavation units and the features. The analyzed portion consisted of grab samples (different-sized bags or percentages of bone recovered from this context), as well as all "items" as designated by excavators in the field. This analysis plan was enacted not to achieve a representative sample of the context but rather to check that no unique species, elements, or patterns were missed.

Control Units

Vertebrate remains recovered from the five control units demonstrate continuity in hunting patterns at the site (see Appendixes I.12.1–I.12.16). In terms of temporal differences, there are few consistent patterns other than a general continuity. Fish bones are present at relatively higher frequencies in the Late and Historical periods (Figure 218). That relationship is particularly apparent within CU 120 and CU 359, although the small sample from CU 353 shows a rather weak trend in the opposite direction (see Appendixes I.12.1–I.12.16). There is a visible difference between the Intermediate and the late Intermediate periods, with greater densities of vertebrates in the latter period. In some cases, as in CU 120, the difference in density between the late Intermediate stratum and the mixed Late/Mission period and Mission period strata is a factor approaching 100. Given the scale, these differences are more likely to be associated with occupational intensity than with taphonomy or differences stemming from disposal practices.

These differences in density lead to two questions. First, what sustained the larger populations in later periods? Second, are these differences in density the result of greater population density in the later periods, or were the distribution and density of faunal remains at this site affected by special activities such as those that created the numerous features

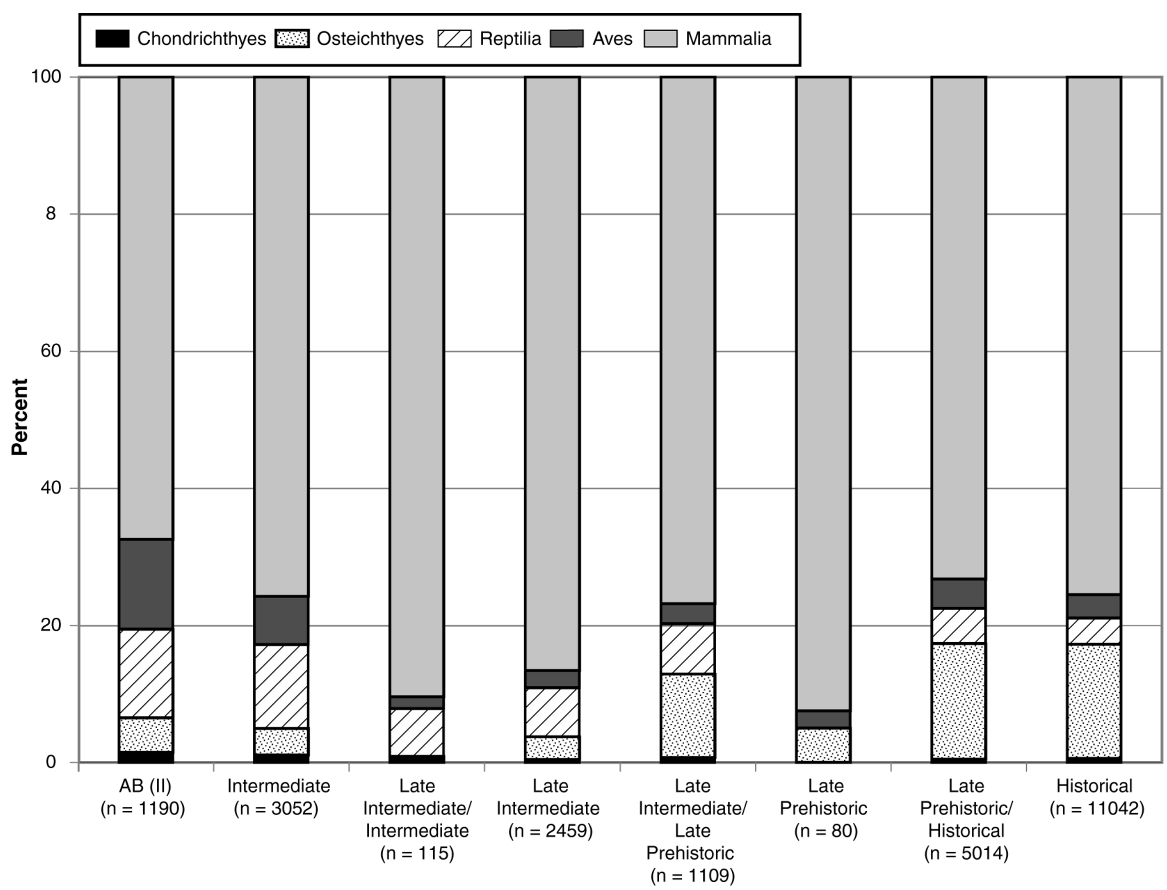

Figure 218. Vertebrate classes by period, from control units at LAN-211.

within FB 1? Regarding the first question, during later times, the LAN-211 population seems to have turned more toward the Ballona Lagoon for animal foods. Already noted is the greater abundance of fish bones within the Late and Mission period strata than in the Intermediate strata. Another difference lies in the importance of birds: the density of avian taxa in the later periods is approximately 10 times that in the earlier, Intermediate period levels. Most of the identified species—coots, kingfishers, ducks, shorebirds, and gulls—are characteristic of aquatic, including marshy, habitats.

The second question proposed above—whether the differences observed may be functional and related to activities carried out in the features of FB 1—is very difficult to answer, given the evidence at hand. The feature-block features are Late and Mission in date; therefore, it is necessary to compare faunal remains for these periods from within FB 1 to contemporary remains outside it. However, only one of the three control units placed outside the feature block (CU 353) contained a Late/Mission occupational stratum. This early stratum contained only a few bones, mainly unidentifiable mammal elements. Nonetheless, it is instructive that the Late/Mission period levels of CU 353 produced a density estimate far below that of the contemporary strata within FB 1. Thus, at this point it cannot be said that hunting, consumption, or deposition of aquatic fauna was somehow related to the activities performed within the feature block. However, one can point to the different densities between the feature block and control units outside it and here state a note of caution, that, rather than from increased population density, the heaps of bones from within FB 1 may result from specialized activities carried out in a circumscribed area.

Nonburial Features outside Feature Block 1

The 11 features outside FB 1 can be divided into five feature-type categories. All contained very similar faunal collections, presented in detail in Appendixes I.12.1–I.12.16. In fact, the only faunal collection that could be separated by content from the others is that from Feature 40, an activity area. Yet this collection contained only six bones; therefore, inferring meaningful distinctions between it and the collections for other features (for example, on the basis of its containing only bones of mammals) is simply not viable. For this reason, the faunal collection from Feature 40 is omitted from subsequent discussion.

All the features other than Feature 40, regardless of category designation, share a focus on mammalian taxa (Figure 219). Within that large taxonomic grouping, there appears a dual

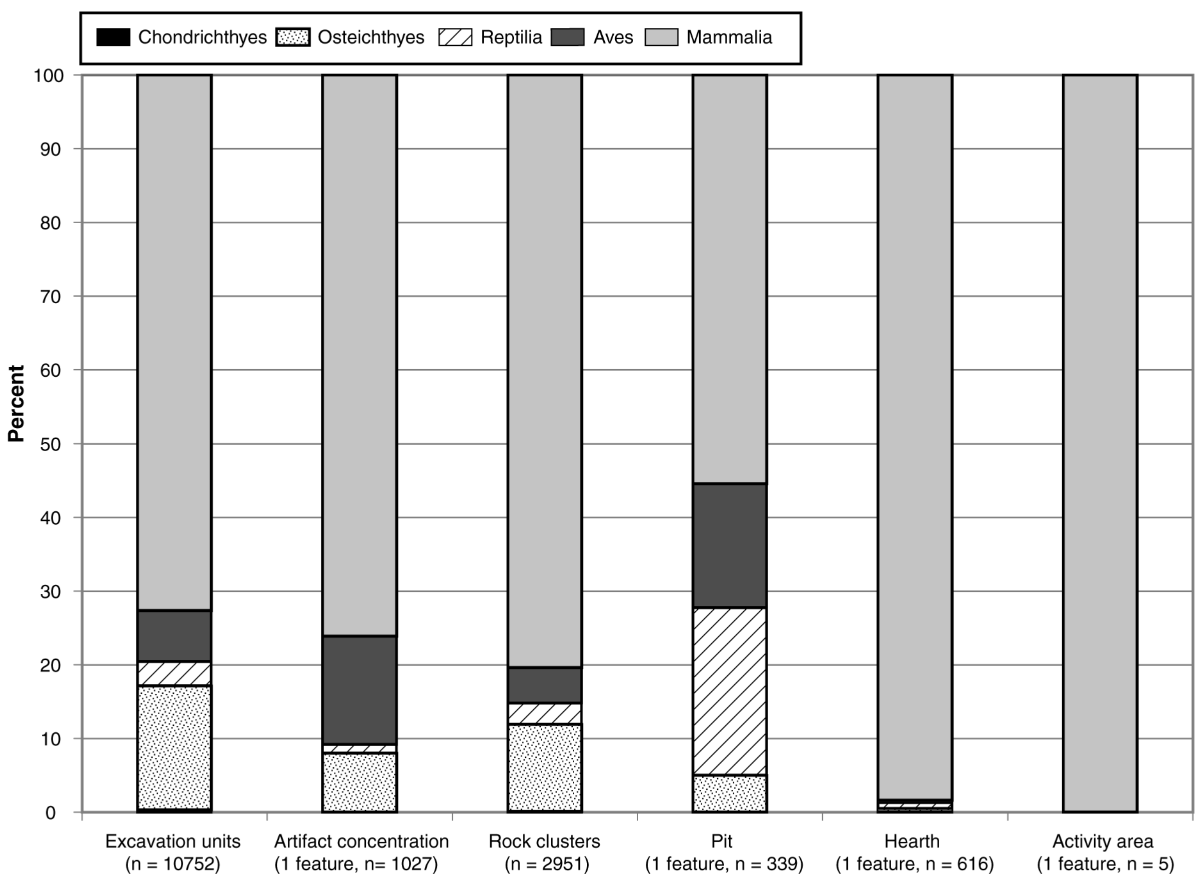

Figure 219. Vertebrate classes from contexts outside FB 1 at LAN-211.

emphasis on rodent species, probably obtained through trapping, and large hoofed mammals like deer, taken on planned hunts and/or drives. In addition to those animals, there are a significant number of rabbits and hares, which are also upland game animals. Nonetheless, the population's aquatic dietary component should not be glossed over. The water-adapted fauna present probably includes most of the birds, given the results from elsewhere at this site, and occasional marine mammals such as whales or their relatives, dolphins and porpoises. Together, fishes, aquatic birds, and marine mammals constitute 10–20 percent of the bones in the various features, truly a significant dietary component that could have been even more important seasonally.

Feature Block 1

The sampling procedure for FB 1 was different from that employed for contexts outside the feature block (see Sampling Strategy section, above). All faunal remains from the excavation units, both items and nonitems, were studied; as a result, the collection was very large. The nonburial features consisted of hearths and rock clusters. The features can be categorized both by type (rock clusters and hearths) and sampling strategy; some hearth collections are made up of individual "items" only, and others contain both items and bulk collections. One hearth contained a sample of some 600 bones, whereas the rock clusters contained nearly 3,000 pieces of bone. The same sampling division exists for the rock clusters inside FB 1, as they also may be categorized as collections consisting of items only or those comprising both items and bulk collections. Item and bulk-sample collections added together for rock clusters produced just 1,326 bones, whereas the hearths produced 13,376—about 10 times that number.

This faunal collection is in some ways very much like those excavated from other contexts at both this site and other Ballona-area sites and in other ways much different. As in other faunal collections from Playa Vista project sites, mammalian remains make up the bulk of the bone collection, outnumbering the next most frequent class, bony fishes, by a ratio of approximately 4:1 (Figure 220). The principal difference between this and other Ballona-area sites is the relatively large number of artiodactyl remains within this context of LAN-211, as they make up 28 percent (n = 904) of the identifiable animal bones from within FB 1. This is in contrast to contexts outside the feature block, where artiodactyls contributed just 3 percent (n = 66) of the identifiable bone sample. In addition to the mammals, relatively small collections of reptiles, amphibians, and birds were identified. A large number of bony fish elements—17 percent of the FB 1 collection as opposed to just 7 percent of the non–FB 1 sample—were also recovered. A single tooth of a great white shark was the only truly unusual specimen found within FB 1. It is perhaps also noteworthy that the within–FB 1 sample contained 6 bones from at least two species of birds of prey, 25 bones from sea otters and fin-footed mammals, and approximately 40 bones of large fishes such as tunas and giant seabass. Cetacean elements are also more common within FB 1 (4 percent vs. 1 percent). The non–FB 1 context lacks most of these taxa, save 1 raptor and 1 seal element and the aforementioned whale and/or dolphin bones.

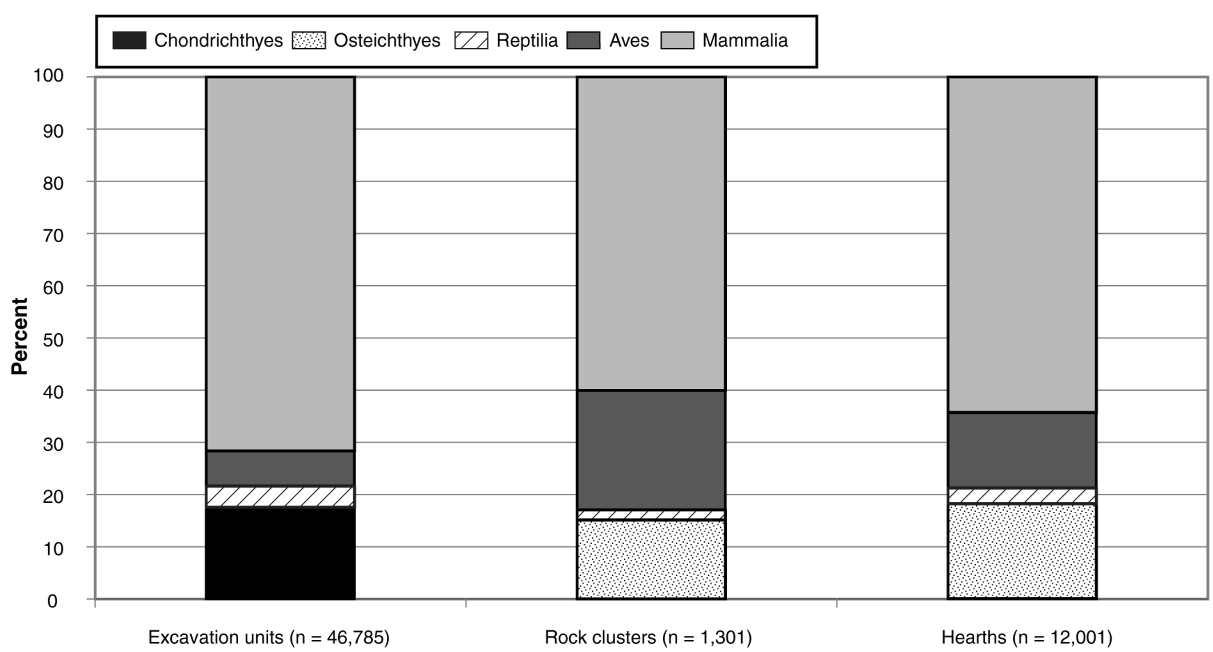

Figure 220. Vertebrate classes from contexts inside FB 1 at LAN-211.

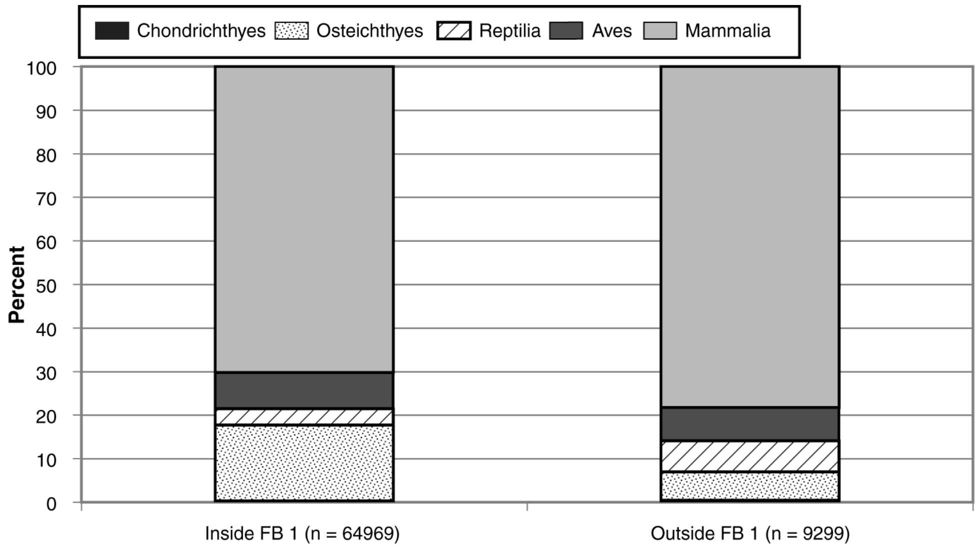

Figure 221. Vertebrate classes from inside vs. outside FB 1 at LAN-211.

Summary of LAN-211

The various contexts, control units, excavation units, burial features, and nonburial features excavated at LAN-211 and sampled for faunal remains allow for intrasite comparison. Of particular interest are differences in species present or absent in the various areas, as well as the comparative abundances of certain taxa. These comparisons are most logically constructed between contexts located within FB 1 and those outside that area, including the features of FB 1, its excavation units, and the contents of two control units that also fall within the block's boundaries (Figure 221). Contexts outside the feature block consist of three control units, the burial features, a number of nonburial features, and excavation units. The FB 1 material, as it was recovered from a single large living surface, all dates to the Late and Mission periods; most contexts are inseparable in date between the two periods. Portions of the material outside the feature block are, however, either undated (as from the features) or date to different periods: namely, the Late, Mission, late Intermediate, and Intermediate periods. The comparison, therefore, involves substantial numbers of bones from different periods, certainly a handicap in interpretation, but not a crippling one, inasmuch as this discussion is about the use of space (the area of FB 1). In addition, the discussion has another handicap, namely that the FB 1 contexts contained a faunal collection about three times larger than those from the control units and features outside the feature block. Therefore, the comparison is constructed using percentages based on NISP, though the presence/absence of species is difficult to evaluate as it is probably affected by the relationship between diversity and sample size.

The features within FB 1, in addition to Late and Mission period levels of two control units and other excavation units in the feature block, produced a very large faunal sample totaling nearly 89,000 analyzed bones. These bones represented as many as 100 taxa (i.e., 1 or more bones identifiable to a taxonomic level lower than class). The diversity of this portion of the collection probably is a function of the large sample size. When faunal remains from all the non-FB 1 contexts are combined, that sample comprises less than 12,000 bone fragments representing no more than 52 taxa (see Appendixes I.12.1–I.12.16).

Beginning the comparison on a gross level, that of taxonomic class, it seems that there are differences between the two areas. Although the relative importance of mammals and reptiles appears lower within FB 1 than outside it—probably but not necessarily related to change over time in diet—the main class-level difference apparently lies elsewhere. The large Late and Mission period collection from FB 1 contains substantially more fish (essentially, bony fish) elements than do the contexts outside the feature block, a difference of approximately 17 vs. 6.5 percent. This finding is not entirely surprising, given that Maxwell (2003:152) already noted the presence of substantial numbers of fish bones from earlier excavations at the site, but this update is intriguing for several reasons. First, it isolates the increase of fish bones and, by implication, fishing to the later periods of the site's occupation. Second, it lessens their contribution to the overall faunal collection: whereas in Maxwell's sample (2003:150) fishes accounted for approximately one-third of the entire vertebrate collection, their place within the final collection is in fact much lower. Third, Maxwell (2003:152) argued on the basis of the evidence available at that time that past populations took fish primarily within the near-coastal waters. Although most of the remains in the LAN-211 collection were of nearshore fishes, there are also a number of specimens of pelagic fish species, including 14 specimens from giant seabass; all were found in the FB 1 context and none in the outside context. Thus, there seems to have been an increased interest in fishing during the latter periods of occupation, especially in relatively deep offshore waters.

When groups of species are compared between the two contexts, the differences discussed above persist, although they are lessened. Thus, when the relative abundance of aquatic fauna—that is, fishes, aquatic birds, and marine mammals—is compared between the two contexts, aquatic taxa were more abundant within FB 1 (13 percent) than outside it (8 percent). These numbers are perhaps buoyed by the number of both fish and whale bones (n = 110). Excluding other aquatic taxa, cartilaginous and bony fishes together account for 18 percent of the collection from FB 1, whereas outside that area the percentage of fish bones is lower, only 7 percent. Along with the pelagic fishes, the higher relative abundance of aquatic fauna, especially the aquatic mammals, suggests a newfound interest in or newly acquired technology for taking these species.

Naturally, however, the greatest contributors to both contexts were terrestrial mammals. Within the feature block, mammals—identifiable and unidentifiable—accounted for 51 percent of all the analyzed bone and 70 percent of the bone identifiable to class level. It is interesting that there is such a large number of bones from this context that are unidentifiable even to class level. Outside this context, mammals constitute a much higher percentage (78 percent) of the collection identified to class level.

In addition to the difference in the overall percentages of mammals in the two contexts, the relative abundance of different species is also very different. The various FB 1 contexts held twice as many mammalian taxa (n =2 7) as the other contexts (only 13). This difference, however, could merely reflect the aforementioned problem that diversity can be mathematically related to sample size, and, given that the sample sizes from the two contexts are so different, the difference in number of taxa is not surprising. Perhaps a more interesting comparison is the makeup of the mammalian faunal array in each context's collection of bones identifiable past the class level. Small mammals such as rodents, rabbits, and hares account for 59 percent of all bones outside FB 1 but only approximately 38 percent in FB 1 contexts. In other words, small mammals account for about two-thirds as many of the bones within FB 1 as they do outside it. What makes up the difference? Within FB 1, large mammals—artiodactyls—make up 28 percent of the bones, but they constitute only 3 percent of the collection outside this surface.

There seem to be true differences between these two contexts, mainly in terms of the relative abundance of fishes and of hoofed mammals. Unfortunately, the nature of these differences is not known precisely: that is, whether they are temporal in origin and therefore demonstrate a shift over time in hunting strategies, or if the two areas are mainly contemporary, and therefore they represent the waste left from two seemingly different sociobehavioral activities. In trying to unravel this knot of causes and consequences, it is possible to look at the overall trends for the PVAHP sites over time, as presented in the final major section of this chapter. There, the compiled evidence for several PVAHP sites does show a trend similar to this case, in which fishes and large mammals become more common later in time. However, given the massive size of the FB 1 collection, do the peculiarities of this deposit largely dictate the content of the compiled Late and Mission period faunal collections? Even though there is an overall trend, in the PVAHP area, in the direction of greater emphases on fishing and hunting large game (or capturing domesticated animals brought by the Spanish), it is unclear whether that is the process seen here, given that only approximately one-third (36 percent) of the collection outside FB 1 can be dated to periods earlier than the Late or Mission periods. Most of that bone collection is in fact from undated contexts.

Whether or not the FB 1 accumulation is different from that surrounding it for reasons having to do with temporal change, the feature block is intrinsically interesting because of the high concentration of bone found there. The working hypothesis is that this midden is an accumulation of domestic trash, yet its scale in terms of concentration is one not seen anywhere else in the Ballona. Either the surrounding settlement was relatively large for a Native American community of the region, or it was intensively occupied, perhaps even year-round. Another alternative is that this is not a simple accumulation of household trash but instead the detritus from feasts held at ritual ceremonies. Ritual feasting may best explain the emphasis on what might be termed "showy" animals, not only deer and other large mammals but also the marine mammals and large pelagic fishes such as giant seabass.

In essence, those animals are abundant within the rock clusters, hearths, and excavation units inside the feature block, and to a lesser extent within those control units, but are uncommon finds in the control units outside the feature block. The contrast in the number of these animals' bones is visible spatially as just discussed, but it is also in part a temporal difference. That is, Late and Mission period strata of control units within the feature block have greater numbers of artiodactyl bones than do Intermediate period levels in those same units. In fact, the spatial difference may be much more a temporal difference, given that the control units outside the feature block contain mainly Intermediate period remains.

This distinction, if indeed temporal, brings up interesting questions concerning the observed dietary differences between areas inside and outside the feature block: animals with a minor dietary role outside the feature block are much more prominent within the feature block. The shift with respect to large mammals appears to have been a calculated decision, in that not only are deer present in greater numbers than before but also other members of the same taxonomic order appear in these late-dating contexts but not at all in earlier ones. Specifically, pronghorn bones appear scattered, in small numbers, within the excavation units both inside and outside the feature block, but not within any of the dated contexts outside FB 1. Sheep—possibly wild but probably of European domesticated stock—as well as cattle also appear at this site. The distribution of the domesticated species obviously has a temporal component, given that these animals were brought by the Spanish from Europe or Mexico. More interesting, however, is their spatial distribution: nearly all the sheep and cattle bones (153 out of 158) come from contexts within FB 1, mainly the excavation units, paralleling the distribution of pronghorn elements.

In general, the large number of wild-artiodactyl bones raises the question why the animals were more intensively hunted during the Late and/or Mission periods, whereas the presence of domesticates introduced by Europeans raises the question of procurement. Most of the deer and pronghorn bones are found within the same contexts that produced most of the bones from domesticated mammals, which suggests that the reason(s) behind the increase in deer, cattle, sheep, and pronghorn bones is (are) connected to one another in some way. One possibility is that the Spanish were interested in acquiring deer hides, and that interest—as documented for the eastern United States (Lapham 2004)—caused Native American hunters to organize hunting logistically, pursuing specific game animals rather than collecting on an encounter basis. A reciprocal interest by the Gabrielino in European trade goods may have brought the two groups together on a regular basis. The domesticated animals could have been obtained either in trade, perhaps for special feasting occasions, or hunted/stolen while grazing in the vicinity of the Ballona. Comparison of the distribution of European trade goods at LAN-211 to that of hoofed-mammal bones may help to resolve this question.

An alternative explanation for the spike in the relative abundance of large game animals might be either ritual feasts or change over time in dietary preferences/hunting practices due to environmental change, overhunting of other species, or the introduction of new hunting technologies or techniques from elsewhere. If ritual feasts were held at LAN-211, it may explain both the higher number of large-mammal bones present within the feature block and the generally higher numbers of fish remains—especially those of large pelagic fishes. The pelagic-fish remains are perhaps even more intriguing a subject than the mammalian species just discussed. These taxa, along with nearly all the marine-mammal elements, are present only within the excavation units inside FB 1. The restricted distribution of these species at this site may be further evidence that all or part of that area was used for discrete ritual events involving feasting.

The presence and abundance of various taxa across LAN-211 provide intriguing data for further reflection and hypothesis testing. In addition to the content of the site's faunal collections, the sheer size of the animal-bone collection—second only to that from LAN-62—recovered from excavations across LAN-211 makes it a critical component of the dietary record of the PVAHP. This faunal collection's hallmarks discussed so far (size, species diversity, and concentration on particular taxa) are that much more relevant because they date to a point in time critical to the history of the Ballona region, when the Native American cultures' lifeways were very rapidly and dramatically impacted by those of the Spanish, who then instituted an entirely new agrarian program for the landscape.

Runway Sites Vertebrate Fauna

The Runway Sites (LAN-2676, LAN-1932, and SR-23) were excavated early during the PVAHP project. This section presents the results of data recovery excavations at LAN-2676 and LAN-1932; vertebrate-faunal analysis was never conducted on the SR-23 materials although this site was included as part of LAN-2676. These sites probably are redeposited midden material from excavated sites situated nearby. Data from the collections are presented in Appendixes I.13.1–I.13.7 and I.14.1–I.14.8. The possible origins for each of the two faunal collections are described below, through comparisons of the collections' overall contents to those from the nearby sites from which they probably originate.

LAN-1932

LAN-1932 is located approximately 330 m northwest of LAN-211 and some 230 m directly north of LAN-62. This redeposited site probably dates to the Late/Mission period and therefore may originally have been part of LAN-211 before being removed for use as runway fill. Faunal remains that formed the study sample summarized here emanated from four excavation units at the site, together producing 3,731 bone fragments. The vertebrate remains at LAN-1932 have a distinctive class-level distribution (Figure 222), one that is different from those at most other sites in the Ballona region other than LAN-211 (testing phase data only; Maxwell 2003). Although superficially similar to the other PVAHP sites in having a high frequency of mammalian fauna among the specimens identifiable to class, LAN-1932 is unique in its high proportions of bony fish and bird remains. Mammalian remains account for at least 75 percent of the collection at most other PVHAP sites; at LAN-1932, mammals make up only 52 percent of the collection. Further, at most other PVAHP sites, the combined bony fish and bird remains yield up to 20 percent of the bones, whereas these account for nearly 40 percent at LAN-1932. The common PVAHP bird/fish and mammal ratios are slightly different within FB 1 of LAN-211, the hypothesized origin of LAN-1932. In the latter context, mammals constitute 70 percent of the recovered fauna, whereas fishes and birds together account for 25 percent. Obviously, the unusual patterning seen at LAN-1932 may be the result of sampling error, as the sample

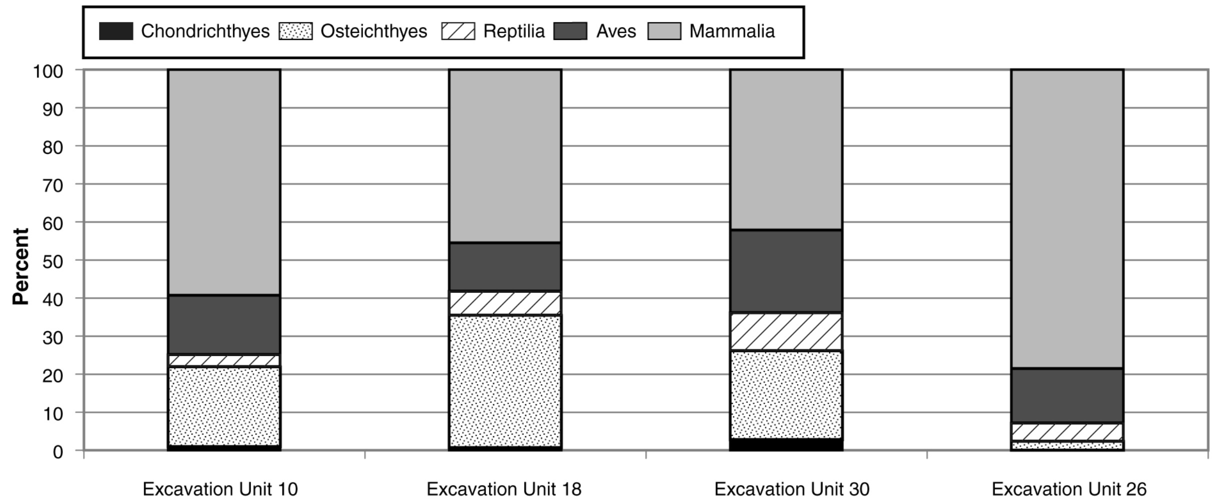

Figure 222. Vertebrate classes by excavation unit at LAN-1932.

size and the sampling context were both small, or of the fact that most of the remains (84 percent) could not be identified even to taxonomic class. However, this pattern is sufficiently distinctive to suggest a different resource-exploitation pattern. This may relate to the late age of LAN-1932, which is a Protohistoric/Mission period site. This in turn could mean that there had been sufficient cultural change to allow for new methods of acquiring food (such as domestic crops and trade, rather than a traditional hunter-gatherer lifestyle). The bird remains, surprisingly high in frequency, are dominated by wing and shoulder elements. This may be evidence for targeting specific species for their feathers, possibly for manufacturing items for trade. Further analysis is needed to identify as many of these bird bones as possible, to determine the likelihood that feathers may have been in demand. It also must be remembered that LAN-1932 has a very high frequency of bone that was not identifiable to the class level—a much higher frequency than at any other site in the Ballona. This is primarily the result of heavy fragmentation of these materials, probably due to the site's having been excavated, redeposited, and then used for a runway. It seems likely that this obscures the class distribution present and probably biases it so that it appears to have fewer mammals than most sites do.

Weathering affects some 20 percent of the bone at LAN-1932, suggesting that much of the bone collection was buried rapidly and stayed buried. This may reflect patterns of sediment deposition, with bones becoming buried more quickly in a lagoon-edge environment. Burning is present on about 20 percent of the materials from LAN-1932. What this means in terms of human behavior is unclear; it may simply be a product of sampling error, or it may be a reflection of different patterns of food preparation or refuse disposal in these areas.

Collection Origins

SRI has proposed that LAN-1932 was derived from areas of LAN-211 that were removed by the Hughes Aircraft Company in the late 1940s or early 1950s to extend the runway paralleling Jefferson Boulevard. LAN-1932 is located directly north of LAN-211. Testing and data recovery at LAN-211 revealed that large portions of this site had been mechanically removed and replaced by clean fill material. The vertebrate fauna from LAN-1932 provides a unique data set within the Ballona region. The composition of the vertebrate collection is unlike that of any other site studied in the area, with its relatively high frequencies of bird (17 percent) and bony fish (25 percent) remains combined with the dominant mammalian fauna (55 percent). From these perspectives, LAN-1932 can be viewed as a "transition zone" site, ranging from the riparian to the lagoon environment. However, some of the variation—particularly the distribution with respect to taxonomic classes—is probably related more to the age of the site than to any other factor. The collection from LAN-1932 is both similar to and distinct from the collection from FB 1 contexts at LAN-211. It is similar to the collection from FB 1 at LAN-211 in that birds (8 percent) and bony fishes (17 percent) are the most frequent taxonomic classes after mammals (70 percent). It is distinct from the collection from FB 1 at LAN-211 in that the LAN-1932 collection does not contain many remains of large mammals (it yielded only two bones from this size class); this result is significantly different from the composition of the collection from FB 1 at LAN-211. On the basis of these patterns, we believe that if LAN-1932 does have its origins at LAN-211, then it is probably associated with the pre-Mission (prehistoric period) rather than the Protohistoric and Mission period component at LAN-211.

LAN-2676

LAN-2676 is located directly north of LAN-62, Locus A/G. Testing suggested that LAN-2676 was an intact site, but data recovery revealed that it was redeposited to extend the runway of the Hughes Aircraft Company, in the same fashion that led to the deposition of materials designated LAN-1932. Large portions of LAN-62 were missing, such as the upper layers and all of Locus B. Thus, we suspect that LAN-2676 originated within Locus B of LAN-62. The faunal collection from this site does not particularly resemble that from LAN-62. For instance, the proportion (15 percent) of bony fish remains present at LAN-2676 is significantly higher than in the burial area of LAN-62, Locus A/G (6 percent), in nonburial features across LAN-62, Locus A/G (8 percent), in FB 3 (10 percent), in FB 7 (5 percent), in Locus C (3 percent), and in Locus D (1 percent). However, within FB 4 at LAN-62, a large number of bony fish elements were recovered; they made up 24 percent of the bones from that Intermediate period context. Also interesting was the variety of bony fish taxa identified (at least 32) at LAN-2676, along with the very strong emphasis on surfperches (n = 221, or 21 percent of all bony fish remains). That pattern cannot be directly compared with data from FB 4, because fish bones from the latter context were not identified. Still, the strong emphasis on bony fishes in both contexts does make for an interesting parallel, and one might suppose that, whether or not LAN-2676 is derived from some part of LAN-62, the deposit might well be Intermediate in date.

The collection from LAN-2676, unlike that from the LAN-62, Locus A/G, burial area, lacks bones from whales, dolphins, porpoises, and fin-footed mammals, which are hallmarks of the burial-context faunal collections. Therefore, it is not surprising that, even if LAN-2676 is redeposited material from LAN-62, Locus B, it contained no such bones. Locus B of LAN-62 was not adjacent to the burial area. Thus, the lack of such bones, unfortunately, tells us nothing about the site's origins.

Collection Origins

The guiding assumption of the Runway Sites excavation project is that these collections of archaeological material are portions of other, nearby sites, the upper portions of which were scraped off and brought as fill for the construction of the runway by Hughes Aircraft Company personnel in the early twentieth century. Excavators believe that LAN-2676 originated as a part of LAN-62. Although there may be good reasons, based on other types of material culture, to suggest this, the faunal collection does not bear that hypothesis out so far as can be guessed from the meager evidence at hand.

There are, to be sure, superficial resemblances between the two sites. Most notably, portions of LAN-62, especially those dating to the Late and Mission periods, contain a relatively high number of bones from large terrestrial mammals: namely, deer and other hoofed mammals, including European-introduced domesticates (Figure 223). That pattern is also visible within the general taxonomic profile for LAN-2676. Yet the fact that the two sites apparently share that characteristic may not be very meaningful. Presumably, when or if portions of prehistoric sites were moved for use as fill,

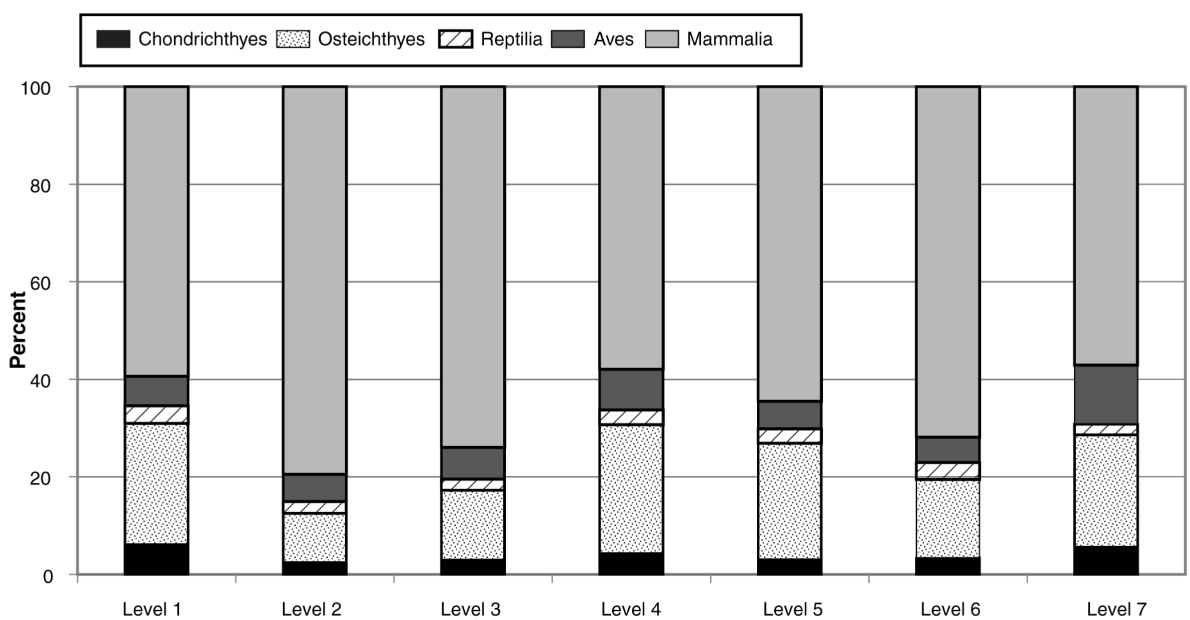

Figure 223. Vertebrate classes by level from excavation units at LAN-2676.

the upper, late-dating layers would have suffered such a fate. However, all of Locus B at LAN-62 was removed as fill for a runway of the Hughes Aircraft Company. Nonetheless, at LAN-2676 the process of removing mainly upper levels can be demonstrated by the fact that there are bones of domesticated cows in the collection. Still, the latest levels of most of the PVAHP sites, which date to the Late and Mission periods, consistently harbor significant numbers of bones from hoofed mammals, some of which are those of species domesticated in the Old World. Therefore, the fact that the collection from LAN-2676 contains many such elements does not help to narrow down the site's origin.

More telling, perhaps, is the quantitative relationship between mammals and bony fishes: mammals are far and away the dominant taxonomic class within every PVAHP site and in nearly every context at each, whereas at LAN-2676 they are only five times more numerous than fishes. That 5:1 ratio is, with a few exceptions, much lower than the same ratio within any one context at either LAN-62, Locus A/G, or LAN-62, Locus C/D. Those exceptions are a number of pit features in different portions of the site, many in the burial area, which apparently were used for storage, cooking, preparation, or disposal of fish in particular. In any event, the builders of the runway probably would not have specifically selected pit features to scrape up and redeposit as fill.

In some respects the bone collection resembles that recovered from the contexts inside FB 1 at LAN-211, which contained approximately 46,000 mammal bones and around 11,000 fish bones (a ratio of approximately 4:1). Also similar is that both contexts show an emphasis on surfperches, a family of fishes inhabiting inshore areas. However, there are prominent divergences as well, most notably with respect to the particular types of fishes exploited. By far the most prevalent fish taxon at LAN-2676 is the Pacific sardine, which makes up 27 percent of all piscine bones. That fish is absent from the FB 1 context at LAN-211, although 2 clupeid bones were identified in a late Intermediate context at the site. Further, LAN-211 contains small numbers of bones from pelagic fish species, including tunas, jackmackerel, and yellowtail jack, none of which is present at LAN-2676. Although some areas of LAN-62, Locus A/G, do contain some bones (n = 212) of fishes in the herring family, possibly sardines, their relative abundance (4 percent of all Late/Mission period fishes; 55 percent of identified fishes in the same periods) is in no way as impressive as the total calculated for LAN-2676 (n = 208; 16 percent of all fishes, 27 percent of identifiable fishes). The origins of this archaeological site, if indeed it was moved from an in situ deposit elsewhere, are puzzling. In the end, given the overall similarity of faunal collections throughout the Ballona area, as well as the sample's relatively small size, the zooarchaeological evidence is insufficient for addressing this question.

Change over Time in Animal Exploitation

Vertebrate remains were recovered from a temporally wide range of contexts, spanning from early Millingstone through the Historical period. Some contexts have mixed temporal ranges, such as the Late/Intermediate period category, because of overlapping radiocarbon dates from some deposits. The vertebrate data are presented here in different ways, but the NISP always forms the basis for quantification and discussion. Summary data tables (see Appendixes I.16 and I.17) therefore present the vertebrate data by class rather than by more-specific taxonomic categories. Although this, of course, masks some variation, it aids in picking out broad trends across periods. Within this table, the data were summarized by showing the varying abundances of remains of different animal classes *within* each period, making it possible to see each period's faunal profile individually. It is also useful to arrange the data comparatively, so that trends may be picked out through time. Figure 224 illustrates the animal-class abundances through time.

Millingstone Period

The Millingstone period evidence comes primarily from the late portion of the period, as the early Millingstone contexts excavated produced fewer than 100 bones. The sample for the general Millingstone period (i.e., contexts not specifically datable to either the early or the late Millingstone period) totaled nearly 8,000 fragments of bone, although that number pales by comparison to the more than 19,000 from late Millingstone deposits. It is within the late Millingstone period that the pattern which generally characterizes Ballona-area sites first emerged: namely, a dominance of mammals over all other animal classes (see Figure 224). Whereas in deposits dated generally to the Millingstone period, mammals made up 58 percent of the bones, by the late Millingstone period that proportion had climbed nearly 30 percent higher, to 87 percent. Differences appear in the bony fish and bird classes, which dropped from 14 and 19 percent, respectively, in the general Millingstone period to 5 and 6 percent by the late Millingstone. It is also instructive to examine Figure 224 in this regard: of all the mammal remains identified, the general Millingstone period contains only approximately 2.5 percent of them; the late Millingstone contains nearly 9 percent. What is also intriguing is that the Millingstone period harbors one of the highest totals of cartilaginous fish elements (17.5 percent) in any period, whereas the following period has approximately half that proportion.

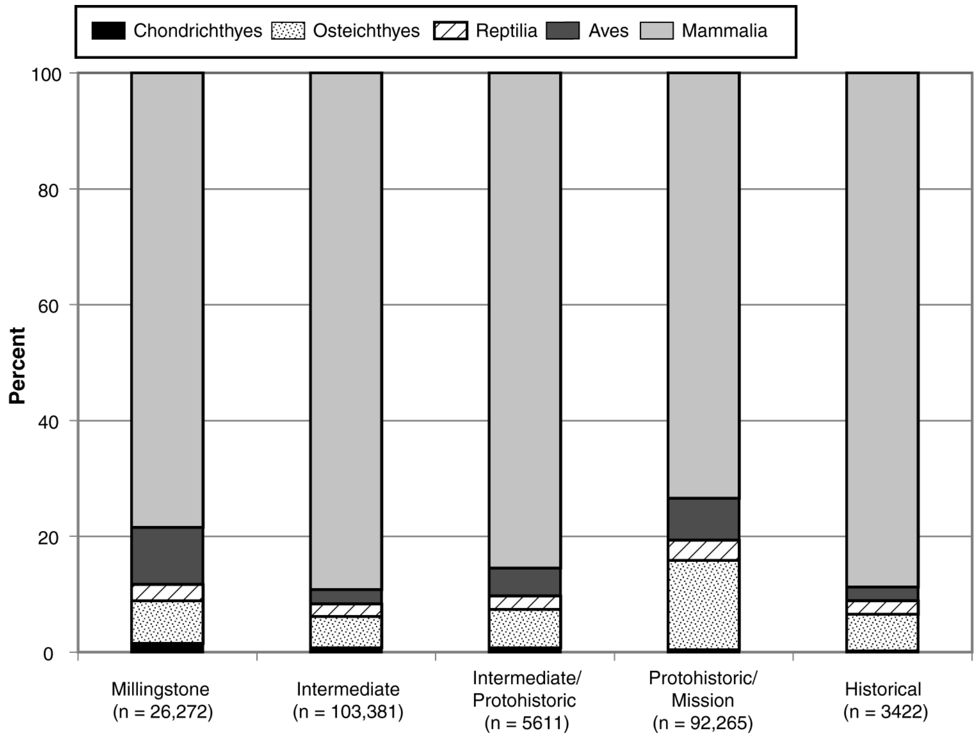

Figure 224. Vertebrate classes by period from all PVAHP contexts.

Intermediate Period

The early Intermediate period appears to be quite similar to the late Millingstone period, including an overwhelming emphasis on mammalian taxa relatively, as compared to the early Millingstone (see Appendix I.16). One relatively small but noticeable difference between the late Millingstone and the early Intermediate is that the latter period contains a smaller proportion of bird bones (2 percent) than the former (6 percent). That decline may be more a factor of the huge number of mammal bones, however, than of a change in hunting preferences. The Intermediate period actually contains few divergences from the early Intermediate, although it is perhaps notable that bony fishes rebound to three times their former proportions in the Intermediate. By the late Intermediate period, the percentage of mammals, which dropped somewhat during the Intermediate compared to the late Intermediate period, rebounded to former highs of approximately 92 percent.

At the same time that mammals rose in importance, bony fishes fell. It seems that within these sites there is some type of relationship, in particular, between fish- and mammal-bone proportions. Much more than is true for other animal classes, as mammal bones rise in relative abundance, fish bones fall—and vice versa. This in large part may be due simply to the fact that, after mammals, bony fishes are by far the most common animal class; percentage fluctuations are more visible in larger samples. Within the longer-bracketed early Intermediate period sample, the same trend is visible: mammals decline somewhat, to 86 percent, and fish spring up somewhat, to nearly 7 percent.

Late, Late/Mission, and Mission Periods

During the later periods encountered at the Playa Vista sites, the trends previously seen remained in large part intact. Mammals form the bulk of each period's collection, forming more than three-quarters of recovered bones in all cases. Although birds reach a high of some 8 percent during the Late/Mission period, that is the only notable rise after a high in the Millingstone period (19 percent). Instead, the decline of mammalian importance—if approximately 75 percent of the collection can be considered a significant lessening in abundance—once again correlates with a rise in the number of recovered fish elements (17 percent, vs. 4–6 percent in earlier periods). Between the Intermediate period and the Mission period, the proportion of fish bones rises from 7 percent to 17 percent, a return to Millingstone proportions (17 percent). On the other hand, mammals decline from the Intermediate period high of 86 percent to a relative low of 73 percent in the Late/Mission period (though the Mission period contains somewhat greater a proportion of them, at 76 percent). Looked at another way, the Late/Mission period collection contains more than 50 percent of all the fish bones recovered by the

PVAHP project; the next highest amount within any single period is 14 percent, within the Intermediate period.

The rise in frequency, and thus presumably in importance, of fish bones and, therefore, fishing is an interesting phenomenon. Why did fishing develop as a key dietary supplement so late, after people had lived along the shores of the Ballona Lagoon for thousands of years? Environmental explanations concerning the development of the Ballona Lagoon, over time, from open bay to enclosed estuary, are not satisfactory. Although various species may have left the area because of changes in, for example, tidal action, water quality, vegetation, and salinity, other species no doubt favored the marsh habitat and established themselves there. Instead of ecological reasons, perhaps other possible factors should be examined, such as the introduction or independent development of some new technology (e.g., seagoing canoes, fish weirs, or nets).

Historical Period

The temporal sequence of the PVAHP ends in the Historical period, that is, after the initial Spanish colonization period, with its establishment of missions, and the subsequent Rancho period. Later deposits containing bones from the nineteenth or early twentieth century were also encountered on occasion: namely, several horse "burials" and an early-twentieth-century-dump (see Chapter 12, this volume). The earlier Historical period deposits together produced one of the smallest collections, which nonetheless contains interesting information. In this period, relative abundance of mammals increases once again, to 89 percent (see Figure 224). At the same time, all other animal classes decline, especially, of course, bony fishes, which had reached their zenith in terms of relative abundance (17 percent) within the preceding Mission period before fading in the Historical period to only 6 percent. Many of the differences between the Mission and the Historical period are apparently products of the small sample for the latter period and not of any visible cultural or economic shift reflecting the drastic changes in lifeways and land use brought on by Spanish settlement and development in the Ballona area. Here it is necessary to be cautious in attributing the decline in frequency of fish bones to anything other than sampling error. Although that decline is striking, one should note that remains of aquatic turtles are still fairly abundant within this period (n = 22, or 28 percent of all reptile bones); therefore, access to and interest in aquatic resources on the part of the population is demonstrable.

Significant Findings and Implications

The most notable changes observed within the PVAHP faunal collections are the exploitation of large and small mammals and the changing emphasis on marine resources. The recovery of the overwhelming number of mammal remains (primarily small) suggests an emphasis on terrestrial fauna. Many of the small mammals are numerous; they include rodents of various species and lagomorphs, and it is very likely that their method of capture was both hunting and trapping. Setting and emptying of animal traps would have been easily accomplished by individuals during daily and regular outings to gather plant foods. Such trapping may have been geared to small mammals that could easily be transported back to the village along with the gathered plant foods. The aquatic fauna, though fewer than their terrestrial counterparts, might have contributed significantly to the diet when available. Fishes and marine mammals tend to have higher fat contents in the spring and summer when some fishes, birds, and sea mammals migrate, spawn, and establish breeding colonies; therefore, they may have been seasonally significant resources. Further, because fishes, and especially cartilaginous fishes, have high ratios of meat to osseous elements (Rick, Erlandson, et al. 2002), their caloric contributions could easily be underestimated in these bone counts.

In addition to the issue of the relative importance of aquatic vs. terrestrial fauna and their methods of capture, the exploitation of hoofed mammals (including artiodactyls) is another important research issue. Arguably, what is most striking overall within the large faunal collection removed from the test units and features of the PVAHP sites is the sheer number of hoofed-mammal bones. With the exception of the relatively high number of artiodactyl bones recovered from the Intermediate contexts at LAN-2768, all significant quantities of hoofed-mammal bones were recovered from the Late and Mission period contexts at LAN-211 and LAN-62. The highest concentration of bones in general, and artiodactyls specifically, came from a rich feature block at LAN-211. At LAN-62, the preponderance of hoofed-mammal bones came from FB 3. Both of these feature blocks are areas in which specific activities were either intensively performed once or even a few times or performed repeatedly, over a long period. The overarching questions are these: What ritual events might have led to the deposition of concentrated numbers of artiodactyl bones and other bones in these two areas? What is the explanation for the apparently successful hunting of deer during the Protohistoric and Mission periods that is absent earlier? In addition to deer bones, a few pronghorn bones were also recovered from LAN-211. Pronghorn probably used to inhabit prairie areas of the Los Angeles Basin, although the location nearest to Los Angeles where the animals are known to have lived is Antelope Valley (Jameson and Peeters 1998:225), considerably more than 100 km from the Playa Vista area. The presence of pronghorn bones suggests that logistical adjustments may have been necessary for the Gabrielino to have shifted their locally focused hunting and fishing regimen to a logistical reorganization involving potentially long-distance expeditions in pursuit of pronghorn.

The large faunal data set from the PVAHP facilitates the evaluation of a several subsistence models proposed for prehistoric populations in coastal California in terms of how well they fit data from the Ballona. Although Reddy et al. (2011) made such comparisons, a brief discussion of some hypotheses and their goodness of fit for the PVAHP faunal data is presented here. Some researchers have argued that pinniped rookeries existed on the California coast up until ca. 1500 B.P. but were eliminated thereafter via hunting pressure (Hildebrandt and Jones 1992). This argument is based on archaeological data from northern and central California, and complementary information from sites in southern California is largely lacking. The large PVAHP data set suggests that there were very few to no rookeries in southern California such as those that may formerly have existed on the mainland north of San Luis Obispo (Hildebrandt and Carpenter 2007:269). Furthermore, faunal data recovered from the Landing Hill project near Seal Beach in Orange County (immediately south of the PVAHP) also suggest the lack of rookeries in southern California (Hildebrandt and Carpenter 2007:269–273). Only 23 pinniped bones (<1 percent of identifiable mammals) were recovered from all the PVAHP sites, including all datable deposits. Most of these (n = 17) were from Mission period contexts; nonetheless, the total number of such bones is so small as to suggest that pinniped hunting was based on occasional and opportunistic encounters with stray animals, rather than systematic and regular exploitation of local rookeries. It should be noted that data from Camp Pendleton Marine Corps Base in San Diego County show a similarly small number of pinniped bones (Wake 1999b:57–58). The Camp Pendleton sites collectively contained approximately 4,500 identifiable mammal bones, of which just 52 (1 percent) were from pinnipeds. Note, however, that there is a marked difference in temporal distribution of pinniped remains (rare as they may be) in the two areas (San Diego County and the Ballona area). Wake (1999b:58) noted that, at Camp Pendleton sites, pinnipeds were more common in the Archaic but disappeared by the Late period. By contrast, within the PVAHP sample, these animals are most common late in the sequence (Mission period) and rare early.

Another research issue of interest that can be explored using the PVAHP data is the decline in foraging efficiency as argued by Broughton (1994). This is noted primarily in the Late period deposits in the Ballona, where numbers of artiodactyl bones are lower than those from earlier strata of central California sites. Other scholars have argued against this hypothesis of reduced foraging efficiency over time, and have instead demonstrated that there is no significant change over time in the relative number of artiodactyl bones found on multicomponent sites in central California (Jones et al. 2008), including those dating to the Late period. However, still others suggest that the relative proportion of artiodactyls increased during the later part of the Holocene, continuing this trend until at least 1000 B.P. (Hildebrandt and McGuire 2002).

There is a very visible shift in the relative abundance of artiodactyls over time in the Ballona, and the PVAHP data do not support the models presented by Broughton (1994), Hildebrandt and McGuire (2002), or Jones et al. (2008). First, the total number of artiodactyl remains across all periods (n = 1,150; 10 percent of identifiable mammals) is quite low. Second, the percentage of artiodactyls in PVAHP Late period levels (n = 10; 5 percent) is similar to the relative abundance of these animals in the late Intermediate period (n = 22; 4 percent) and the Intermediate period (n = 68; 5 percent). In addition, these figures are all higher than those for the early Intermediate (n = 53; 1 percent) and Millingstone periods (n = 4; 2 percent). Third, although there is a rise in the abundance of artiodactyls after the Intermediate period, the phenomenon does not appear until the Mission period. In these Mission period contexts, artiodactyls constitute 28 percent (n = 956) of identifiable mammal elements. The increase in the relative abundance of artiodactyls may be related to societal changes that occurred within the context of Spanish colonization, but most of the Mission period artiodactyl bones are not, or are not likely to be, from domesticated animals (note that many of these bones could not be identified below taxonomic order). Most of the artiodactyl elements identifiable below the level of order (n = 549) are in fact from deer or pronghorn (70 percent); the rest are divided among cattle, sheep, goats, and pigs. Therefore, we state that the central California hypotheses as argued by Broughton (1994) are not supported by the PVAHP data. Similarly, the increase in relative abundance of artiodactyls put forward by Hildebrandt and McGuire (2002; see above) did occur in the Ballona area, but significantly later in time.

A final research issue that the PVAHP faunal data can be used to address on a regional level is the social elements of diet. Specifically, the issues are whether animal foods were ritually offered to the dead and whether the Gabrielino held funerary or other types of feasts in which animal foods were consumed in significant quantities and, if so, whether particular animal foods were preferred for these events. The burial-area evidence is difficult to interpret, given that people were interred within a midden full of domestic refuse including large numbers of animal bones. During excavation, archaeologists attempted to recover only animal-bone items that appeared to be directly associated with the interment, rather than refuse bone from the midden used as grave backfill. Nonetheless, as the discussion of the LAN-62 burial-area fauna details, there is no recognizable pattern among the bones that are distinguishable from domestic refuse. There are, however, several bones from animals whose presence may indicate a ritual association. These include, from burial contexts, the partial maxilla from a mountain lion mentioned earlier and bones from several unusual birds (a barn owl and a great blue heron, as well as several brown pelican elements). In addition, from a burial-area context emerged a single bone from a bald eagle. FB 1 at LAN-211 presents another unique context wherein large-scale food preparation and consumption can be delineated within the context of mortuary ritual. The scale of animal-food consumption was significantly higher at FB 1 at LAN-211 than elsewhere in the project area, given that the bones from this context accounted for nearly one-third (32 percent) of all bones from the PVAHP.

The large PVAHP faunal data set has provided important insights into Native American subsistence practices involving animals. In comparison to those of other regions of California, large faunal collections from southern California are rare. It can also be used to determine differences and similarities in such practices in other parts of southern California and other parts of California, such as Landing Hill (Hildebrandt and Carpenter 2007) and Camp Pendleton (Wake 1999b). Hunting and fishing patterns have been defined more rigorously in other areas of California, especially with respect to ancient ecological variation and the power of models from evolutionary ecology to explain prehistoric human subsistence choices (Broughton 1994; Jones et al. 2008). Some of the trends, including artiodactyl and pinniped hunting over the 8,000-year human history of the Ballona, already appear quite different from the data published for central and northern California. Trends in large-game hunting and fishing within Ballona-wide data, based on published data from all Ballona-area sites and the five PVAHP sites, are more specifically contrasted with the archaeological literature for central and southern California by Reddy et al. (see Volume 5, Chapter 4, of this series).

Aboriginal Butchery

Justin Lev-Tov

Introduction and Background: Distinguishing Cultural vs. Natural Modifications on Bones

The analysis of aboriginal butchery is an important topic for the PVAHP. The analysis of various types of marks on animal bones recovered from archaeological sites has become a major topic within prehistoric archaeology in general, and zooarchaeology in particular, particularly from the 1980s until the present day (Binford 1981; Greenfield 1999, 2006; Lyman 1987). In large part, this interest has been motivated by the idea that human evolution at the Pliocene-Pleistocene temporal boundary was in some way propelled or influenced by the development of carnivory and the concomitant ability of hominids to hunt large game. Therefore, researchers invested serious study—archaeological, ethnoarchaeological, and experimental—in trying to define and separate damage done to bones by various taphonomic processes, including trampling, gnawing by a variety of carnivores and rodents, and purposeful butchery and bone breakage with stone tools (Binford 1978; Fisher 1995; Lupo and O'Connell 2002).

Although the emphasis in the butchering and taphonomy literature has been on elucidating sources of damage on lower and middle Paleolithic bone assemblages, there is a growing body of studies examining both the signatures of metal-tool damage on bones and the cultural implications of delineating styles of butchery in the context of internally differentiated complex societies (Greenfield 1999; Langenwalter 1980; Lyman 1987; Schulz and Gust 1983; Walker and Long 1977). Such studies present methods for the differentiation of stone vs. metal tools and of different types of metal tools, and for inferring ethnicity, industrialization, and acculturation from distinctive marks produced by these various implements (e.g., Crader 1990; Langenwalter and McKee 1985).

This research, whether directed at questions concerning the origins of human hunting or at the delineation of ethnicity from tool marks and butchery patterning, has significantly advanced knowledge in the discipline. We can now make confident inferences concerning implements used and the purpose(s) for which the butchering was performed. More specifically, we can examine bone samples micro- and macroscopically and differentiate marks according to the following general attributes (though it should be noted that researchers differ to some extent in their descriptions and differentiations of such marks; cf. Lyman 1987:270–281):

Carnivore damage: Generally U-shaped grooves, along with pitting; often is present at the articular ends of bones.

Rodent gnawing: Closely spaced, parallel striations that can be found anywhere on the bone and that usually obliterate a portion of the cortical surface.

Damage from bifaces: Uneven V-shaped grooves, whose walls are striated upon magnified observation.

Damage from flakes: Typically, multiple, parallel "slice" marks in a single location, evidently produced because such tools are small and light and lack the ability to cleanly cut through flesh and connective tissue.

Damage from metal knives: Greenfield (1999) has attempted to differentiate marks made by bronze vs. iron or steel knives on bones, as an oblique way of examining the origins of metallurgy in the Near East; however, the present concern is merely to differentiate the mark of any type of metal blade from the mark of a stone blade, a topic that has been explored by Walker and Long (1977). In their analysis, metal knife blades left V-shaped cut marks having smooth sides, as opposed to the relatively jagged marks left even by obsidian flakes and flake tools.

Other types of damage seen on bones that may overlap with tool marks include the effects of trampling either by animals or people (which may crack or break bones lying on or immediately beneath the ground surface), the action of water and wind (sometimes creating striations), aerial weathering (which can crack and flake bone), and etching by the roots of plants (which creates shallow, straight, or erratic lines anywhere along a bone's surface). The signatures of all these processes and more have been studied by various authors (e.g., Behrensmeyer 1978; Miller 1975; Shipman 1984; Thorson and Guthrie 1985). Generally, under close macroscopic or, better, microscopic examination, it is possible to separate most such damage from that caused by the purposeful use of stone or metal tools for butchering.

Although differentiating between butchering marks and other causes of damage can be difficult and, especially with very ancient assemblages, is sometimes hotly debated (Bunn 1981; Potts and Shipman 1981), it is generally less of a problem in much more recent periods, when site structure is apparent, carnivore damage is generally absent or low, and obvious stone or metal tools are found in association with the bones. Also, some processes such as aerial weathering are much more muted in the temperate coastal climate of southern California than is true in east Africa, where most such observations have been made.

Nonetheless, bone fractures made with blunt tools for the purpose of opening up the marrow cavity can be difficult to discern from dry-bone breaks caused by trampling and other natural processes (Binford 1981; Sadek-Kooros 1972). Though once considered a definitive signature of human hunting and meat processing, the "spiral fracture," a descriptive term for a distinctively fractured long-bone shaft, now is known to be caused also by nonhuman carnivores' powerful jaws and trampling by herd animals (Lyman 1984; Thomas 1971). Again, however, in archaeological contexts with considerable evidence for continuous human occupation with refuse pits, middens, and large artifacts, and within bone assemblages lacking widespread damage from carnivore ravaging, spiral fractures can, inter alia, be taken at face value as one type of butchery mark. The interest by both past and present hunter-gatherer, pastoralist, and incipient-agriculturist peoples in harvesting within-bone nutrients such as marrow and grease is well documented (e.g., Binford 1978; Binford and Bertram 1977; Outram 2002), and it may be stated that marrow-fractured long bones form a typical component of animal-bone collections from preindustrialized or nonintensive-agriculturist peoples. Therefore, an abundance of such marks in an analyzed bone assemblage may not delineate ethnicity but instead may be indicative of the general economy followed by the former occupants of a site. However, given a situation in which industrialized and nonindustrialized peoples lived together or close together, as in the colonial period of North America, such a pattern can serve as an ethnic marker for the presence of Native Americans, providing that two conditions are fulfilled: first, it must be demonstrated that clearly prehistoric sites in the same area contain faunal collections exhibiting similar patterns of bone breakage, and second, a researcher should demonstrate that the occupying colonial power's tradition at the time of colonization did not typically include bone smashing as a component of its butchery tradition.

Beyond the presence of spiral fractures possibly delineating ethnicity, the presence, type, placement, and directionality of butchering marks in general have often been thought to mirror ethnic preferences in meat cuts. Foodways are commonly thought to be a conservative element of culture, more resistant to change than other realms, and therefore may be a useful tool to sort out different groups where more than one is present. Yet as it pertains specifically to butchery, it is not clear that ethnicity is well reflected by the tool marks left behind on bones. Lyman (1987:287–289) has reviewed the positions of authors taking opposite sides on the matter of whether butchering marks generally reflect ethnic preferences. The matter comes down to whether butchery is to a large degree dictated by the broadly similar anatomy of large hoofed mammals the world over, and therefore whether culturally induced variations in the positioning of tools to strip meat and strike dismembering blows are, by comparison, very minor and largely invisible in an archaeological bone collection. Lyman (1987:288–289) has trod a fine line between the two positions, allowing that butchery probably does vary according to cultural tradition, but within the constraints allowed by anatomy. Perhaps the overarching problem in detecting cultural traditions in butchery patterning is that, unlike the marks created by purposefully designed and highly visible tools, butchery marks are accidental by-products of grease, marrow, and meat accumulation. That is, "marks on bones may or may not result from butchering activities because many of these marks are an incidental, not purposeful result of the extraction of carcass resources" (Lyman 1987:262). Indeed, a butcher often does not see the bone, obscured by meat and other soft tissues, as the tool is being used and, perhaps, a cut mark is made. In the best of cases, butchery marks are by-products of conscious, though not necessarily consistent, efforts to separate edible from inedible portions of a carcass.

To have any hope at all of distinguishing ethnic traditions of butchery, the observer should record not only the tool material and tool type responsible for the given mark or marks but also the placement of the mark on the bone and the mark's direction. These additional observations make it possible to hypothesize why a mark is found where it is found. That is, beyond the very general observation that a given type of damage observed on a bone occurred during the butchering of the carcass, it may be also possible to infer what the specific goal of a given butchering event was: whether this was slaughtering, skinning, dismembering, gross or fine carcass division, bone smashing for marrow and grease, or "pot-sizing," in which all larger carcass portions are reduced to similar size in order to fit into cooking pots. Binford's (1981) work has been especially illuminating in this regard. His observations of the Nunamiut Eskimo led him to delineate the latter general categories for divining the purpose and placement of marks. Seetah (2006) has collapsed the categories into a five-stage system of carcass reduction, covering primary butchery (slaughter, skinning, and initial carcass dressing), secondary butchery (dismemberment at joints and main muscle sites, producing large portions of meat), tertiary butchery (dividing major meat portions into smaller pieces suitable for cooking), extraction of marrow, and bone working. In this arena of butchery studies, the placement of butchering marks, more than the type of mark, can lead to insights on purpose. Thus, cut marks on the foot bones apparently stem from skinning; knife or cleaver marks on the hyoid, the back of the skull, or cervical vertebrae result from slaughter (cutting the throat and/or beheading); disarticulation or dismembering marks are normally found at bone joints; and a variety of marks found along central portions of various bones result from carcass division and marrow processing (Binford 1981; Seetah 2006; but see Lyman 1987:262–263 for cautions).

The major point in determining the specific portion of a process during which a butchering mark was created is that this can be used to detect patterns in carcass processing that may be culturally specific. Just as Langenwalter (1980) and Schulz and Gust (1983) were able to distinguish Chinese styles of butchery from Anglo-American methods, so it may also be possible to differentiate among Hispanic, Native American, and Anglo-American styles of butchery present in the butchered-bone assemblage from LAN-211. As with bone fracturing, rather than ethnic affiliation, discerned patterning may reflect economic and/or social distance from a group of industrialized people who use implements such as metal saws and cleavers to achieve more-precise butchery than hammerstones and other stone tools may allow. This is arguably true, for instance, on some antebellum plantations, where there seems to be a distinct butchering pattern among African American enslaved persons: the pattern may be one of social and economic division between the planter and the enslaved, rather than ideological resistance or maintenance of a distinctive West African tradition of butchering for one-pot meals of stews (Crader 1990:710).

Methods Employed

The butchered bones from PVAHP sites LAN-211, LAN-2768, LAN-62, LAN-54, and LAN-193 were first identified as such by laboratory personnel during the initial sorting and identification of faunal remains recovered from excavations. These identifications were based entirely on macroscopic examination, aided at most by hand lenses or desk-mounted magnifying glasses. Nonetheless, the well-trained archaeological staff did discern a number of bones bearing cut marks and other butchering marks. Tool incisions were recognized not only on the relatively large fragments of bone that characterized Feature 1, in particular, but also on rather minute (<1 cm) bone fragments. The recording of butchering marks on such small bone fragments is of limited utility, however, as without knowing from which part of a skeletal element, or sometimes from which element or species, a fragment originated, it is impossible to glean more-detailed data such as mark location and orientation. Therefore, larger pieces of butchered bones are more useful, and a greater amount of time was invested in analyzing those marks.

After the initial bone study, bones bearing butchering marks were pulled for further study. This more in-depth study of butchery was performed with the aid of both a mounted magnifying glass and a microscope using 10× and 20× magnifications. This study had two goals: validation and detail extraction. That is, butchering marks previously recorded were all reexamined under greater magnification, in order to check whether the bones were indeed butchered and, if so, with what type of implement. In addition to validation, various other aspects of observed butchery marks were recorded in a database designed only to capture information about butchery. Recorded aspects of the butchering marks were organized into the following categories:

Type of mark: Chop, cut, hammer, saw, spiral fracture, or some combination of these.

Butchery event number: A category created to record separate instances of butchery on the same bone.

Number of marks: Simply a way to record how many butchering marks were associated with any single butchering event.

Mark location: Where on the bone a mark appears. Possible entries for this field are based on anatomical designations of bone portions adapted from von den Driesch (1976). Designations consist of proximal, shaft, distal, medial, lateral, anterior, posterior, cranial, caudal, dorsal, plantar, and volar.

Mark orientation: These designations are based on anatomical descriptions of directionality within the skeleton (von den Driesch 1976). Categories consist of proximal-distal, medial-lateral, anterior-posterior, cranial-caudal, and dorsal-ventral.

Butchery intent: Determination of the purpose of butchering marks, designated on the basis of type of mark, placement, and direction, is based on Binford's (1981) descriptions of marks made during caribou-meat processing by the Nunamiut Eskimo. The terms used in this database are not as extensive as those in Binford's list, because of the difficulty inherent in separating marks he designates as "food preparation" from "defleshing." The categories chosen for the present analysis are slaughtering, skinning, dismembering, filleting, pot-sizing, and marrow extraction.

Implement: Microscopic examination of butchery marks has enabled a number of scholars, including Walker and Long (1977) and, more recently, Greenfield (2005, 2006), as well as others, to differentiate cut marks made by stone tools from those made by metal tools. Greenfield (2005) and others have, to an extent, been able to differentiate marks made by stone bifaces from others made by stone flakes, sharp steel blades, dull steel blades, low-tin bronze knives, and serrated steel blades.

Together, the above characteristics enable a researcher, when given a large enough sample, to delineate trends in butchery, in the sense that there may appear general tendencies to use certain types of tools and to cut in favored directions at specific and repeated points along animals' skeletons. These trends are usually summarized qualitatively and presented as butchering patterns, implying that a given people approached carcass division in a planned, normative fashion. Therefore, these models become evidence for a specific group's ethnic or economic approach to meat eating, a stand-in for larger arguments concerning the maintenance, abandonment, alteration, or simple identification of a distinctive cultural identity in the archaeological record, analogous to similar arguments concerning ideas of "style" in stone-tool-making traditions (e.g., Sackett 1981; Wiessner 1986).

For the present analysis, perhaps the single-most-important characteristic recorded for the database is the implement used to create the marks. Clearly, the question of whether or to what extent stone-tool technology persisted after the establishment of Mission San Gabriel is a question integral to the study of Gabrielino identity within the Mission period. Under macro- and microscopic examination, both stone- and metal-tool marks were identified; the tools used consisted of stone flakes, hammerstones and bifaces, and metal knives and cleavers. The criteria used to identify and separate the tool scars were as follows:

Stone flake: Relatively open, V-shaped marks with fine striations within the groove. Often, multiple cut marks are found next to each other on the bone (Binford 1981; Greenfield 2006; Potts and Shipman 1981).

Stone biface or retouched flake: Impacts made by such implements are often designated chopping marks in the taphonomic literature (Lyman 1987) and are wide, open, V- or U-shaped grooves with ragged, stepped sidewalls (Greenfield 2006; Walker and Long 1977).

Hammerstone: These are often pro forma tools such as river cobbles, which have good weight and are sized to fit well into a hand. Such tools are not used for primary butchering, that is, carcass dismemberment and meat removal. Rather, they are used to smash open bone diaphyses in order to access the medullary cavity for marrow. On the other hand, it is also possible, as Binford (1978, 1981:158–159) has shown, that a bone can be picked up and hit across a handheld anvil, an elongated piece of stone that variously acts as a blunt hammer or a pointed tool, depending on the angles present and the side put toward the falling bone. Cracking open the marrow cavity in these manners leaves marks at distinct points on the bone. Whereas hammer blows most often are present in the middle of bone along the diaphysis, anvil blows are aimed just above or below the articular ends (Binford 1981:159–161). The marks themselves are distinct from cut marks. Rather than producing various types of striations and gouges, hammer and anvil blows produce conchoidal fractures, which break bone shafts into the classic "spiral" form; often have cracks radiating out from a point of impact; and/or demonstrate a negative impact fracture on the interior of the bone, where a bone chip is dislodged from the blunt-force impact.

Metal knife: Most taphonomists agree that metal blades produce narrow, V-shaped cut marks having smooth side walls. In addition, unlike flake scars, these marks usually are not found in groupings parallel to each other at one location on the bone. Possibly, this may result from the lower amount of force needed to penetrate muscle mass, periosteum, and connective tissues with a metal blade; it may be necessary to make a number of slices with a stone flake to achieve the desired result, leaving multiple scars as a consequence (Bunn 1982; Potts 1983). Overall, however, researchers suggest that metal tools leave more cut marks in a given bone assemblage than do stone tools, because even light cutting motions easily scar the bone beneath soft tissue.

Metal cleaver: Seetah (2006) defined cleaver marks as generally having wide, smooth entry points into a bone, with ragged exits, because the wide device delivers a powerful blow that sinks well into the bone in fast motion but then must be removed with twisting effort (see also Langenwalter 1980). Chop marks are recognizable, therefore, by their width coupled with the smoothness of the scar. In addition, particularly powerful cleaver blows can travel all the way through a bone or fracture it beneath the stopping point of the cleaver.

Results: The Butchered-Bone Assemblages

Within the collection from these sites, the number of bones bearing butchering marks was small: 91 separate incidents of butchery visible on 81 bones (Tables 180–182; see Appendix J.1). Ten bones had two different sets of marks carved into them, from different tools and/or from separate butchering incidents; each incident of butchery was recorded separately in order to glean the greatest amount of information. Although LAN-2768 (see Table 180) and LAN-62 (see Table 181) contributed samples, the largest contribution of butchered bones came from LAN-211 (see Table 182). The two additional sites, LAN-54 and LAN-193, produced only 4 bones total (2 per site) bearing butchering marks. Three of those 4 bones were clearly cut using a metal saw, which indicates that the specimens probably are not from the Mission period but rather originate in the mid- to late nineteenth century, when the use of metal saws for butchery became prevalent.

Table 180. Characteristics of Butchered Animal Bones from LAN-2768

Scientific Name	Common Name	Animal Size	Element	Portion	Type	Intent	Implement	Location	Orientation	Depth	No. of Marks	Butchery Catalog No.
Antilocapra americana	pronghorn	large	first phalanx	complete	cut	skinning	flake	proximal	anterior-posterior	medium	4	1
Odocoileus hemionus	mule deer	large	radius	shaft	chop	dismembering	biface	distal	anterior-posterior	cut through	2	2
Cervidae	deer family	large	ulna	distal	cut	unknown	flake	midshaft	unknown	deep	2	3
Cervidae	deer family	large	scapula	proximal	cut	dismembering	biface?	midshaft	anterior-posterior	shallow	2	4
Cervidae	deer family	large	radius	shaft	cut	filleting	flake/biface	midshaft	medial-lateral	shallow to medium	6	5
Cervidae	deer family	large	ulna	proximal	saw	pot-sizing	saw	anterior	anterior-posterior	deep	1	6
Artiodactyla	even-toed ruminant	large	cervical vertebra	centrum	cut	dismembering	metal knife	cranial	cranial-caudal	deep	1	7
Artiodactyla	even-toed ruminant	large	radius	shaft	chop	dismembering	biface	posterior	anterior-posterior	cut through	1	8
Artiodactyla	even-toed ruminant	large	rib	shaft	cut	pot-sizing	flake, metal knife	midshaft, medial	proximal-distal	shallow	3	9
Artiodactyla	even-toed ruminant	very large	long bone	shaft	spiral fracture	marrow extraction	hammerstone	midshaft	anterior-posterior	cut through	1	10
Artiodactyla	even-toed ruminant	large	rib	shaft	chop	unknown	stone tool	midshaft	anterior-posterior or medial-lateral	deep	1	11
Mammalia	mammal	large	pelvis	acetabulum	hammer	unknown	biface	posterior	medial-lateral	deep	3	12
Mammalia	mammal	large	long bone	shaft	chop	dismembering	biface	proximal	anterior-posterior	deep	1	13
Mammalia	mammal	large	unknown	unknown	cut	filleting	flake	anterior	cranial-caudal	superficial	5	14
Mammalia	mammal	large	skull	fragment	cut	unknown	flake	unknown	unknown	medium	2	15
Mammalia	mammal	large	unknown	unknown	cut	unknown	flake	unknown	unknown	superficial	12	16
Mammalia	mammal	large	long bone	shaft	cut	dismembering	flake/biface	proximal	cranial-caudal	shallow	1	17

Table 181. Characteristics of Butchered Animal Bones from LAN-62

Scientific Name	Common Name	Animal Size	Element	Portion	Type	Intent	Implement	Location	Orientation	Depth	No. of Marks	Butchery Catalog No.
Accipiter gentilis	northern goshawk	medium	tarsometatarsus	complete	cut	dismembering	flake	medial	anterior-posterior	superficial	12	18
Anser sp.	goose	large	coracoid	complete	cut	dismembering	flake	anterior	medial-lateral	deep	20	19
Bos taurus	cow	large	radius	distal	spiral fracture	marrow extraction	hammerstone	lateral	medial-lateral	cut through	1	20
Canis sp.	dog, wolf, or coyote	large	metacarpal IV	complete	cut	skinning	flake	midshaft	medial-lateral	medium	2	21
Capra hircus	domestic goat	large	humerus	proximal	saw	dismembering	metal saw	distal	medial-lateral	cut through	1	22
Odocoileus hemionus	mule deer	large	mandible	partial	chop	dismembering	biface	buccal	lingual-buccal	deep	5	23
Odocoileus hemionus	mule deer	large	mandible	partial	cut	filleting	flake	lingual	anterior-posterior	shallow	13	24
Odocoileus hemionus	mule deer	large	first phalanx	complete	drilled	tool manufacture	drill	proximal	proximal-distal	into marrow cavity	1	25
Ovis aries	domestic sheep	large	tibia	distal	saw and chop	dismembering	biface	midshaft	medial-lateral	cut through	1	26
Artiodactyla	even-toed ruminant	large	hyoid	fragment	cut	dismembering	flake	anterior	cranial-caudal	deep	25	27
Artiodactyla	even-toed ruminant	very large	rib	shaft	saw	pot-sizing	saw	anterior	anterior-posterior	deep/cut through	2	28
Canidae	dogs, wolves, and foxes	large	femur	shaft	cut	filleting	flake	anterior	medial-lateral	shallow	8	29
Canidae	dogs, wolves, and foxes	large	femur	shaft	cut	filleting	flake	posterior	medial-lateral	superficial	60	30
Canidae	dogs, wolves, and foxes	large	pelvis	complete	cut	filleting	flake	lateral	anterior-posterior	superficial	8	31
Cervidae	deer family	large	humerus	shaft	cut	filleting	flake	midshaft	medial-lateral	shallow	20	32
Leporidae	rabbits and hares	small	radius	distal	hammer	pot-sizing	hammerstone	midshaft	anterior-posterior	cut through	1	33
Mammalia	mammal	large	long bone	shaft	cut	filleting	flake	midshaft	medial-lateral	shallow	2	34
Mammalia	mammal	large	long bone	shaft	cut	filleting	flake	midshaft	medial-lateral	shallow	25	35
Mammalia	mammal	large	long bone	shaft	cut	filleting	flake	midshaft	medial-lateral	superficial	1	36
Mammalia	mammal	large	long bone	shaft	cut	unknown	flake	midshaft	medial-lateral	shallow	4	37
Mammalia	mammal	large	long bone	shaft	cut	filleting	metal knife	midshaft	medial-lateral	superficial	4	38
Mammalia	mammal	large	long bone	shaft	saw	pot-sizing	metal saw	midshaft	anterior-posterior	cut through	2	39
Mammalia	mammal	large	mandible	ascending ramus	cut	dismembering	flake	unknown	cranial-caudal	superficial	2	40
Mammalia	mammal	large	metapodial	distal	cut	skinning	flake	anterior	medial-lateral	deep	6	41
Mammalia	mammal	large	unknown	unknown	hammer	marrow extraction	hammerstone	midshaft	anterior-posterior	shallow	3	42

Table 182. Characteristics of Butchered Animal Bones from LAN-211

Scientific Name	Common Name	Size	Element	Portion	Type	Intent	Implement	Location	Orientation	Depth	No. of Marks	Butchery Catalog No.
Arctocephalus townsendi	Guadalupe fur seal	large	astragalus	complete	cut	dismembering	flake/biface	lateral	medial-lateral	medium	4	43
Bos taurus	cow	very large	atlas	complete	cut	dismembering	metal knife	cranial	medial-lateral	medium	8	44
Bos taurus	cow	very large	humerus	distal and shaft	hammer	marrow extraction	hammerstone	lateral	medial-lateral	into marrow cavity	1	45
Bos taurus	cow	very large	humerus	shaft	hammer	marrow extraction	hammerstone	lateral	medial-lateral	cut through	1	46
Bos taurus	cow	very large	humerus	shaft	hammer	marrow extraction	hammerstone	lateral	medial-lateral	cut through	2	47
Bos taurus	cow	very large	humerus	proximal	spiral fracture	marrow extraction	hammerstone	medial	medial-lateral	cut through	1	48
Bos taurus	cow	very large	pelvis	ilium-ischium	chop	dismembering	metal cleaver	midshaft	anterior-posterior	cut through	1	49
Bos taurus	cow	very large	pelvis	ischium	chop	dismembering	metal cleaver	distal	medial-lateral	medium	2	50
Bos taurus	cow	very large	thoracic vertebra	dorsal process	chop	dismembering	metal cleaver	caudal	cranial-caudal	deep	1	51
Bos taurus	cow	very large	tibia	distal	hammer	marrow extraction	hammerstone	distal	medial-lateral	into marrow cavity	1	52
Odocoileus hemionus	mule deer	large	long bone	shaft	hammer	marrow extraction	hammerstone	midshaft	medial-lateral	cut through	3	53
Odocoileus hemionus	mule deer	large	long bone	shaft	cut	defleshing	unknown	midshaft	medial-lateral	superficial	2	54
Odocoileus hemionus	mule deer	large	femur	proximal	hammer	marrow extraction	hammerstone	posterior	anterior-posterior	cut through	1	55
Odocoileus hemionus	mule deer	large	femur	distal	spiral fracture	marrow extraction	hammerstone	midshaft	medial-lateral	cut through	1	56
Odocoileus hemionus	mule deer	large	femur	proximal	cut	dismembering	metal knife	proximal	medial-lateral	superficial	4	57
Odocoileus hemionus	mule deer	large	humerus	proximal	spiral fracture	marrow extraction	hammerstone	midshaft	medial-lateral	cut through	1	58
Odocoileus hemionus	mule deer	large	metacarpal	distal	chop	dismembering	metal cleaver	distal	medial-lateral	cut through	2	59
Odocoileus hemionus	mule deer	large	temporal	incomplete	cut	dismembering	flake	cranial	cranial-caudal	shallow to deep	7	60
Cervidae	deer family	large	long bone	shaft	cut	filleting	unknown	midshaft	medial-lateral	shallow	4	61
Pinnipedia	fin-footed mammal	very large	sternum	segment	chop	dismembering	biface	lateral	medial-lateral	deep	1	62

contiued on next page

Scientific Name	Common Name	Size	Element	Portion	Type	Intent	Implement	Location	Orientation	Depth	No. of Marks	Butchery Catalog No.
Artiodactyla	even-toed ruminant	large	long bone	shaft	chop	pot-sizing	cleaver	midshaft	anterior-posterior	cut through	1	63
Artiodactyla	even-toed ruminant	large	long bone	shaft	cut	filleting	metal knife	midshaft	medial-lateral	deep	1	64
Artiodactyla	even-toed ruminant	large	long bone	shaft	cut	filleting	metal knife	medial	medial-lateral	medium	3	65
Artiodactyla	even-toed ruminant	large	long bone	shaft	cut	filleting	unknown	midshaft	medial-lateral	superficial	3	66
Aves	bird	medium	tibiotarsus	shaft	chop	dismembering	metal cleaver	midshaft	medial-lateral	cut through	1	67
Aves	bird	small	tibiotarsus	shaft	chop	dismembering	unknown	midshaft	anterior-posterior	cut through	1	68
Mammalia	mammal	large	carpal	incomplete	cut	skinning/ dismembering	metal knife	anterior	medial-lateral	shallow	5	69
Mammalia	mammal	large	long bone	shaft	chop	marrow extraction	biface	midshaft	anterior-posterior	medium to deep	2	70
Mammalia	mammal	large	long bone	shaft	chop	unknown	biface?	midshaft	unknown	medium	4	71
Mammalia	mammal	large	long bone	shaft	cut	unknown	flake	midshaft	medial-lateral	superficial	17	72
Mammalia	mammal	large	long bone	shaft	cut	unknown	flake	midshaft	medial-lateral	shallow	4	73
Mammalia	mammal	small	long bone	shaft	cut	filleting	flake	midshaft	medial-lateral	shallow	2	74
Mammalia	mammal	large	long bone	shaft	cut	unknown	flake	unknown	unknown	deep	1	75
Mammalia	mammal	large	long bone	shaft	cut	unknown	flake	anterior	medial-lateral	superficial	1	76
Mammalia	mammal	large	long bone	shaft	hammer	marrow extraction	hammerstone	lateral	medial-lateral	into marrow cavity	1	77
Mammalia	mammal	large	long bone	shaft	hammer	marrow extraction	hammerstone	midshaft	anterior-posterior	into marrow cavity	1	78
Mammalia	mammal	large	long bone	shaft	saw	unknown	saw	midshaft	anterior-posterior	cut through	1	79
Mammalia	mammal	medium	long bone	shaft	cut	unknown	unknown	midshaft	medial-lateral	superficial	6	80
Mammalia	mammal	large	long bone	shaft	chop	pot-sizing	unknown	proximal	proximal-distal	cut through	1	81
Mammalia	mammal	large	long bone	shaft	chop	unknown	unknown	midshaft	medial-lateral	medium	3	82
Mammalia	mammal	large	pelvis	ischium	cut	filleting	metal knife	anterior	medial-lateral	shallow	2	83
Mammalia	mammal	large	unknown	fragment	cut	filleting	flake	midshaft	medial-lateral	superficial	8	84
Mammalia	mammal	medium	unknown	unknown	cut	filleting	metal knife	midshaft	anterior-posterior	medium	1	85
Mammalia	mammal	large	unknown	unknown	cut	unknown	flake	midshaft	medial-lateral or anterior-posterior	medium	11	86

These 3 bones, therefore, will not be discussed further here. Another 6 bones, 4 from LAN-62 and 1 each from LAN-2768 and LAN-211, were also sawn. Likewise, these bones will not be considered further in this report, although they appear in Tables 180–182 and Appendix J.1.

Within the collection of butchered bones from LAN-211, 44 incidents of butchery were recorded on 40 pieces of bone, including the sawn specimen. Of these, 7 fragments were too small to identify to a taxonomic grouping beyond class and possessed no identifying landmarks by which they could be placed on a particular part of any element. Therefore, those fragments did not contribute useful information to the butchering analysis. In all but 2 of the latter cases, the marks were probably made with stone implements, but it was impossible to tell where on the bone and in what direction the cut had been made. This in turn made an assessment of butchering purpose unattainable. For that reason, the analysis of butchery at LAN-211 is based on the subsample of 33 bone specimens.

The smaller collection from LAN-62 totaled 22 bone specimens exhibiting 25 instances of butchery. LAN-2768 produced 17 bones bearing butchering marks, with 2 bones each subjected to two separate cutting incidents; the total number of butchering incidents is 17. LAN-54 and LAN-193 produced only 2 butchered bones each, and all but 1, from LAN-193, had clearly been sawn. Only the solitary specimen without saw marks will be discussed here.

Species and Elements/ Element Portions

The principal identified species present within all the collections are cow (*Bos taurus*) and mule deer (*Odocoileus hemionus*). Deer elements are more abundant than those of cattle (12 bones vs. 7). When one takes into account bone fragments not identifiable to a taxonomic category lower than mammal, but sorted by size class, those likely to be deer on the basis of size outnumber cattle fragments by about 5 to 1. However, the possibility does exist that some of the deer-sized fragments actually belong to sheep (*Ovis aries*) or goats (*Capra hircus*), given that 1 bone of each of these animals is present within the butchered-bone samples. Other identified bones include those of unidentified mammals and birds of various size classes: Guadalupe fur seal (*Arctocephalus townsendi)*, pronghorn (*Antilocapra americana*), dog (*Canis*), rabbit/hare (Leporidae), northern goshawk (*Accipiter gentilis)*, and goose (*Anser*). Therefore, whether or not all the deer-sized bones are deer, it is clear that much of this collection comes from native rather than nonnative animals. This should be compared with the larger, nonbutchered faunal collections, but if this pattern holds for all the collections, then we may suggest that the Gabrielino living at this site largely maintained a nomadic lifestyle not dependent on the mission for food, despite the encouragement of mission personnel to adopt sedentism and despite reports indicating that they were attracted to missions because of food offers.

The remains of Eurasian-domesticated animals, relatively scarce though they are, bring up a related point, that of access to and acceptance of European fauna. How did the native inhabitants of these sites get cattle, sheep, and goats outside the confines of Mission San Gabriel? Possibly, in return for working at the mission or to tempt them into settling at it, they were supplied with beef, perhaps mainly in the summer when ranchos slaughtered large numbers of cattle for their hides and to gain tallow (Langenwalter and McKee 1985:104). The Gabrielino's beef could have come either as live animals "on the hoof" or in the form of meat portions, as from the rancho tanning operations. Alternatively, the Gabrielino may have stolen domesticated animals from mission or rancho herds. There are reports as early as the late 1700s (Mason 2004) of cattle ranging in the Ballona that were stolen by Gabrielinos. A third possibility is that beef was obtained from slaughtering waste dumped by Spanish rancho workers and owners. Horses, for example, were slaughtered in large quantities several times during the Mission period because of overgrazing of land (Mason 2004). Of these alternatives, the last seems the least likely. Rather than slaughtering waste, cattle elements consist mainly of leg bones and vertebrae. Only one bone present, the first vertebra or atlas, may be interpretable in such a fashion; it is sometimes removed with the head during initial carcass processing, and multiple metal-knife cuts to the bone indicate that this was done. Nonetheless, the head is not necessarily a waste product, given that the brain, tongue, and other parts are edible, and it is a good source of fat. Langenwalter and McKee (1985:107), discussing a faunal collection from another mission, noted a similar butchering mark on a cervical vertebra and also suggested that the head was removed for further processing, rather than discarded (see also Binford 1981:104).

Stolen cattle remain a possibility, but they are impossible to directly identify in the archaeological record. Circumstantially, however, what may favor the stolen-animal scenario, aside from ethnographic accounts (which may be exaggerated), is a consideration of the entire species range within both the butchered and the nonbutchered animal-bone collections from the site. Within the butchered collection, cattle are only one animal among at least four other taxa—two species of birds, deer, and Guadalupe fur seal, as well as unidentified mammal bones that may or may not be from one or more of the identified species. Rather than depending on domesticated animals obtained from the mission as rations or rewards, the occupants of this Gabrielino settlement ate beef as one component of a varied meat diet made up principally of hunted animals, of which deer were the main component. It seems that cattle were integrated into this regimen as deer were; in both cases, skeletal remains consist mainly of limb elements in addition to a few cranial and axial bones. This pattern is indistinct in and of itself, but the similarity between the arrays of bones for the two species may in turn indicate similarity in method of capture and in meat part obtained (the entire animal vs. specific parts of the animal).

The range of wild species present also provides interesting information regarding the nature of Gabrielino interaction with the mission. It is well known from period literature that a basic purpose of the missions was to "civilize" and convert to Christianity the Native American populations they encountered. One method of doing so was to limit their movement, tying them economically to a mission so that the Indians relied on the mission for food and other goods. Yet the dietary profile displayed by this faunal collection demonstrates that the Gabrielino maintained the ability to roam away from the mission, successfully hunting deer and small mammals on dry land, as well as collecting or hunting aquatic species, including seals and sea otters. At least one concerted hunting effort may have taken place well away from both Mission San Gabriel and the Ballona. The assemblage from LAN-2768 contained a single pronghorn bone. The pronghorn currently ranges in the high inland valleys of the Great Basin but formerly lived in the Central Valley and even Antelope Valley northeast of Los Angeles, where it was last sighted in the early twentieth century (Jameson and Peeters 1998:218–220). It is unclear what the range of the pronghorn was during antiquity. Wherever this animal were taken, the site probably was at some distance from the Ballona but perhaps not far from Mission San Gabriel. Reconstructions of the Pleistocene landscape of Los Angeles on display at the Page Museum at the La Brea Tar Pits show a prairie habitat which in that epoch supported an extinct antilocaprid species, the dwarf pronghorn (*Capromeryx minor*) (Natural History Museum of Los Angeles County 2002). However, it is also possible that the pronghorn bone, a first phalanx (toe), was brought in attached to a hide; it features cut marks possibly related to skinning, on the ventral surface of the shaft just beyond the proximal end. The bone also displays a drilled hole (Figure 225) similar to one observed in a mule deer first phalanx (Figure 226). Pronghorn hides were not highly sought after, at least not by Europeans within the Historical period: the hollow hairs tend to fall out quickly from the skin, which then becomes useless as a rug or for other insulating purposes (Arizona Game and Fish Department 2007).

Butchering Implements

A number of different butchering tools were apparently used to remove skin, to dismember the animal carcasses, and to extract within-bone nutrients, that is, marrow and/or grease (see Table 180). As mentioned above, several bones exhibited saw marks. This is probably related to the historical period, as saws were not widely used in North America for meat processing until the mid- to late nineteenth century (Pavao-Zuckerman and LaMotta 2007:249, 257, 262; Schulz and Gust 1983:48); earlier European precedents for using saws to split apart bones stem mainly from specialized workshops dedicated to bone-tool manufacture, rather than butchering debris (Schmid 1972:43–48). Langenwalter and McKee (1985:110), in their analysis of animal bones from neophyte quarters at Mission San Antonio de Padua in San Luis Obispo, noted the presence of a single sawn specimen and concluded that it was intrusive from a later context, on the basis of close examination of stratigraphic position as a result of suspicions raised by the saw mark. Other butchery-marked bones from the PVAHP sites bear the imprint of stone or metal tools, including heavy and wide-bladed chopping instruments (bifaces and metal cleavers) (Figure 227) and light and thin-bladed cutting implements (flakes and metal knives). In addition to these, 15 bones bear clear impact marks from hammerstones or stone anvils, although the actual number of bones bearing such marks may be much higher, given the highly fragmented nature of all the faunal collections and the fact that such tools do not leave scars as distinctive as the more easily recognizable marks of blades and flakes.

A few bones demonstrate damage from more than one type of implement. In at least six cases, two different tools were used to reduce large carcass portions into smaller pieces of meat or to extract marrow. One bone, an artiodactyl long-bone fragment from LAN-211, displays chopping marks from a cleaver along with a single, shallow cut from a metal blade. The cleaver was apparently used to reduce the piece of meat into a smaller portion, and the metal knife to cut the flesh

Figure 225. Two views of a pronghorn toe from LAN-2768, Unit 19, Level 5.

Figure 226. Proximal end and medial side of deer toe from LAN-62, Unit 304, Level 56.

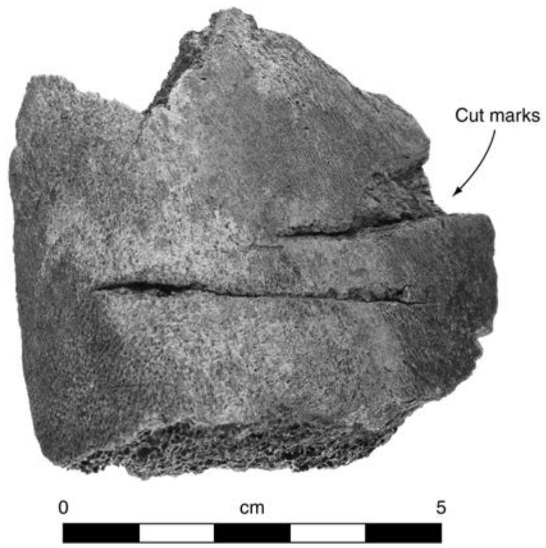

Figure 227. A cow ilium from LAN-211, Unit 429, Level 66.

off, either in preparation for a meal or in the process of cutting the meat while it was eaten. A single bone from LAN-62 demonstrates a similar pattern, even though the chopping marks were probably made by a stone biface, and the cuts probably were incised with flakes. Another piece of bone, from LAN-2768, bears the imprint of both a saw, employed to dismember the carcass, and a metal knife, used in filleting the leg portion. Although it is perhaps not surprising to find metal tools being used by the Gabrielino at this time, it is worth pointing out that at the same time when they adopted these implements, they persisted in using stone tools. Interestingly, not only did they continue to use stone tools (a continuity that has been observed elsewhere on mission sites [Langenwalter and McKee 1985:110; Sampson and Bradeen 2006]) but, apparently, they also used metal and stone-tool technologies in tandem for different butchering tasks. Thus, a deer long bone found at LAN-211 displays two sets of marks: first, it was defleshed using a metal knife, evidenced by narrow slice marks, and subsequently the diaphysis was smashed open with a hammerstone to remove the marrow or to prepare the bone for grease extraction via boiling. This demonstrates an interesting mix of traditional and new technologies in use at the same time and raises the question how extensively the Gabrielino were incorporated into or acculturated to mission life.

Certainly, butchering technology is one window into this process, but not an obvious one. If these scars, both hammer and cut marks, both stem from butchering, then an interesting case could be made for the incorporation of new technology, as well as animals domesticated by Europeans, into the Gabrielino world. However, the cracked bones are an equivocal piece of evidence by themselves. Spirally fractured bones with impact marks are traditionally understood as evidence of marrow extraction, on the basis of archaeologists' observations of traditional peoples (e.g., Binford 1978). Yet Schmid (1972:48) has argued that cracked and broken bones may result from glue manufacture rather than marrow extraction, on the basis of an analysis of animal bones from a Roman site in Switzerland. Tallow processing, a generalized industrial process from which not only glue but also soap, candles, and lubricants (grease) can be produced, could well have been ordered or encouraged by the missions, or it might have been a by-product of the ranchos that were focused on cattle hides. In contrast to Langenwalter and McKee (1985:110), who concluded that the splintered long-bone shafts were necessarily artifacts of marrow processing, Pavao-Zuckerman and LaMotta (2007:263) suggested that the presence of hammer marks may result from either marrow extraction or tallow production or both. Nonetheless, it seems more probable that the hammer marks and the fractured bones originated from marrow extraction because there are no marks associated with skinning on any of the cow bones, such as a humerus (Figure 228), and just two deer bones exhibit such scars (Figures 229 and 230). Presumably, if the Gabrielino were getting meat from the ranchos or processing tallow for the ranchos or the mission, there would be more skinning marks, especially on cow bones, given the investment by Hispanic ranchers and the mission system in cowhide production.

Placement of Butchering Marks

The placement and direction, as well as type, of butchering mark can be suggestive of ethnic traditions in terms of meat-cut preferences. Langenwalter (1980; Langenwalter and McKee 1985) has suggested as much for butchering marks derived from Chinese American and Spanish settlements in California. In the case of the latter, large-mammal ribs were segmented with a cleaver to cut through the bones in a dorsal-ventral direction, producing cuts similar to spare ribs in modern Anglo-American butchering parlance; these were interpreted as Spanish-style meat cuts (Langenwalter and McKee 1985:107–109). Only three rib fragments from deer or sheep/goat–sized animals (one from LAN-62 and two from LAN-2768) bore butchering marks. These marks were all located on the element's dorsal or ventral surfaces and traveled across the bone in cranial-caudal or medial-lateral directions. The cuts seem to have been made with a variety of implements: a metal knife, a flake or bifaces, and, on one bone, a saw. Two of the marks may have been made in the process of removing slabs of meat from the rib cage (cf. Binford 1981:113). The other two cut marks—a deep slice made by a stone tool and saw marks on a rib—were produced by butchery similar to what Langenwalter and McKee (1985:107–109) described as the process used for a typically Spanish cut of meat.

Figure 228. A cow humerus from LAN-211, Unit 451, Level 68.

Figure 229. Deer proximal femur from LAN-211, Unit 451, Level 68.

Figure 230. Deer distal femur from LAN-211, Unit 441, Level 67.

Other bones bearing butchering marks are best summarized by the hypothesized action that created the scar. Five of the bones bear chopping marks made by a metal cleaver. Ten bones appear to have been scarred by large/wide stone tools such as bifaces. The cuts and chops severing these bones are found near the proximal or distal ends, indicating actions meant to separate the carcasses into smaller portions. An unusual chopping mark is seen on a cow pelvis from LAN-211 (Figure 231), where the pubis has been cut away (cf. Lyman 1987:284). Other bones, such as a proximal femur of a deer from LAN-211 and a goose coracoid from LAN-62, bear a number of shallow cut marks on the proximal ends, probably incurred during removal of the leg from the pelvis and the wing from the sternum during the process of cutting away the strong tendons. Several other marks—cut marks made with metal blades in some instances and with stone flakes in others—are equivocal; they may relate either to dismembering or to skinning. One is situated on a distal metapodial and two others on foot bones (a carpal and tarsal), all from LAN-211. The pronghorn toe bone from LAN-2768 is another case in point; tool marks on it may relate to either of those butchering processes, and a hole in the same (posterior surface) area may be either from drilling or from a carnivore's tooth. The knife cuts at such points in the body suggest that they result from the separation of the hide at the feet, but simple carcass disarticulation cannot be ruled out. Dismembering cuts, in general, are meant to separate animal carcasses into manageable or edible portions; thus, there is a certain near-universal logic in where to aim such blows: namely, along paths of least resistance at joints or weak points of bones (Lyman 1987:283). Therefore, other than identifying a unique instrument used in the process, dismemberment in and of itself may provide little information about identity.

Eighteen butchered bones exhibit knife or flake cuts located at or near the middle of the bone fragments and running in either medial-lateral or anterior-posterior directions. The location and directionality of these marks suggest that removal of meat was the goal. Two additional bones, both artiodactyl limb-bone fragments, bear scars from larger tools (in one case certainly a cleaver), stemming from actions related to reducing the size of the meat cut, perhaps to fit into a pot or for redistribution. One of these marks was made with a metal cleaver in an anterior-posterior direction at midshaft, and the other bone was split by a tool in a proximal-distal direction. With two exceptions, all of these marks were made on leg bones or ribs of medium-sized (mustelid-sized) to very large (deer-sized) animals; one set of marks is visible on a long bone of a small (rodent-sized) mammal, and another is found on the ascending ramus portion of a deer-sized mandible. In addition, three canid bones, probably from dogs, bear two certain filleting marks and one mark (on a metacarpal) from either dismembering or skinning. This, of course, means that dog flesh was eaten in two cases and possibly a third. The inclusion of the dog bones with butchering marks, in addition to

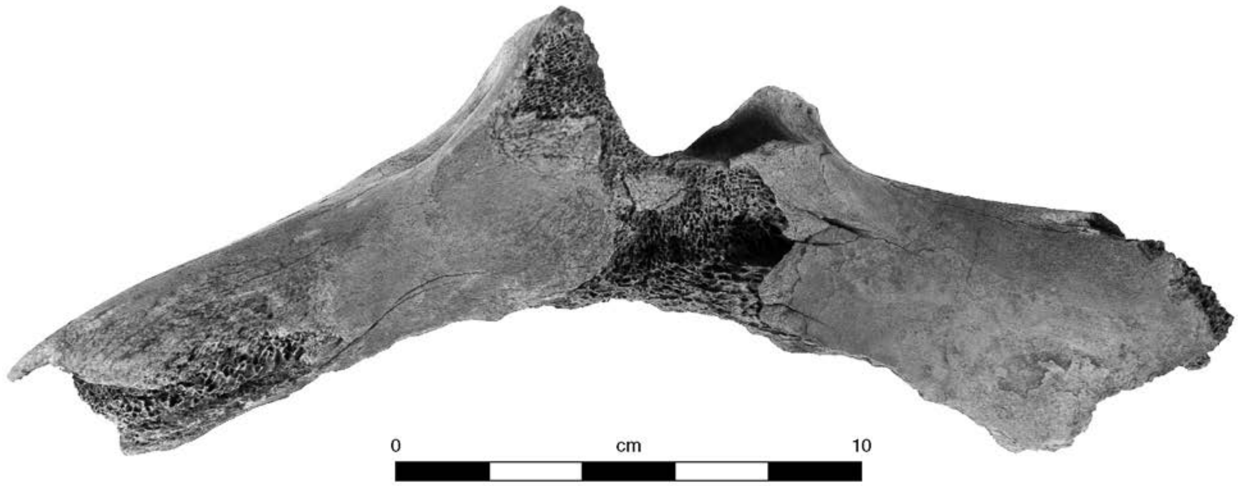

Figure 231. Cow pelvis from LAN-211, Unit 429, Level 66.

butchering marks on a variety of other wild fauna that probably were not eaten by the nascent European community in the area, indicates that native culinary traditions continued to exist along with those introduced by the Spanish.

Skinning was the final action discernible in the assemblage of butchered bones, aside from the nine bones featuring cut marks whose purpose was not apparent. Five mammal bones, including the pronghorn phalanx from LAN-2768 and the canid metacarpal from LAN-62, have "slicing" marks (Greenfield 2006), made by either unretouched flakes or metal blades, whose placement on bodily extremities not bearing meat or fat suggests hide removal (Binford 1981:106–107) (Figure 232). It is possible that the cut marks on a Guadalupe fur seal astragalus from LAN-211 (Figure 233) were inflicted during skinning. Unfortunately, this possibility cannot be substantiated given the divergent anatomy of sea vs. land mammals; the current zooarchaeological literature (e.g., Binford 1981) reports only on the impact of butchering on land-mammal bones. Without further analogical insight, it cannot be ruled out that the incisions could have been made during disarticulation of the lower rear limbs during carcass division and initial meat processing (cf. Binford 1981:119–121). In any event, it is apparent that taking hides was one of the goals of hunting and butchering. The animal species for the bones bearing these suggestive marks again indicate maintenance of an independent economy and, by implication, identity, because the Spanish colonizers were interested in cattle hides rather than those of wild game or, especially, canids.

Discussion and Conclusions

The sample of butchered bones from the PVAHP sites demonstrates continuity of earlier practices as well as new, presumably European, ways of harvesting meat from animal carcasses. The assemblage, unlike others from Spanish colonial California (cf. Langenwalter and McKee 1985), does not display many specific meat cuts attributable to Spanish food preferences. No doubt this is in part due to the sample, which is both relatively small and highly fragmented. Yet the fragmented nature of the bones studied may be indicative of continuity in native practices, despite the presence of European animals and tools. That is, the bone fragmentation, coupled with numerous hammer marks, argues for a strong interest by the Gabrielino in the within-bone nutrients of marrow fat and grease. In addition, there is a persistence of stone-tool use for butchering, although it is mixed with use of metal tools.

The influence of the mission on the Gabrielino is clearest with respect to butchering implements, as when evidence of metal-tool use is apparent. However, metal tools did not immediately replace those of stone. Also, the present collection cannot demonstrate that metal tools became the dominant implements for certain butchering tasks: in all categories, whether the butchery scars resulted from hypothesized

Figure 232. Large-mammal long-bone articular end from LAN-211, Unit 441, Level 67.

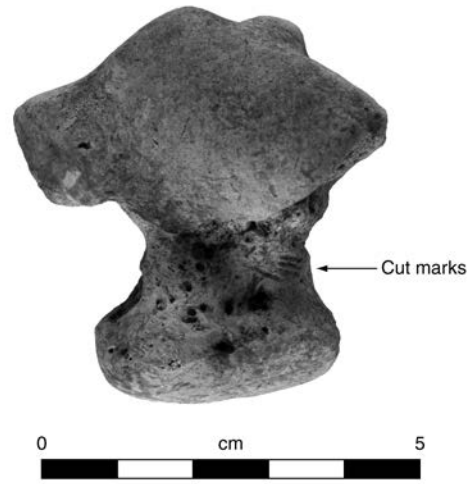

Figure 233. Guadalupe fur seal astragalus from LAN-211, Unit 107, Level 59.

dismembering, skinning, filleting, or other actions, there is a mixture of marks made by stone and those left by metal tools. One measure of the persistence of stone-tool technology is the number of butchering marks attributed to such tools: out of a total 389 butchering marks that could be assigned to a stone vs. a metal tool, 359 probably were made by a flake, hammerstone, or bifaces; the rest probably are attributable to metal tools, including saws. This preference for stone tools may or may not be an artifact of raw-material physical properties. Potts (1982:238) has suggested that metal tools are more likely to leave butchering scars than stone implements, because they are harder and sharper and so more easily penetrate the periosteum. But that suggestion is far from proven (see Lyman 1987:267), and the present data indicate the opposite. Alternatively, one can modify Potts's argument to suggest that butchers using at least some types of stone tools must apply more pressure and use more strokes to accomplish the same feat than they would have done using metal tools (Jones 1980:158–161). If that is true, then, on average, more marks might be inflicted on bones butchered using stone tools. But the discrepancy between stone- and metal-tool marks may instead reflect other factors: perhaps metal tools were scarce and thus not as readily available to the Gabrielino, even those closely associated with the mission, as stone tools (Silliman 2003). Alternatively, at least for butchering, stone and metal tools may be equally efficient.

The Gabrielino may have chosen to continue the use of stone tools as a matter of cultural resistance, conscious or unconscious, to the radical changes that the Spanish wished to impose on them (Silliman 2003). It has often been said that diet is one of the most conservative aspects of culture. If so, food technology may, by association, also be a cultural element slow to change. Greenfield (2005:183) has demonstrated that, despite the introduction of bronze metallurgy to the southern Levant during the Early Bronze Age (3300–1200 B.C.), most butchering scars were caused by stone, rather than metal, tools. That ratio changed by the Middle Bronze Age, when metal tools caused most butchering marks, but that transition occurred over as much as 500 years. That is, there was no rapid replacement of utilitarian stone tools with metal ones with the onset of the metal ages, and, indeed, stone blade production continued for centuries (Rosen 1996). Closer to the PVAHP area, Sampson and Bradeen (2006) have demonstrated that aboriginal lithic-tool production in what is now San Diego continued into the mid-nineteenth century. Although the case is often made that such "holdout" traditions were in fact attempts at resistance to change (e.g., Silliman 2003), the evidence from LAN-211 can be interpreted otherwise.

What perhaps epitomizes this mixture of technology is the single fragment of a deer bone that bears both impacts from a hammerstone and cuts from a thin-bladed instrument, probably a metal knife. Adopted metal technology was used along with stone tools for tasks that the Spanish also (separately) engaged in: skinning, dismembering, filleting, and chopping up carcasses. There was, however, no metal tool brought by the Spanish that could replace the blunt-force utility of a hammerstone for cracking open marrow and grease-rich bones. Although practices like smashing bones for marrow have been assigned to the Spanish tradition (Langenwalter and McKee 1985:111), this is questionable because the evidence comes from early Spanish settlements in California, within which Native Americans may have been living and working. The evidence from butchering tools, as well as butchering patterns, suggests not so much resistance as hybridization of technologies and traditions. Metal blades and cleavers were used concurrently with and similarly to stone flakes and bifaces, and heavy, blunt hammerstones continued to be used for opening marrow cavities.

The study of the butchered-bone collection from LAN-211 suggests that Native American dietary patterns continued into the Mission period. New tools as well as new species were introduced into the dietary regimen, but these, at least at first, complemented rather than replaced earlier traditions. In a general sense, the butchery evidence from this site compares well with that from other studies using such patterns as a means to delineate cultural identity. Langenwalter and McKee (1985:111) identified Spanish-style butchering practices and impact scars from metal implements among aboriginal neophyte-related faunal remains at the Mission San Antonio de Padua in California but nonetheless concluded that the patterning demonstrated "intercultural contact but not acculturation." The faunal assemblage from Ek Balam, a sixteenth-century lowland Maya site in the Yucatán area of Mexico produced a different pattern. Despite the presence of a friary in the village, faunal remains display mainly traditional methods of carcass processing (deFrance and Hanson 2008). This butchery pattern argues for a kind of acculturation brought on by Spanish laws restricting population movement, such that indigenous fauna were, to an extent, replaced by imported domesticates such as pigs and chickens, but aboriginal tools and cooking habits were used to process them into meals. In contrast, faunal analysis of collections excavated from probable indigenous settlements within three late-eighteenth- to early-nineteenth-century Texas missions indicates that, although hunting of native animals (and perhaps cattle as well) remained common, butchering was performed at the missions entirely with metal tools (deFrance 1999). Pavao-Zuckerman and LaMotta (2007:262) identified a preponderance of metal-tool marks on a collection of animal bones from the Spanish mission in Tucson, Arizona. Although these authors did not speculate on the implications of the butchering scars for acculturation processes among the O'odham, they did suggest that many of the cut marks relate to skinning and tallow processing, both of which produced important goods on a large scale put in place by the missions (Pavao-Zuckerman and LaMotta 2007:262–263). Those activities, as Pavao-Zuckerman and LaMotta (2007:252) pointed out, should be understood "less as evidence for the *diet* of neophytes, but as evidence of Native American labor activities in the service . . . of the mission" (emphasis in original).

The comparative evidence briefly summarized above raises the question whether the Gabrielino eagerly accepted the new technology and lifeways proffered by the Spanish or selectively resisted them. If they resisted them, perhaps they instead maintained some aspects of their culinary cultural identity and worked out a dualistic public accommodation with private resistance behavior, a pattern that, according to Silliman (2001:400), appears elsewhere at similar communities in Mission period California. Although the butchering data are, by themselves, not strong evidence from which to draw conclusions, some preliminary observations can be stated with regard to the alternatives of acceptance and resistance. Butchering scars seem much more commonly made by stone rather than metal tools, and it appears that the Gabrielino either were not able to obtain sufficient numbers of metal tools or simply saw the technology as equal or inferior to their preexisting flaked tool technology. This latter possibility is perhaps supported by the hammer marks on the bones, as apparently there was no metal instrument obtainable by the aboriginal people equal to the task of opening the bones for marrow and grease processing. The find of the single bone specimen bearing impact scars of both stone and metal tools reinforces the view that the two distinct tool technologies, as well as impacted but not acculturated identities, existed side by side for some time.

The butchering evidence reviewed here suggests a scenario different from the one proposed by Silliman (2001) for Mission San Antonio de Padua: namely, that there may have been more acceptance by the Gabrielino of European technology, and perhaps by implication, the presence of the mission. The present data portray a process of what has been called "creolization" in the archaeological literature of ethnicity, in which a subordinate group in a colonial or otherwise unequal political situation borrows from the dominant group's material culture but does not necessarily abandon all foregoing material and other traditions. More generally, this short study also demonstrates that butchering studies can contribute useful information on cultural identity and acculturation processes, something that several authors have claimed (e.g., Crader 1990; Langenwalter 1980; Seetah 2006) but others have expressed doubts about (Lyman 1987:287–289). Clearly, no generalized hypotheses of identity based on butchering style can be proposed; decisions must be made on a case-by-case basis. As Lyman (1987:289, 292; 2005) astutely pointed out, much in the nexus of butchery and identity rests on implements used and other factors, rather than the physical process of carcass division itself, which to a greater or lesser extent is constrained by carcass anatomy.

Early-Twentieth-Century Vertebrate Fauna from LAN-54, LAN-62, and LAN-193: Ethnic, Economic, and Industrial Implications

Justin Lev-Tov and John D. Goodman II

Introduction

This chapter presents the results of the faunal analysis conducted on Historical period specimens recovered primarily from the eastern area of LAN-193. In addition to faunal remains from LAN-193, a few bones from two other PVAHP sites, LAN-62 and LAN-54, are discussed. The bones from the last two sites are included within the present chapter because, although they emerged from sites primarily prehistoric or early Historical period in date, the bones exhibit modifications that make them appear to be later intrusions into those earlier deposits.

LAN-193, as reviewed in Chapter 1 (this volume), has a large refuse scatter (Feature 600; see Chapter 1 for site and feature location) in a Historical period component of the site that underwent data recovery; the results of vertebrate-faunal analysis are discussed here. This refuse feature consists of, among other classes of material culture, a large and, in places, concentrated discard of butcher-sawn retail meat cuts, along with many ceramic and glass fragments. As discussed in Chapter 8 (this volume), the ceramic and glass fragments date primarily to the mid-1920s, and the method of butchery observed on the bones is largely in agreement with that date. The primary origin of the large numbers of faunal remains in this deposit, consisting of pig bones primarily, with a few cow and chicken bones, has not been determined with certainty. Swope and Douglass (Chapter 8, this volume) have argued that the Historical period artifacts probably were from the Ocean Park Casino and restaurant in the nearby Venice/Ocean Park area just north of the Ballona. Therefore, the bones are in secondary context at LAN-193. Makers' marks on glass bottles from the refuse deposit for the most part date to a period before the merger, in 1929, of two major bottle manufacturers, Owens and Illinois. Potters' marks on the ceramics similarly date mainly to the 1920s.

During these years and before the World War II Japanese internment program in 1942, the land in this area was farmed by Japanese immigrants/Japanese Americans (Altschul et al. 1991). In addition to farms for truck crops such as celery in the general area, a large hog farm was established on this site, run by the Kitahata family (Bancroft Library, University of California, Berkeley [UCB] 2006). As many other Japanese farmers in the western United States were accused of doing, the Kitahata hog-farming operation may have acquired restaurant refuse to feed their pigs, separating out edible food items to supplement their hog feed (Blair 2006). Refuse collected by the hog farmers may be the origins of the early-twentieth-century trash deposit, possibly visible as debris strewn on the ground outside the hog-pen fence (Figure 234). In Greenfield's (1988) experiments of feeding bones to pigs, he found that they, like many species of scavengers and carnivores, favored bones laden with fat and ignored those without it. If scavengers had access to this midden, they probably would have quickly removed many of the bones from roasted/grilled steaks, bones with high fat content. Yet there are no tooth marks visible on the bones. Instead, the observed patterning in meat cuts is evidently not an artifact of scavenger ravaging, but that of other taphonomic factors, such as trampling and burning, that rendered some elements consistently less identifiable than others.

In this chapter, we begin with a brief summary of the historical background for the data recovery. The next section presents a review of the rationale for and methods of analysis, including the archaeological background of the faunal collection and the sampling strategy used to winnow the faunal sample down to a manageable yet representative size. The following section addresses ethnic differences in butchering methods, which are central to interpretations of patterns in the faunal collection. Next, we present the results of the faunal analysis: first, for the small samples from LAN-54 and LAN-62, and second, for the much larger collection from LAN-163, on which most of the interpretation is based. This section includes treatments of taxa, elements, and Historical period meat cuts present; their relative abundance; and observed butchering methods. In the final major section, we discuss the implications of this faunal collection for interpreting the site and provide insight into early-twentieth-century social and economic relationships in the Los Angeles area. We also address questions for future research concerning the nature of the Ballona area in the early twentieth century and the extent to which faunal remains aid archaeological efforts to reconstruct ethnic diets.

Figure 234. Refuse scatter next to Kitahata Hog Farm before cleanup. (Courtesy of The Bancroft Library, University of California, Berkeley; Call No. 1988.052:271-PIC.)

Figure 235. Kitahata Hog Farm after cleanup from 1924 plague outbreak. (Courtesy of The Bancroft Library, University of California, Berkeley; Call No. 1988.052:272-PIC.)

Historical Background

Data recovery in 2005 consisted of mechanical trenching and unit excavation of Feature 600. The Historical period refuse deposit was visible in trench walls as a dark line in many places, though at the western edge, two lenses of the dark material appeared separated by a non-artifact-bearing layer of light-colored sand. The types and the relative amounts of artifacts in the two lenses appeared very much the same, indicating that separation by the layer of sand was not temporal. Analysis of Historical period artifacts by Swope and Douglass (see Chapter 8, this volume) indicated that portions of the deposit were contemporaneous.

Rather than a temporal hiatus in dumping at the site, what may explain both the artifact lenses and the widespread burning evidence visible within the refuse is the City of Los Angeles's reaction to a plague outbreak. During the 1920s, there was an increasingly anti-Japanese, and generally anti-immigration/racist, attitude prominent up and down the West Coast. At the same time, in Los Angeles, there was an outbreak of pneumonic plague in 1924. During the plague, many people died, and rats were blamed for the spread of the disease (Deverell 2004:172–206). Therefore, Los Angeles and other (especially West Coast) municipalities decided to crack down on rat populations by literally hunting and killing rats with "rat pack patrols" (*Los Angeles Times*, 22 November 1924:A6, 30 November 1924:B1, B3). Specifically targeted in municipal rat-hunting and cleanup efforts were Japanese-owned and Mexican-owned businesses and communities. The Kitahata farm was among the places reported to have been targeted for rat removal and cleanup by these patrols. The digital photographic archives of Los Angeles at the Bancroft Library, UCB (2006), show pictures of the farm labeled "Kahataha [*sic*] after the cleanup from rat infestation 1924" (Figure 235). The farm buildings and fences appear little different from how they looked before the cleanup. That the buildings are still standing after the cleanup is interesting, in that numerous buildings viewed as derelict or containing rats were destroyed between 1924 and 1925 (Deverell 2004:172–206).

Faunal Analysis: Methods and Rationale

Rationale and Importance of this Analysis

As part of SRI's ongoing research in the Ballona, vertebrate-faunal analyses have been conducted at several sites (Cairns 1994; Maxwell 1998a, 2003; Sandefur and Colby 1992). To maintain comparability and consistency with recovered prehistoric-age faunal material, comparable methods of identification and description were employed wherever possible. However, the butcher-sawn bone from LAN-193 is considerably different from the prehistoric faunal material so far analyzed in earlier PVAHP reports. For this reason, methods used and specimen descriptions for this collection diverge somewhat from prior procedures. For example, in most prehistoric faunal analyses, a primary goal is to determine the species richness of a collection, and to determine the relative abundance of one exploited animal group compared to another. Other topics that are generally addressed with prehistoric collections include taphonomic issues, including bone breakage (human or natural in origin); butchering patterns; degrees of burning; and other morphological characteristics of a collection.

With late-nineteenth- and twentieth-century butcher-sawn bone/retail meat cuts, as is true for the collection analyzed and discussed here, the species richness is generally very low, consisting almost entirely of bones from domesticated mammals (primarily pig with a few cow and chicken, and very few wild animals). Thus, the primary goals shift from identification and diversity analysis to issues of meat-cut "quality," as derived from historical-period price lists (price being a surrogate measure for quality, with better-quality cuts costing more because of market forces). For instance, bone refuse from a high-status household or restaurant would probably yield many high-quality meat cuts such as (sirloin-derived) steak cuts, whereas the bone from a low-status dwelling or eating establishment would presumably yield a high incidence of lower-quality, round steak bones (Schulz and Gust 1983). In general, wealthier groups and/or fine restaurants discard bones from meat cuts of higher quality than those discarded by less wealthy groups, and often these collections have ethnic signatures (Goodman 1993, 2006; Gust 1982; Langenwalter and Langenwalter 1987). It may also be possible, in addition to social and/or economic status, to derive ethnic-group affiliations from food refuse. For instance, bones discarded from a Chinese restaurant may consist of many small, cleaver-cut pieces of meat designed to be picked up and eaten with chopsticks, yielding piles of bones looking considerably different from those from a Euroamerican restaurant of the period 80–120 years ago. In fact, faunal analysts have become increasingly interested in examining faunal collections from socially complex periods and areas of the historical-period United States, to determine ethnic patterns in the collections, as in the case of Hispanic communities or early Asian immigrants to the U.S. West (Goodman 1993; Gust 1982; Langenwalter 1980; Langenwalter and Langenwalter 1987) or enslaved Africans and African Americans in the East and Southeast (e.g., Crader 1990; Otto 1984). Such studies have found evidence of group-boundary maintenance in terms of foodways (e.g., Lightfoot and Martinez 1995), whereas others have documented the abandonment of traditions (Stewart-Abernathy and Ruff 1989). Still other studies, which remain quite popular in the field of historical archaeology, examine differences between wealthy/dominant and poor/subordinated groups, not infrequently by examining bone refuse (Ambro 1972; Crass and Wallsmith 1992; Goodman 1993; Herskovitz 1978; Olsen 1964; Schulz 1979).

Cultural differences in cuisine influence the types of animals that are consumed, the parts of animals that are considered appropriate food items, and butchering methods. For instance, the heads and feet of cattle are commonly used as food by many Hispanics, but this is no longer true for Anglo-Americans. In modern times, Anglo-Americans have generally come to view extremities and most internal organs as inappropriate food items. Within a single ethnic group, socioeconomic status can be reflected by the parts and types of animals consumed. In Anglo-American cultural traditions, superior meat cuts associated with wealthy groups often contain an abundance of discarded lumbar-vertebra sections from the so-called short-loin area (bones from T-bone and porterhouse steaks), sacrum and ilium pieces (cut from the pelvis) from the sirloin area, and bones from other areas that have high meat-to-bone ratios. Inferior cuts associated with subordinate groups often consist of various cranial parts, cervical (neck) vertebrae, the distal (toward the feet) portions of leg bones, a variety of the so-called knucklebones, and soup or tail bones (usually vertebrae or non–meat-bearing portions of leg bones). Bones from the feet, lower legs, neck, and back (the latter applied to bird elements only) were labeled soup bones in this study, a term of convenience rather than an attempt to define the dish prepared. In general, when lower-status groups purchased butchered meat from the same source as higher-status groups, the former had greater access to the lower-priced cuts, obviously those less sought after by the dominant or wealthier groups. This dichotomy becomes clouded by meal variation, ethnicity, and access. Higher-status groups sometimes used lower-priced/poorer-quality bones to make soups, broths, stews, and gravies, whereas members of some ethnic groups, regardless of their economic levels, sometimes—at least within early generations in the United States—also used such cuts to make favored dishes of their homelands. Further, household servants to the wealthy may have had access to better cuts, pilfered or otherwise obtained from their place of work, or at least may have taken and made use of refuse bone for soups, stews, and other dishes. A final complication is that, in rural areas, cuts priced high in urban areas may have been cheaper, because consumers lived on or were close to livestock farms.

Because of the way in which animal carcasses were processed by this time (by professional butchers using handsaws or powered saws to produce very similar cuts), normal recording features for PVAHP faunal remains had to be altered. That is, in addition to recording species, state of burning, element, and bone portion, we also recorded, where possible, the retail cuts represented by pieces of bone, as well as method of butchering. We also recorded, where identifiable, which skeletal elements were present (Tables 183–185), although the discussion below is based principally on meat cuts. Retail cuts were labeled using meat-cut charts, a variety of which are available online (e.g., Weber Company 2007). The most easily available charts are modern; certainly, named meat cuts have varied over the years, but in general, modern meat cuts are the same today as those used in the 1920s, with important differences due to ethnicity and a post–World War II trend toward avoiding carcass extremities.

Analytical Methods

Taxonomic classification of specimens was based on morphological attributes. Identifications were conducted by matching identifiable elements against specimens in SRI's comparative vertebrate collection. Small fragments, butchering marks, and other attributes were examined with the use of a dissecting microscope. In all cases, specimens were identified to the lowest taxonomic category possible. Recorded attributes of identifiable elements included the relative age of a represented animal (adult or juvenile), the orientation and part of an element (right, left, or axial), the degree of weathering or breakage pattern, and whether a specimen had been subjected to heat such as boiling or roasting.

Small, indeterminate fragments that lacked diagnostic attributes were placed into various categories, e.g., "unidentifiable," "very large artiodactyls," "large artiodactyls," or "medium bird." The term "artiodactyl" refers to the taxonomic order Artiodactyla, made up of hoofed mammals with an even number of functional toes on each foot. We made qualitative judgments concerning the thickness and curvature of a shaft fragment, the size of a vertebra piece, or other characteristics in order to place the fragments into a specific category. These categories are a standard means of placing unidentifiable bones into more-specific categories, although what size classes or general species they may include is not always specified or agreed upon (e.g., Landon 1996:38–39). Part of the definition problem is that different periods and different parts of the world produce faunal collections varying greatly in species composition. Zooarchaeologists who study faunal collections primarily made up of domesticated mammals generally use the category "large mammal" to mean cow- or horse-sized bones, "medium mammal" to indicate sheep-, goat-, or pig-sized specimens, and "small mammal" to refer to anything smaller (Zeder 1991:82–83). On the other hand, in prehistoric California the largest common game animal was mule deer (*Odocoileus hemionus*), and the lists of identified species include many more organisms. Therefore, Maxwell (1998b:128–129) defined the categories "large," "medium," and "small" in reference to native North American animals and with weight ranges different from those of Zeder (1991). Clearly, there is a significant divergence in body size between the average size of cattle vs. that of sheep, goats, pigs, and deer, such that a "large" category encompassing anything deer sized and larger presents a problem on historical-period sites. Another problem, aside from the integration of two conflicting size-classification schemes, is the body-size codes built into the SRI database (SRID) coding system for faunal remains. The database contains seven size categories: "Extra Large," "Very Large," "Large," "Medium," "Small," "Very Small," and "Indeterminate." No formal guidelines for weight or species ranges have been drawn up for how SRID

Table 183. Analyzed and Identified Mammalian Skeletal Elements by Taxon from LAN-193

Element	Artiodactyl	Bovidae	Cow	Canidae	Dog	Cat	Hare/Rabbit	Sheep/Goat	Sheep	Goat	Pig	Total
Astragalus	—	—	—	—	—	—	—	—	1	—	—	1
Articular surface	—	—	1	—	—	—	—	—	—	—	—	1
Carpal	—	—	3	—	—	—	—	1	—	—	2	6
Caudal vertebra	—	—	1	—	—	—	—	—	—	—		1
Cervical vertebra	4	—	1	—	—	—	—	—	—	—	2	7
Cranial	1	—	1	—	—	—	—	—	—	—	13	15
Femur	—	—	6	—	—	1	1	1	—	—	1	10
Fibula	—	—	—	—	—	—	—	—	—	—	1	1
Fourth carpal	—	—	1	—	—	—	—	—	—	—	—	1
Frontal	—	—	—	—	—	—	—	—	—	—	1	1
Humerus	—	—	8	—	—	—	—	2	—	—	3	13
Innominate	—	3	4	—	—	—	1	2	—	—	9	19
Lateral malleolus	—	—	—	—	—	—	—	—	—	—	1	1
Long bone	3,978	34	92	—	—	—	—	—	—	—	5	4,109
Lumbar vertebra	—	—	2	—	—	—	—	—	—	—	—	2
Maxilla	—	—	—	—	—	—	—	—	—	—	2	2
Metapodial	—	—	—	—	—	—	—	—	—	—	2	2
Metatarsal	—	—	—	—	—	—	—	1	—	—	—	1
Metatarsal 1	—	—	—	—	—	—	—	—	—	—	3	3
Metatarsal 5	—	—	—	—	—	—	—	—	—	—	1	1
Navicular	—	—	—	—	—	—	—	1	—	—	—	1
Patella	—	—	—	—	—	—	—	1	—	—	—	1
Phalanges	—	—	—	—	—	—	—	—	—	—	9	9
Phalanx 1	—	—	—	—	—	—	—	—	—	—	2	2
Phalanx 2	—	—	—	—	—	—	1	—	—	—	1	2
Phalanx 3	—	—	—	—	—	—	—	—	—	—	2	2
Radial carpal	—	—	—	—	—	—	—	1	—	—	—	1
Radius	—	—	1	—	2	—	1	—	1	2	1	8
Rib	80	—	135	1	—	—	—	—	—	—	5	221
Sacrum	1	—	—	—	—	—	—	—	—	—	—	1
Scapula	2	—	5	—	—	—	—	—	—	—	9	16

continued on next page

Element	Artiodactyl	Bovidae	Cow	Canidae	Dog	Cat	Hare/Rabbit	Sheep/Goat	Sheep	Goat	Pig	Total
Tarsal	—	—	1	—	—	—	—	—	—	—	—	1
Thoracic vertebra	—	—	2	—	—	—	—	—	—	—	7	9
Tibia	1	—	4	—	—	—	—	2	—	—	—	7
Tooth, canine	—	—	—	—	—	—	—	—	—	—	2	2
Tooth, incisor	—	—	—	—	—	—	—	—	—	—	4	4
Tooth, molar	—	—	—	—	—	—	—	—	—	—	15	15
Tooth, premolar	—	—	—	—	—	—	—	—	—	—	10	10
Ulna	—	—	—	—	—	—	2	—	—	—	1	3
Vertebra	12	—	10	—	—	—	1	—	—	—	7	30
Total, analyzed sample	4,079	37	278	1	2	1	7	12	2	2	121	4,541
Unidentified	4,433	57	12	—	—	—	—	—	—	—	—	4,502

Table 184. Analyzed and Identified Avian Skeletal Elements by Taxon from LAN-193

Element	Unidentifiable Birds	California Quail	Chicken	Turkey	Total
Carpometacarpus	1	—	2	—	3
Cervical vertebra	—	—	1	—	1
Coracoid	—	—	8	—	8
Fibula	—	—	3	—	3
Furculum	—	—	1	—	1
Humerus	—	—	4	—	4
Synsacrum	—	3	2	—	5
Phalanx 1	—	—	1	—	1
Radius	—	—	6	—	6
Scapula	—	—	4	—	4
Sternum	—	—	6	2	8
Tibiotarsus	—	—	3	1	4
Ulna	—	—	3	—	3
Long bone	160	—	9	—	169
Vertebra	—	—	7	—	7
Total, analyzed sample	161	3	60	3	322
Unidentified	95	—	—	—	95

Table 185. Relative Frequency of Meat Cuts per Mammal Taxon from LAN-193

Meat Cut	Hoofed Mammals	Cow/Sheep/Goat	Cow	Sheep/Goat	Domestic Pig	Total
Arm pot roast	—	—	—	—	—	—
Back	—	—	—	—	—	—
Blade chop	—	—	1		2	3
Blade roast	—	—	—	—	1	
Blade steak	28	—	1	—	7	36
O-bone roast	1	1	1	—	—	3
O-bone steak	302	26	18	—	2	348
Rib-eye steak	—	—	1	—	—	—
Ribs, large	—	—	4	—	—	—
Ribs, back	—	—	38	—	—	38
Ribs, indeterminate	99	—	68	—	6	173
Ribs, short	—	—	2	—	—	—
Shank, indeterminate	1	—	—	—	4	5
Shank, rear	—	—	3	—	1	4
Soup bones	2,346	11	99	11	16	2,483
Square shoulder	—	—	1	—	—	—
T-bone steak	—	—	1	—	—	—
Tenderloin roast	—	—	—	—	3	3
Tenderloin steak	3	—	—	—	3	6
Total butchered	2,780	91	238	11	45	3,102
Unbutchered	5,686	53	39	1	160	5,939

Table 186. Size Classes Used for PVAHP Faunal Remains, by Exemplary Fauna

Size Class	Mammal	Bird	Fish	Reptile/Amphibian
Extra large	whales			
Very large	cattle, bison, horse, elk, porpoises and dolphins	condors	ocean sunfish, large sharks, tunas, swordfishes	sea turtles
Large	deer, pronghorn, sheep, goat, pig	geese, swans, pelicans, birds of prey	rays, smaller sharks, sheepshead, mackerels	kingsnakes, rattlesnakes
Medium	canids, mustelids, otters, hares	chicken, turkey, ducks, gulls	salmon, croakers, seabasses	alligator lizards, pond turtles
Small	ground squirrels, domestic cat, rabbits	songbirds, rails, plovers	surfperches, chubs, flatfishes, gobies	frogs, toads, garter snakes, glass lizards
Very small	rats, mice, shrews, moles	hummingbirds	herrings, sardines	salamanders

size categories are to be used. A newly formalized scheme, agreed upon by company analysts and used in the present analysis, is presented in this chapter (Table 186).

Butchering marks were examined to determine the types of cutting tools and butchering procedures. Whether a bone was hand or machine sawn can be determined by examining saw marks on cut surfaces. Although saw marks vary with the type of blade used (Mann et al. 1991), those produced by handsaws are usually coarser and less regular than rapid band-saw cuts (Reitz and Wing 1999:131–132). The sawn bones in this collection were cut with both handsaws and power saws, as determined from the striations left behind from processing (Figure 236). The direction of cuts is also sometimes distinctive; band-saw cuts are often at awkward angles, a feat possible because they are powered rather than hand operated. Butchers also sectioned carcass portions using axes, cleavers, and knives. As will be discussed below, Chinese/Japanese cleaver marks can be distinguished from "American" cleaver marks because Chinese/Japanese cleaver marks are thinner and more acute (Langenwalter 1987:81).

This faunal collection may be profitably examined through analysis not only of relative species abundance but also of

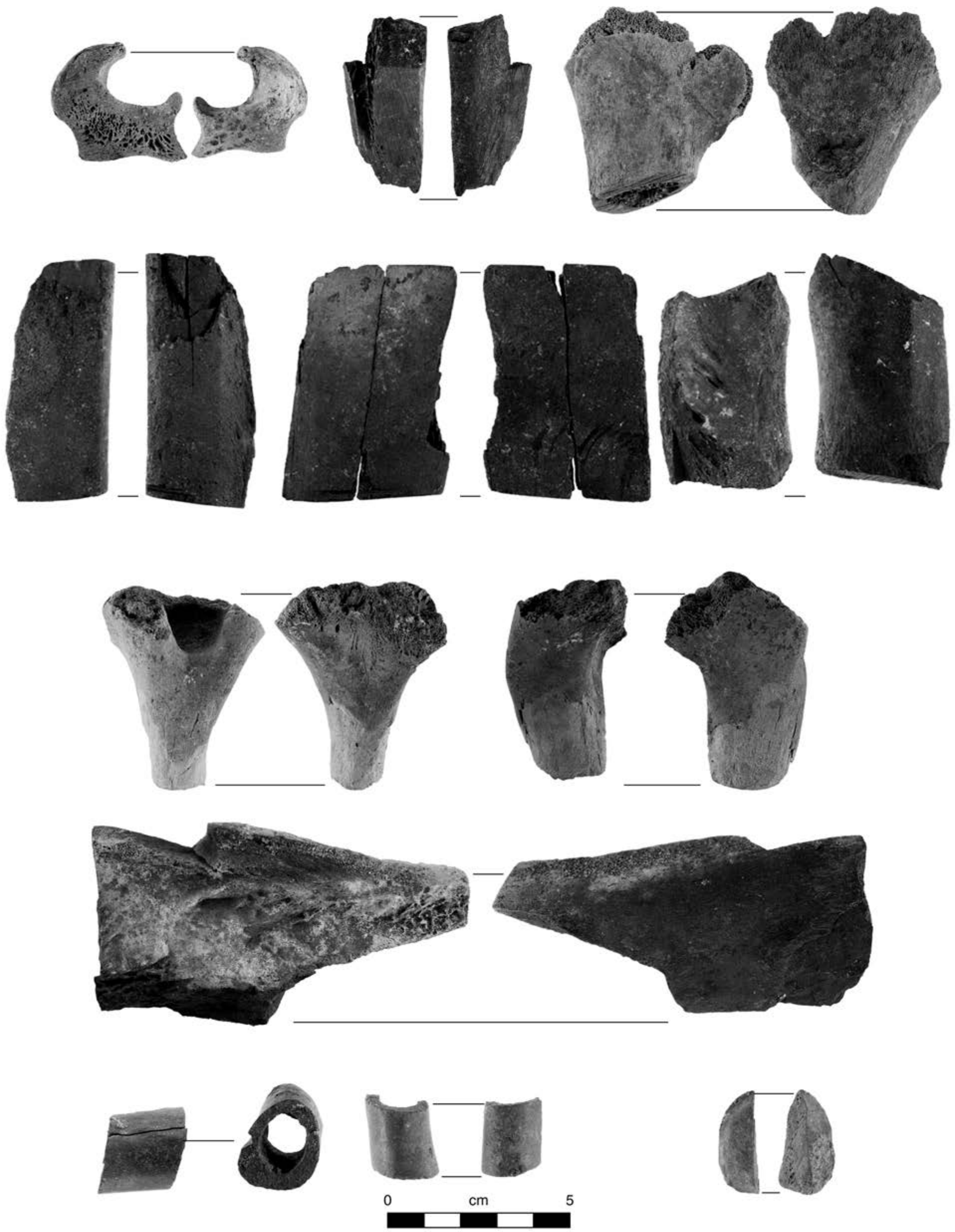

Figure 236. Bones from LAN-193 showing handsaw and machine-saw striations.

patterning in identifiable retail cuts of meat. The qualitative value of meat cuts is an additional way to examine a faunal collection from a period when meat cuts were produced according to a standardized pattern. This is possible because available cuts were priced according to factors like number of such cuts per carcass, the difficulty of producing such a portion, and the esteem with which the buying public held various pieces of meat and species of meat-producing animals. Schulz and Gust (1983), for instance, argued that they could detect economic differences among three late-nineteenth-century Sacramento establishments (a jail, a saloon, and a hotel restaurant) by relating meat cuts found to contemporary price lists for beef cuts. Not having such detailed records at our disposal, we instead more generally ranked the cuts by relative value. Meat-cut rankings were guided by the idea that rear-leg roasts, steaks, and chops were more highly valued than those from the front leg, which in turn had higher values than most midbody cuts from the ribs and vertebral column. In turn, torso-meat portions were ranked higher than those from the head or extremities (feet and tail). Identified cuts were eventually collapsed into four categories: high (steaks, roasts, and chops from the rear leg/pelvic girdle and front leg/shoulder), medium (rib and backbone), low (head, feet, and tail), and indeterminate (Table 187), based on existing standards derived from Anglo-American population views. We, of course, recognize that Asian Americans may well have had different meat-value perceptions, but these are not readily available in period literature. Also, they may have bought meat from Anglo-American markets and thus had to pay according to the dominant population's pricing.

Quantification of the sample was based on the total NISP per taxon rather than the MNI values. This basic measure was used because meat distribution in an urban area where the parts of many different animals were being circulated would preclude the deposition of whole animals, or even necessarily of most of the meat from individual animals. In addition, given that the bone sample appears to be refuse collected from a wide area and dumped as trash/hog swill, there is even less reason to suppose that a quantification based on individuals would produce meaningful results. The research questions we have posed for this bone collection have to do with detecting socioeconomic as well as ethnic patterns of meat consumption. The East Asian association of this site makes these subjects natural to investigate, because it may be possible through zooarchaeological analysis to trace maintenance of ethnic boundaries as well as to examine the class position of at least a part of this immigrant community. Both subjects of investigation center on the presence/absence and relative abundance of various carcass portions, rather than the relative frequency of species. Thus, the meat cut is the most natural unit of quantification and analysis.

On prehistoric and historical-period sites, postdepositional modifications to bones can be important. Because of the time elapsed since deposition in prehistoric sites, such taphonomic factors assume greater importance, but nonetheless they should not be overlooked in historical-period contexts. Therefore, both degrees of burning and weathering stage (following Behrensmeyer 1978) were recorded, by means of the same categories used for the vertebrate remains in the PVAHP. Weathering, however, was not evident on any of the bones from this deposit. All examined bones were equally well preserved, and none showed weathering beyond Behrensmeyer's (1978) Stage 1, where the bone's cortical surface has started to crack and flake away.

Much of the cracking visible on the bones in this collection, however, may result not from prolonged aerial exposure but from burning. In fact, approximately 35 percent of the bones were burned to some degree (Table 188). Burning can cause bones to crack and the surface to exfoliate, depending on the intensity and duration of the burning and the bones' proximity to the fire (Bennett 1999). The high proportion of burned bones here is probably not related to food preparation but instead either to periodic burning of the garbage or to burning of the garbage during the cleanup of the farm in the midst of the 1924 rat infestation and plague outbreak. Table 188 demonstrates that the proportion of burned bones for each of the taxa most frequently present is similar, ranging between 30 and 40 percent. If the burning were related to food preparation, one might suppose that, for example, steak and roast bones from cattle might be more frequently burned (being subject to direct heat from skillets or fires) than chicken bones (normally cooked in hot oil or roasted in ovens). In addition, of the three types of burning recorded—blackened, partially burned, and calcined—the last is by far the most common, with 74 percent of burned bones reaching that stage. Bones exposed to fire during cooking do not normally become calcined. Rather, various bone-burning experiments show that that level of color change is reached only under conditions of very high temperatures in combination with prolonged and direct exposure to fire (Bennett 1999; Buikstra and Swegle 1989; Shipman et al. 1984; Stiner et al. 1995).

Ethnic Butchering Methods in Early-Twentieth-Century California

Japanese/Chinese Butchering Methods and Patterns of Animal Use

Historically, by the early twentieth century, the Ballona region had a relatively large Japanese population consisting of truck farmers and other types of farmers (Altschul et al. 1991). Nearby urban areas had large Japanese and Chinese immigrant communities, and within these ethnic communities were abundant "Oriental/Eastern" restaurants. From historical data, we can draw a picture of the Ballona, during the first quarter of the twentieth century, as a farming community made up

Table 187. Cut Qualities by Taxon of Domesticated Mammal from LAN-193

Taxon	Common Name	Indeterminate	High	Medium	Low	Total Bones with Identified Butchery Marks
Artiodactyla	hoofed mammals	8,472	—	33	9	42
Bos taurus	domestic cow	227	5	20	25	50
Ovis/Capra[a]	sheep/goat	4	—	—	12	12
Sus scrofa	domestic pig	93	3	11	14	28
Total bones with identified butchery marks		8,796	8	64	60	132

[a] Category includes bones identified as goat, sheep, and sheep/goat.

Table 188. Amount of Burning Visible, by Burn Category and Taxon, on Bones from LAN-193

Taxon	Common Name	Unburned or Slightly Discolored	Blackened	Calcined	Partially Burned	Percent Burned	Total
Artiodactyla	hoofed mammals	5,043	745	2,648	—	40	8,436
Aves	birds	209	38	75	—	35	322
Bovidae	cattle, sheep, and goats	73	16	2	—	20	91
Bos taurus	domestic cow	196	47	13	21	30	277
Callipepla californica	California quail	2	—	1	—	33	3
Canidae	dog/wolf/coyote	—	—	1	—	100	1
Felis catus	domestic cat	1	—	—	—	—	1
Gallus gallus	domestic chicken	39	17	—	4	35	60
Leporidae	hares and rabbits	7	—	—	—	—	7
Meleagris gallopavo	turkey	3	—	—	—	—	3
Osteichthyes[a]	bony fishes	41	5	3	36	52	85
Ovis aries	domestic sheep	2	1	—	—	33	3
Capra hircus	domestic goat	2	—	—	—	—	2
Ovis/Capra	sheep/goat	7	3	2	—	42	12
Mammalia	mammals	1,140	—	26	—	2	1,166
Phasianidae	fowl-like birds	2	—	—	—	—	2
Sus scrofa	domestic pig	93	25	3	—	23	121
Unidentifiable		2	—	3	—	60	5
Total		6,862	897	2,777	61	35	10,597

[a] This category includes fish bones identified to more-specific taxonomic categories.

primarily of Japanese immigrants who were probably in frequent contact with the Japanese urban enclaves (and perhaps Chinese enclaves as well) within Los Angeles proper.

Working on the faunal remains from historical-period Chinatown in Riverside, California, Langenwalter (1987:83) reported that Chinese butchering techniques in the United States were a hybrid of traditional Chinese methods and Anglo-American procedures. We assume that Japanese butchering methods were analogous to the historical-period Chinese patterns. Retail cuts produced by Chinese storekeepers (doubling as butchers) were probably obtained from wholesale cuts from slaughterhouses located outside the Chinese community. This sequence may, in part, account for a variety of different types of butchering marks observed on the recovered bone. Chinese butchers either integrated the use of Anglo-American meat saws to cut bones that were too large to be cut with traditional Chinese cleavers or obtained such portions already cut from slaughterhouses.

Traditional Chinese butchers make use of cleavers that are thinner and sharper than standard Anglo-American ("American") cleavers (Langenwalter 1980). The use of Chinese cleavers on bones can be distinguished from use of American cleavers because Chinese cleavers leave more steeply angled and thinner marks on bone than do thick-bladed American cleavers. Use of the handsaw made possible the production of American cuts such as shoulder steaks, rib steaks, and round steaks; this involves the sectioning of larger bones. That is, no longer did butchers have to follow the animal's anatomy, cutting at joints; instead, they could cut wherever most convenient to produce desired portions. These types of cuts were recovered from nineteenth-century Riverside's Chinatown (Langenwalter 1987:101). However, typical Chinese retail cuts made with a cleaver were also recovered, with an especially high incidence of Chinese-cleaver cuts on pork ribs. Chinese meat cuts are generally consumed with the use of chopsticks, which conditions to a large extent the size of retail meat cuts that are generated. Because knives are not used at the table, much of the meat sold for direct consumption is cut into small pieces that can be handled with chopsticks. Meat cuts purchased from the market that have not been reduced to the appropriate size for the use of chopsticks are generally further reduced in size ("chopped") at home.

Chinese/Japanese cuisine also uses more-varied meats/animal taxa than those in the Anglo-American diets of the era, and many different animal products are also used as medicines (Goodman 1987). Chinese cuisine also uses different quantities of the same animals used in Hispanic and Anglo-American cookery. The vertebrate-faunal remains recovered from Riverside's Chinatown included cow, sheep, pig, horse, deer, rabbit, dog, cat, rat, turtle, lizard, and snake; pork is more common than other meats (Langenwalter 1987). Asian geckos, as well as rats and snakes, were also used in traditional medicines (Goodman 1987). The bones of cattle, sheep, and pigs are typically recovered from Chinese, Hispanic, and Anglo-American sites, but in the western United States, pork is generally dominant only in Chinese and Japanese collections. The Chinese and the Japanese traditionally regarded cattle primarily as beasts of burden rather than as a food source; this may be the reason why beef and mutton were eaten far less frequently than pork. It is also quite possible that affordability was a factor in meat choice. In this period, after railroads with refrigerated cars had made meat from midwestern slaughterhouses a regular cargo item, prices depended more on the cut than the kind (Schulz and Gust 1983). Many traditional Chinese and Japanese were Buddhists, and they may have consumed lower quantities of large domestic animals than did many other ethnic groups. This may have been true even though, with cultural developments in late-nineteenth-century Japan as well as acculturation in the United States, it was no longer taboo for Japanese Buddhists to eat meat (Uchiyama 1992). The condition of this faunal collection prevents firm conclusions about the relative abundance of mammalian species. Certainly, cattle appear to be about twice as abundant as pigs, but this may be an artifact of preservation, given that many of the otherwise unidentifiable large-mammal and artiodactyl bones could well be those of hogs. Still, the prevalence of cow, very-large-mammal, and artiodactyl bones, especially professionally cut steak bones, presents a challenge to the ethnic-Japanese interpretation. It may be that this is a mixed trash deposit collected from a variety of sources, Asian businesses and households among others, and is neither an exclusive product of Los Angeles's early-twentieth-century Asian quarter nor related to the Kitahata hog farm, except by circumstance of proximity.

Anglo-American Butchering Methods and Patterns of Animal Use

During colonial times, individual farmers slaughtered their own livestock and "packed" some of the meat in salt and/or smoked it. Early urban dwellers depended on local butchers for their fresh and cured meat supplies. With the development of railroads by the mid-nineteenth century, the transport of barreled preserved meat, and even fresh meat, from countryside to city, packed in ice and sawdust, became much more feasible. The innovation of refrigerated railroad cars in the late nineteenth century made such midwestern cities as Chicago and Cincinnati the focal points of a new, highly centralized meatpacking industry.

Before the development of railroad refrigerator cars and the large-scale dressed-beef trade of the late nineteenth century, the fresh-meat business was primarily in the hands of local butchers. Meat retailers either killed livestock themselves or purchased dressed carcasses from farmers. Specialized Anglo-American slaughterhouses date to around the mid-nineteenth century. Initially, animal by-products (heads, feet, bones, and internal organs) were considered waste material (Ives 1966). Many of the early slaughterhouses were situated on streams and rivers, where this waste could be disposed of with minimal effort. Around the turn of the century and earlier, some destitute groups such as Native Americans regularly scavenged slaughterhouse waste for food (Goodman 1993).

Anglo-American butchers generally produced dressed beef, pork, and mutton carcasses using the butchering methods brought to the New World with European settlers; these methods were maintained because of the popularity of British cookbooks necessitating Continental cuts of meat for recipes (Tobias 1998). With beef carcasses, heads and feet were removed, internal organs were discarded, and the carcasses were sawn or hacked in half. Each side of beef was further divided into fore- and hindquarters for easy handling. These primary or wholesale cuts were further portioned into standard (secondary) retail cuts such as steaks and roasts (see Ives 1966; Lyman 1977; Schulz 1979). Axes, knives, and cleavers were the primary butchering tools of the early Anglo-American butcher. Meat saws were employed to cut larger bone. According to some authorities on the U.S. meat industry (e.g., Dansie 1979:358–359; Gust 1983:344), powered machine saws were employed in the early twentieth century, but some qualify this date of introduction, arguing that they were not introduced into the western United States until around 1929, and in some cases not for another decade (Langenwalter 1987:83). Early Sears, Roebuck and

Co. catalogs in 1897 and 1902, as well as a contemporary Montgomery Ward & Co. catalog of 1895, offered a variety of powered circular saws, band saws, and other types of saws, but none meant specifically for cutting meat (Bounty Books 1969; Dover Publications 1969; Israel 1993). Some 20 years later, meat-cutting band saws were still not advertised in the Sears, Roebuck and Co. catalog of 1927 (Mirken 1970). Nonetheless, a set of improvements to various models of powered meat saws existing at that time was patented in the mid-1920s by an employee of a Pennsylvania saw-manufacturing company (Jull 1926), indicating that in at least some areas of the United States, powered meat saws were already widespread by that time. Mail-order-catalog companies prided themselves on being able to bring the latest technological innovations to the most far-removed rural parts of North America. Therefore, the companies' catalogs can be used to document the appearance of new inventions and, to an extent, the public's demand for them, such that the lack of powered meat-cutting saws may mean that this technology was not yet available, or at least had not yet become popular, in the early-twentieth-century western United States. Alternatively, perhaps powered meat saws were simply items considered too specialized for such catalogs to carry; the saw marks on the bones themselves may help to clarify this situation. In fact, close examination of saw marks on the bones belies the use of both powered saws and handsaws (see Figure 236). Some of the sawn areas of the bones appear very smooth, with nearly invisible striations. Other examples, however, are rougher, with coarse striations, incomplete saw cuts, or stop-and-start marks where the saw skipped out of the groove; all of the latter are typical for handsaws.

Sampling Strategies and Results

Most of the analyzed artifacts were taken from Feature 600, the early-twentieth-century refuse deposit. Because of the large number of artifacts excavated from the trenching operation at LAN-193, as well as the artifacts' redundancy, a few proveniences and an uncontrolled grab sample of materials pulled out during mechanical operations were selected for analysis by the project directors. Chronologically diagnostic artifacts, but not faunal remains, were saved from the grab sample. Faunal remains were saved and studied from two control units (CUs 4 and 5), as well as from TR 6. The faunal remains within that sample form nearly the entire collection reported on here. Those three units produced 10,597 bone fragments, which a pilot study suggested were redundant in terms of species and body portions. Therefore, the very large sample from CU 4 was further reduced, and only 25 percent of the total was examined, having been selected with a splitter device in the archaeological laboratory of SRI in Redlands. In addition, the entire small samples of bone produced by the excavation of CU 5 and TR 6 were examined. In addition to the bone collection from LAN-193, as mentioned at the beginning of this chapter, small samples from PVAHP sites LAN-54 and LAN-62 have been included in this report. These are briefly discussed immediately below; an in-depth analysis of the large sample of bones from LAN-193 follows.

Sawn Bones from LAN-54 and LAN-62

A primarily prehistoric site with Historical period features, located along Ballona Creek, LAN-54 produced only a very small collection of faunal remains. Archaeological data recovery at the site (a combination of mechanical trench excavations and hand-excavated units) revealed two components to the site: one prehistoric and one Historical period (Keller and Altschul 2002). The bones described here originate from control units rather than from discrete features. The three specimens recovered were of large mammals, probably sheep or goats, although pigs are also a possibility (Table 189). Each of the fragments was butchered with a saw; for that reason, we decided to discuss them in this chapter rather than in Chapter 11. As determined from the method of butchery, the bones presumably date to the last quarter of the nineteenth century or, more probably, to some time in the twentieth century. Thus, these faunal remains are presumably late Historical period in origin, having found their way into the site through one of the several Historical period dumping or construction features discovered there (Keller and Altschul 2002).

One of the fragments from LAN-54 is an unidentifiable unfused epiphysis of a limb bone, probably the distal radius, sawn in a medial-lateral direction. Possibly, the bone was sawn in this manner in order to separate the foot (waste) from the upper limb (Figure 237). This fragment would have stayed with the upper limb after butchery but would have separated after deposition, when the cartilage holding the epiphysis remainder in place decomposed. A second fragment was sawn from the ilium portion of the pelvis, in an anterior-posterior

Table 189. Historical Period Butchered Bones from LAN-54

Taxon	Common Name	Element	Saw Directionality	Meat Cut
Ovis/Capra	sheep/goat	radius	medial-lateral	butchering waste
Ovis/Capra/Sus	sheep/goat/pig	pelvis	anterior-posterior	steak/chop
Ovis/Capra/Sus	sheep/goat/pig	rib	anterior-posterior	indeterminate

direction (Figure 238). This is the most recognizable fragment of the three, in terms of what meat cut was being produced by the butchery. The piece clearly formed the bone embedded in a steak/chop of good quality, made of the highly esteemed pelvic-girdle muscles of the animal. The final piece from this site is a small (approximately 1-by-2-cm) shaft fragment of a rib, with saw cuts visible proximally and distally (Figure 239). The sawing apparently intentionally formed a miniscule rib cut, which could not have had much meat on it. Possibly, this is an example of East Asian butchery, in that the portion was cut small enough to be picked up with chopsticks.

Two of the three bones from LAN-62 are, like those from LAN-54, from sheep- or goat-sized mammals; the third is from a cow (Table 190). All three were sawn. LAN-62 is a complex site with a long span of occupation, both prehistoric and in the Historical period. The material from LAN-62 analyzed in this chapter dates to the late-nineteenth- and early-twentieth-century deposit, which is physically and temporally separate from the prehistoric and early Historical period deposits. Although sawing is an old European method of butchering animal carcasses, the method was not in widespread use before the introduction, by the late nineteenth century, of meatpacking houses and mass production of meat cuts, with the concomitant need for standardization, to which the saw lent itself. One of the three bones is the humerus of a sheep or goat (Figure 240) at least 3 years old at the time of its death, as determined from the fusion of the proximal epiphysis (Silver 1969). The bone was found within Feature 677. The distal end of the humerus was sawn off; the saw traveled in a medial-lateral direction. Striations from the saw are so fine that they are barely visible on the bone. Although this is usually a marker for a power saw, that does not seem to be true here. The saw marks continue only approximately three-quarters of the way across the bone before the cut was completed by snapping the remainder away. A combination of sawing and snapping was a technique typical at least of premodern surgeries with handsaws (Mann et al. 1991); the same may be assumed for animal butchery. The resultant limb portion must have formed a large shoulder roast, probably of mutton. A second piece of sawn bone, a rib-shaft fragment, is probably from a cow and shows saw marks that travel in an anterior-posterior direction (Figure 241); it was found within the same context as the previously described humerus. The piece of bone was clearly sawn by hand; a partial saw mark is visible just above the complete one. During butchery, the narrow saw blade evidently jumped from the partial groove, and the sawing was restarted in a new groove slightly below the first. This rib shaft is much bigger than that from LAN-54 and therefore may be from an Anglo-American butcher, given that, in this tradition, such cuts were meant to be eaten with the hands and not with implements. The final piece of bone from LAN-62 is a limb-shaft fragment, either a humerus or a femur, from a sheep or goat (Figure 242); it was found in EU 560. The specimen was sawn both proximally and distally, leaving a piece of bone approximately 1 cm thick, which originally, before (presumed) postdepositional breakage, would have formed a round, O shape. These so-called O-bones were commonly included in steaks and chops, because, with a saw as the primary butchering tool, a single animal leg could be subdivided into several thin steaks.

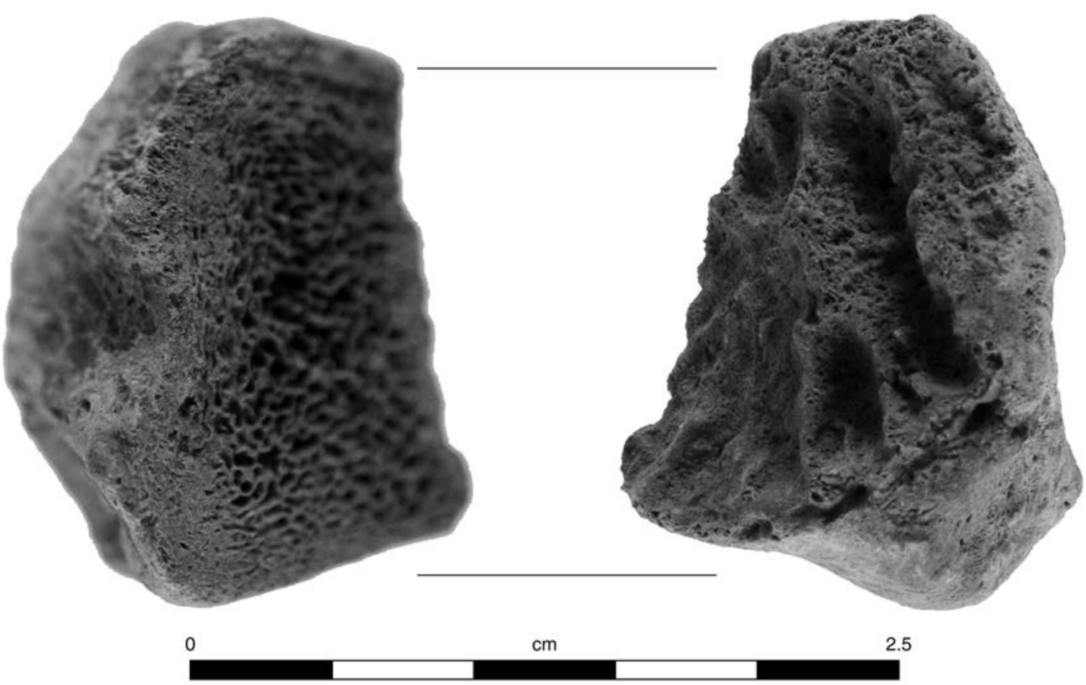

Figure 237. Sawn long-bone epiphysis from EU 3, Level 1, LAN-54.

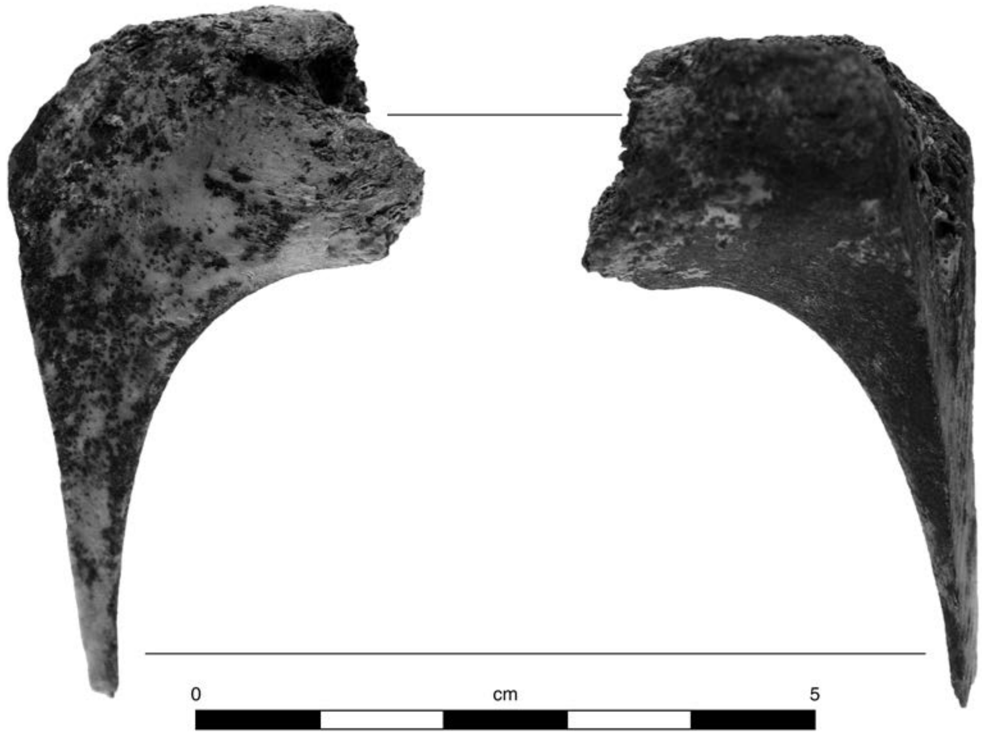

Figure 238. Sawn ilium from EU 3, Level 1, LAN-54.

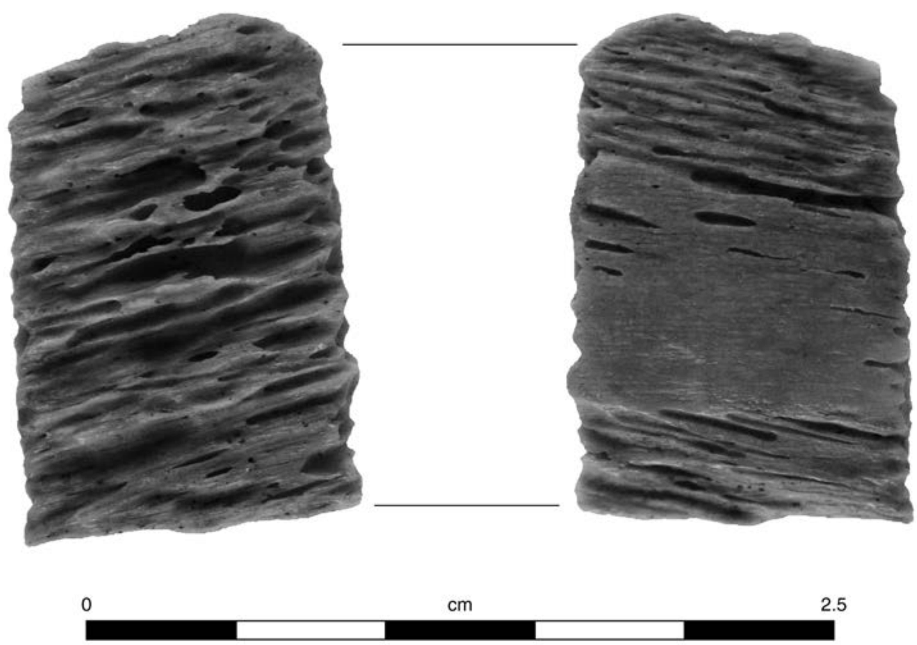

Figure 239. Sawn rib fragment from EU 3, Level 3, LAN-54.

Table 190. Historical Period Butchered Bones from LAN-62

Taxon	Common Name	Element	Saw Directionality	Meat Cut
Ovis/Capra	sheep/goat	humerus or femur	indeterminate	rib-eye steak
Ovis/Capra	sheep/goat	humerus	medial-lateral	roast
Bos taurus	cow	rib	anterior-posterior	indeterminate

Figure 240. Sheep or goat humerus from nonburial Feature 677, LAN-62.

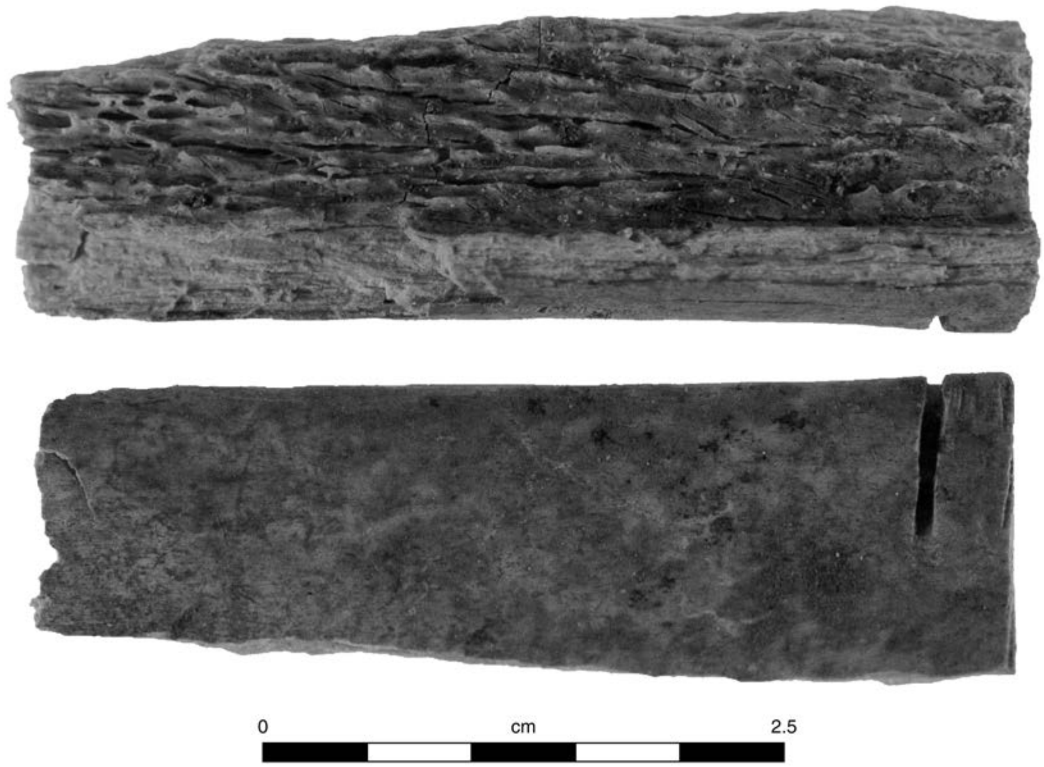

Figure 241. Sawn rib fragment from nonburial Feature 677, LAN-62.

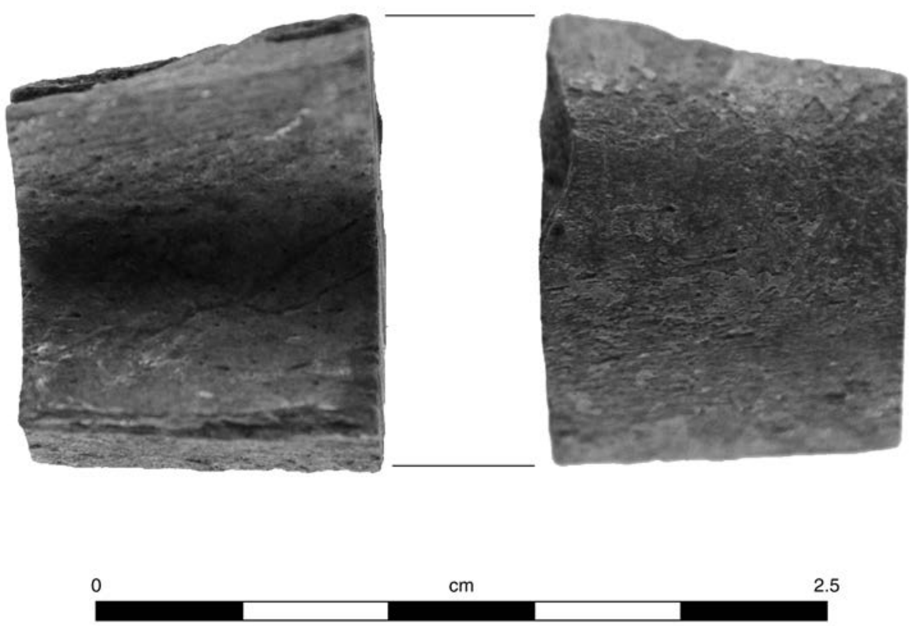

Figure 242. O-bone: sawn section of a femur or humerus from EU 560, Level 92, LAN-62.

Faunal Remains from LAN-193

In the analyzed sample of 10,597 specimens (including unidentifiable bones), 9,474 bones were identified to species or subfamily (Table 191); most of them were very small fragments weighing 5 g, on average. The relatively poor state of preservation probably results from their burning in situ, which made the bones friable. In addition, the burned bones may then have been trampled by the pigs of the Kitahata farm, although it seems unlikely that the hog farmers would have let their animals directly forage in the dump, given all the glass and other inedible trash found with the bones. Indeed, visible in Figure 234 is a fence separating the hog pens from the refuse dump. As a result of the fragmentation, we were unable to classify most of bones to species and could not identify which elements of the body the fragments had come from. The identifiable portion of the sample mainly consists of retail cuts of beef, mutton, and pork. In addition, a few rabbit, one cat, two canid (probably dog), and California quail (*Callipepla californica*) bones are present. Presumably, given the scarcity of cat and canid remains in the collection (n = 3), they are not food remains but instead are accidental inclusions, even though Asian immigrants did eat those animals (Langenwalter 1987:98). Similarly, the rabbit and quail bones also are accidental inclusions or represent only occasional food items. The most popular

Table 191. Identified Taxa from LAN-193

Taxon	Common Name	Total	Percentage of Identifiable Bones
Osteichthyes	bony fishes	7	
Actinopterygii	ray-finned fishes	18	
Pleuronectiformes	flatfishes	4	
Paralichthys californicus	California halibut	9	1.0
Embiotocidae	surfperches	1	
Sebastes sp.	rockfishes	1	0.1
Paralabrax clathratus	kelp bass	3	0.3
Paralabrax nebulifer	barred sandbass	4	0.4
Paralabrax spp.	seabasses	27	2.9
Sciaenidae	drums and croakers	3	
Trachurus symmetricus	jack mackerel	2	0.2
Sphyraena argentea	Pacific barracuda	3	0.3
Scomber japonicus	chub mackerel	2	0.2
Scombridae	tunas and mackerels	1	
Aves	birds	322	
Phasianidae	fowl-like birds	2	
Callipepla californica	California quail	3	
Meleagris gallopavo	turkey	3	0.3
Gallus gallus	domestic chicken	60	6.4
Mammalia	mammal	1,088	
Artiodactyla	hoofed mammals	8,514	
Bovidae	cattle, sheep, and goats	91	
Sus scrofa	domestic pig	121	13.0
Capra hircus	domestic goat	2	
Ovis aries	domestic sheep	2	0.2
Ovis aries/Capra hircus	sheep/goat	12	1.3
Bos taurus	domestic cow	277	29.7
Canidae	coyotes, dogs, foxes, and wolves	1	0.1
Canis familiaris	domestic dog	1	
Felis catus	domestic cat	1	0.1
Leporidae	hares and rabbits	7	0.8
Unidentifiable		5	
Total		10,597	

meat served by the (presumed) restaurants or eaten by the local inhabitants who dumped their trash here was from "very large" domesticated mammals, in other words, sheep, goats, or pigs. Bone fragments were assigned size categories by means of the criteria of thickness and degree of curvature. During the analysis, we were able to assign most of the unidentifiable bone fragments to a size category. Most of these pieces (n = 9,514) came from large mammals. We labeled a much smaller number (n = 378) very large mammals. Much of the remainder of the collection came from medium-sized birds; for these, we could not decide with any certainty whether the bones were of chickens or of birds (for example, ducks) of similar size. It is probable, but not demonstrable, that pig bones account for most of these small, unidentifiable pieces of bone, given their relative dominance among identifiable bones. Beef must have been a frequent dietary item as well, as there are many bones from "extra large" animals. Most of these are too extensively butchered or too highly fragmented to identify positively to a certain bone of the body, much less to species. Nonetheless, the thickness and mass of these bones suggest that they must be from cattle; indeed, there would have been no other food animals in this size class commonly available in the area. A final important dietary species was the chicken; bones of this species make up approximately 10 percent of the identifiable bones in the collection. What is interesting about the heavy bias toward pig-sized animals is that, according to Schulz and Gust (1983), beef was the most available meat in California by the late nineteenth century. The meat was priced according to which part of the animal it came from, and prices ranged quite a bit. If this was true, then what accounts for the overwhelming interest by the consumers or restaurant owners and patrons in pork? One possibility is temporal change: with the advent of meatpacking plants in the Midwest and the invention of refrigerated railcars to ship fresh meat safely, meat harder to obtain a few decades before was by the 1920s widely available and reasonably priced. Alternatively, the bias toward pork could have been an ethnic preference on the part of Los Angeles's early-twentieth-century Asian population; the preference for pork among California's Chinese population is well documented archaeologically (Greenwood 1996:129; Langenwalter and Langenwalter 1987:48). It has long been assumed that meat eating was not widely practiced in Japan, for religious reasons, until the beginning of the twentieth century. However, recent excavations in Japan have demonstrated that meat eating was, in fact, popular, and that—as at LAN-193—the most common animal bones are from pigs and cattle, in that order (Uchiyama 1992). Excavations at various overseas Chinese communities in California (Langenwalter 1987:71) have yielded a preponderance of pig bones compared to those of other species, usually outnumbering cow bones by far.

The data for actual meat cuts present are more revealing. Again, comparing the two dominant species, cow and pig, clear differences are apparent (Table 192). Pig bones appear, from the nature of the cuts, to have been taken from

Table 192. Relative Frequency of Meat Cuts per Mammal Taxon from LAN-193

Meat Cut	Hoofed Mammals	Cow/Sheep/Goat	Cow	Sheep/Goat	Domestic Pig	Total
Arm pot roast	—	—	—	—	—	—
Back	—	—	—	—	—	—
Blade chop	—	—	1		2	3
Blade roast	—	—	—	—	1	
Blade steak	28	—	1	—	7	36
O-bone roast	1	1	1	—	—	3
O-bone steak	302	26	18	—	2	348
Rib-eye steak	—	—	1	—	—	—
Ribs, large	—	—	4	—	—	—
Ribs, back	—	—	38	—	—	38
Ribs, indeterminate	99	—	68	—	6	173
Ribs, short	—	—	2	—	—	—
Shank, indeterminate	1	—		—	4	5
Shank, rear	—	—	3	—	1	4
Soup bones	2,346	11	99	11	16	2,483
Square shoulder	—	—	1	—	—	—
T-bone steak	—	—	1	—	—	—
Tenderloin roast	—	—	—	—	3	3
Tenderloin steak	3	—	—	—	3	6
Total butchered	2,780	91	238	11	45	3,102
Unbutchered	5,686	53	39	1	160	5,939

roasts and perhaps subsequently used in soups and stews. Other popular cuts of pork included ribs and various types of rear-leg steaks. Most of the pork cuts consisted of shorter pieces of bone (approximately 5 cm long), smaller than the equivalent cuts today. This is especially apparent with regard to ribs, which not only appear short but also generally have been segmented with a cleaver. These features may be due to different cut-production standards for that period, or perhaps they are, once again, ethnic differences, reflecting an Asian origin for the faunal remains. Possibly, the hand-sawn bones result from some processing by home or local Asian butchers, whereas the machine-sawn bones were purchased from city butchers as prepared cuts. Because most of the bones were highly burned and fragmented, the poor preservation of the sample prevented us from determining the relative value of most of the examined specimens. Within the smaller sample of bones whose relative meat-cut value could be determined, there is not much difference visible between the species: very few high-value meat cuts are present; instead, most pieces come from cuts of moderate value.

Overall, soup bones are present in the highest frequencies, followed by O-bones (Figure 243) and ribs. Soup bones have little flesh but high marrow and/or fat content. The distribution of cow bones is distinct from that of pig bones in terms of relative proportions. Ribs account for 13 percent (n = 6) of the butchered pig bones (n = 45) and 47 percent (n = 112) of the butchered cow bones (n = 238). O-bones account for only 4 percent (n = 2) of the butchered pig bones but 8 percent (n = 19) of the butchered cow bones (see Table 192). There is less disparity among the soup bones, which constitute 36 percent (n = 16) of the butchered pig bones and 42 percent (n = 99) of the butchered cow bones. Cow rib cuts are of medium value, and the preponderance of such cuts of medium value indicates that the consuming population was of some means, not poor. Thus, the difference between the two species (cow and pig) in meat-cut representation is one of degree and kind. Schulz and Gust (1983) have shown that in the late nineteenth century, price and behavioral differences were associated with using primarily steaks vs. roasts. Although the nature of the present deposit precludes testing such hypotheses, it is interesting to note that O-bones are no longer included in U.S. steaks and roasts; therefore, their presence here is a temporal marker. Southern California butchers interviewed during this project estimate that butchers began to remove O-bones from such cuts before sale approximately 20 years ago. Therefore, the presence of these bones in consumption waste can help to date a deposit between the early twentieth century, if machine sawing is visible, and the late twentieth century, when the bones should disappear from the archaeological record. Nevertheless, other temporal markers suggest use of LAN-193 in the early twentieth century. As determined from the higher frequency of soup bones (associable with Anglo-American culinary tradition) along with O-bones in lower but notable frequencies (associated with Asian cuisine), the trash deposit from LAN-193 may represent a mix of origins, coming from Asian enclaves or restaurants, as well as Anglo-American neighborhoods or businesses.

Not surprisingly, few bones from sheep and goats were identified. In the United States, with scattered exceptions such as in New England (Bowen 1975) and western Kentucky, and in Arizona among the Navajo (Root and de Rochemont 1976), lamb and mutton have never been popular. Historians and archaeologists have posited various explanations for the lack of appeal, from Hilliard (1972:142), who circularly argued that mutton was not eaten frequently because beef and pork were more readily available (see also Root 1980:11), to those who hypothesize that sheep were more vulnerable either to disease (Reitz and Honerkamp 1983:21) or to wolf predation (Miller 1988:183) than other livestock in the United States. Perhaps most difficult to believe are explanations charging that mutton spoils more quickly than other meats and that, for that reason, the U.S. public rejected it in favor of hardier meats. As Root and de Rochemont (1976) pointed out, salting mutton was already a northern European tradition by the time of colonization, and Native Americans adapted their practice of smoking venison to smoking the meat of domesticated animals introduced by Europeans. Whatever the earlier causes for the lesser popularity of the meat in North America, its market share was dealt a further blow by late-nineteenth-century competition with cattle ranchers over grazing land in the West, which led to a gradual decline in its consumption over the course of the twentieth century.

Chicken bones, as mentioned, are also numerous, but the relative abundance of avian elements cannot be directly compared with that for mammalian bones, given the differences in skeletons, animal size, and the way in which fowl vs. domesticated mammals are and were cooked and served. With respect to chickens, the most frequent elements recovered are those from the wing and neck, both low-quality cuts. Possibly, these were used in soup and/or to make soup stock or alternatively were simply thrown out and collected for hog swill. Because of their fragmented and burned condition, most elements could not be identified, but it seems that a large assortment of body parts was present. If so, that would indicate that chickens were bought and prepared whole (not including the head and feet) and that specific parts—for example, drumsticks and breasts—were not yet commercially available. Interestingly, there are clear size and morphological differences between the chicken bones in the deposit and modern ones. Whereas those in the deposit have fused ends, meaning that they were slaughtered after maturity, modern chickens do not; they are slaughtered at younger ages but are bigger because of highly selective breeding and a diet that includes growth hormones. In addition, the archaeological chicken bones have pronounced tuberosities and well-developed muscle-attachment points. Modern butchered chickens raised at "factory farms" have limited movement, preventing their bodies from developing tough muscles; therefore, their bones are not remodeled with well-formed articulations and muscle attachments.

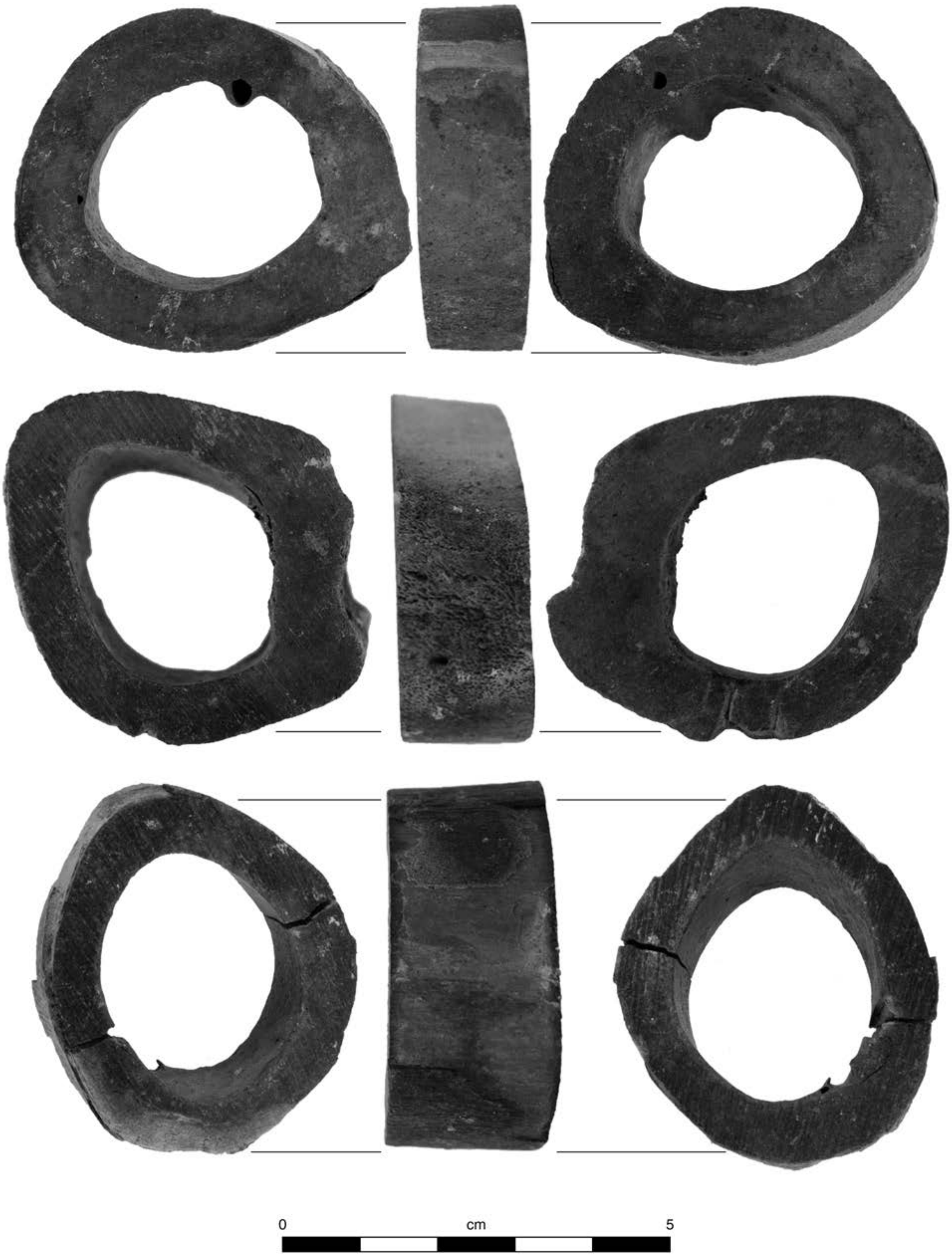

Figure 243. O-bones from EU 4, Level 1, LAN-193.

At least three other species are present, in small numbers only, including turkeys and rabbits. Turkeys have been only a minor component of American diets since the colonial era (Landon 1996), perhaps because their large size precludes them from being everyday fare, or because the chicken had already occupied a similar place in the culinary mindset of European immigrants to North America. The rabbit bones present (n = 7) are nearly all both small and juvenile. If the early regional meat markets regularly stocked rabbits, then they probably would have been domesticated animals raised in cages. Domesticated rabbits (*Oryctolagus cuniculus*) are relatively large lagomorphs (members of the order containing rabbits and hares); therefore, it seems more likely that the LAN-193 specimens are from locally occurring wild rabbits. The most common wild rabbits in the area are the desert cottontail (*Sylvilagus audubonii*) and the brush rabbit (*Sylvilagus bachmani*). The small size of most of the rabbit elements suggests that they are from brush rabbits. A market niche may have developed in the region, for specialized hunters to supply markets with easily taken fresh game such as rabbits, although why wild rabbits were available, and domesticated ones not, is a mystery, especially given that domesticated rabbits—imported from Europe centuries ago—have and had an important culinary and mythological place in China. Analysis of faunal remains from Riverside's Chinatown (Langenwalter 1987) demonstrated a similar pattern, in which domesticated rabbits, though present, were far outnumbered by wild lagomorphs, both rabbits (*Sylvilagus* spp.) and hares/jackrabbits (*Lepus* spp.).

A number of fish bones (n = 85) are also present in the collection (see Table 191) and these were identified by Ken Gobalet (California State University in Bakersfield). Given the small sample size, it is remarkable that so many species (eight identified) were present. Most of the identified bones come from species, genera, or families of fishes that can generally be found relatively close to the shore. All the fish were marine fish and did not include freshwater taxa. Those fishes include various species of flatfishes (Pleuronectiformes) as well as drums and croakers (Sciaenidae). Other species, present in smaller numbers, are more characteristic of offshore habitats; these include seabasses (Serranidae), Pacific barracuda (*Sphyraena argentea*), and pelagic fishes like tunas and mackerels (Scombridae). Most of the fish elements were vertebrae, leading us to hypothesize that the recovered fish were bought already processed—heads and perhaps internal organs and scales removed—at a market, rather than caught locally. Similarly, the variety of species identified, together with the presence of pelagic and offshore species, suggests either a commercial source for the fish or dedicated local fishermen making use of either boats or piers (such as that constructed in the early 1900s within the Venice development) to catch fishes from deeper waters. However, taphonomic and recovery processes may have biased against the recovery of skull elements. The excavated sediments were water sieved, but through relatively large (1/4-inch) screens, mesh that is known to bias against the recovery of small bones (Shaffer and Sanchez 1994). Certainly, a commercial origin for the fish bones would accord with the mammalian remains, which, to judge by the preponderance of very similar sawn pieces of bone representing standard-sized cuts of meat, also were purchased from markets rather than produced at the farms of this rural area.

Discussion and Conclusions

The collection provides insights into the various retail meat cuts that were discarded on the property at LAN-193, and to a much lesser extent, given the tiny samples, at LAN-54 and LAN-62. Because the bones at all three sites were recovered within secondary deposits, it is best to view them as a whole, reflecting the general availability, development, and consumer preferences of meat cuts during the early twentieth century. The collection also provides information on the economic status of the individuals who contributed the food refuse from Japanese/Chinese restaurants and/or households; this waste was eventually dumped adjacent to the Kitahata hog farm. At LAN-193, other evidence besides the "style" of meat cuts supports an Asian origin for the debris, as a large number of Japanese-type rice bowls were found within the midden. Nonetheless, other, nonrestaurant debris was also found there, including period medicine bottles. Possibly, the collected trash was a mix of domestic and commercial refuse from nearby areas of Los Angeles, or some locally originating household trash may have been dumped there, in addition. In any event, LAN-193 appears to be a dump with a specialized origin, given that only consumption refuse (not yard debris, building remains, or other debris) was recovered.

Butchered bones from the collection recovered from LAN-193 provide an interesting glimpse into the economic conditions and ethnic traditions of Los Angeles's Asian community of the 1920s. Nearly all the meat cuts, whether beef, chicken, or pork, were of moderate value rather than on the high or low ends of the price spectrum. Roasts provided a large amount of meat for the money, whereas steaks of less than premium value were also a moderate economic investment. The faunal evidence suggests that chickens were purchased piecemeal (although this could be a taphonomy-induced pattern). Chicken remains consist principally of low-to-moderate-range body parts, but this is logical if they were primarily used for soup. In terms of ethnicity, ample evidence from faunal remains alone seems to associate this bone collection with an Asian population. Marks from Chinese-style cleavers and the cuts of meat (primarily, smaller-than-normal sections of rib and other bones) are clues present here as well as at Chinese American sites in California (Langenwalter 1980, 1987). This collection of bones therefore adds valuable knowledge concerning the maintenance of ethnic boundaries by the overseas Asian community, perhaps not coincidentally at a time when elements of the established European-derived populations began agitating against them (Blair 2006). At the same time, the study adds to other archaeologically based analyses of dietary remains and helps to establish a pattern by which archaeologists can identify ethnic Asian enclaves where documentary materials, as in this case, are sparse.

During the course of this analysis, several interesting observations became apparent with regard to the morphological attributes of the Historical period animal bones compared to corresponding modern ones. Most of this variation between characteristics of earlier and later bones probably relates to decades of selective breeding and diet and to the confinement of modern animals without free-range habitats. For example, the Historical period pork elements are considerably more slender and have more-accentuated processes and tuberosities than corresponding modern ones. The ribs, long bones, and podials (knucklebones) of modern pigs are also considerably thicker than common ones from the Historical period. The difference between Historical period and modern chicken bones is even more striking, as discussed above. The Historical period long bones of chickens are much smaller in girth than most modern ones, and the tuberosities and processes are far more accentuated. As an example, the femur head of a Historical period chicken is very obvious, with head and neck, whereas modern chickens raised in barns and cages have femurs with small heads that are little more than nubbins projecting from the proximal shafts. The faunal collection at LAN-193, and sites from a similar period when and if encountered, therefore form valuable resources above and beyond traditional cultural/dietary questions. Such faunal remains evidently serve as temporal markers, delineating the era during which factory meat processing had already been established for several decades, but before the time when highly selective breeding and factory farming had combined to produce rather unnatural animals devoid of normal developmental-morphological characteristics. With the coming eligibility of mid-twentieth-century sites in the United States under the 50-year rule included within the evaluation process for Section 106 of the NHPA, it will be intriguing to trace the rise of factory farming as reflected in animal-bone samples. At the moment, in late-nineteenth- and early-twentieth-century faunal collections, we can demonstrate the rise of meat-cut standardization and mass production, but not yet the implementation of breeding, restricted movement, and feed regimens aimed at producing large animals as quickly as possible.

Invertebrate Faunal Remains

Justin Lev-Tov and Sarah Van Galder

The results of invertebrate faunal studies at the PVAHP provide valuable information about prehistoric human behavior and environmental interaction in the region. Invertebrate types and abundance in archaeological contexts reflect environmental changes affecting the habitats of different invertebrate species, the timing of human exploitation, and changes in prehistoric subsistence practices affecting foraging choices (Claassen 1998:6). In this chapter, we address questions of prehistoric human behavior and environmental change based on the invertebrate species present and their relative abundances in the PVAHP excavations. For additional information regarding the information presented in this chapter, please see Appendixes K.13.1–K.13.96 on the accompanying disk.

Previous archaeological excavations at several sites in the Ballona, including along the bluff tops (Douglass et al. 2005; Van Horn 1984, 1987a; Van Horn and Murray 1985; Van Horn and White 1997c) and in the flatlands along the margins of the lagoon and creeks (Altschul, Homburg, et al. 1992; Altschul et al. 1998; Becker 2003; Freeman et al. 1987; Grenda et al. 1994; Keller 1999) have indicated a long-term focus on invertebrate food resources (see Appendixes K.13.1 and K.13.2). Figure 244 shows the dominant shellfish taxa recovered from previous research at sites in the Ballona. Estuarine species were preferred across time, including venus clam, littleneck clam, Pacific calico scallop, and native Pacific oyster. During the Millingstone period, for example, the inhabitants preferred scallops, venus clam, and Pismo clam.

Venus clams dominated the collections in all but four sites dating to the Intermediate period, and at these four sites (LAN-54, LAN-193, LAN-211, and LAN-2768), they are the second most dominant shellfish type, with Pismo clam (at LAN-54 and LAN-193), scallops (LAN-2768), and abalone (LAN-211) being the most dominant. Following the Intermediate period, there was a shift from an earlier collection strategy that focused on venus clams to a more generalized strategy in the Late and Protohistoric periods, during which people seemed to harvest other species in greater proportions than earlier, particularly scallops, Pismo clams, and littleneck clams. Abalone also appears much more frequently than earlier, albeit their relative abundance is somewhat exaggerated by the shells' high weight in comparison to other mollusks.

This chapter begins with a summary discussion of the environmental setting that provides an ecological context for the study and is followed by an analytical methods section. Subsequently, the invertebrate remains from each of the PVAHP sites are discussed in turn, beginning with the sampling strategies used, a discussion of control units and features, taxonomic and taphonomic trends, and any other intriguing patterns teased out of the data. Detailed data tables and descriptive discussions are presented in appendixes. Although this portion of the report is primarily descriptive and summary in nature, interpretations are scattered throughout, and detailed discussions of analyzed contexts are presented in accompanying appendixes. Sites are presented in the following order: LAN-193, LAN-2768, LAN-54, LAN-62, LAN-211, and the Runway Sites (LAN-1932 and LAN-2676, which are of poor cultural integrity and likely represent redeposited midden). Following the descriptions of each site is a summary of diachronic trends in the Ballona.

Background

The following is a description of the major habitats exploited, the major shell taxa types recovered from these habitats, and when possible, the harvesting, processing, and disposal methods used for each of these taxa. Unfortunately, little ethnographic information is available for Gabrielino shell-procurement and -processing methods. Although several sources agree that the Gabrielino relied heavily on shellfish resources (Johnston 1962; McCawley 1996; Sparkman 1908), few go into detail concerning how shellfish were procured and processed. For this reason, we rely on ethnographic accounts of traditional shellfish economies in northern California, the Northwest coast, and northern Australia.

Environmental Setting

The Southern California Bight is home to a variety of marine habitats. The closest and most easily accessible from the PVAHP sites is the Ballona Lagoon. Over the past

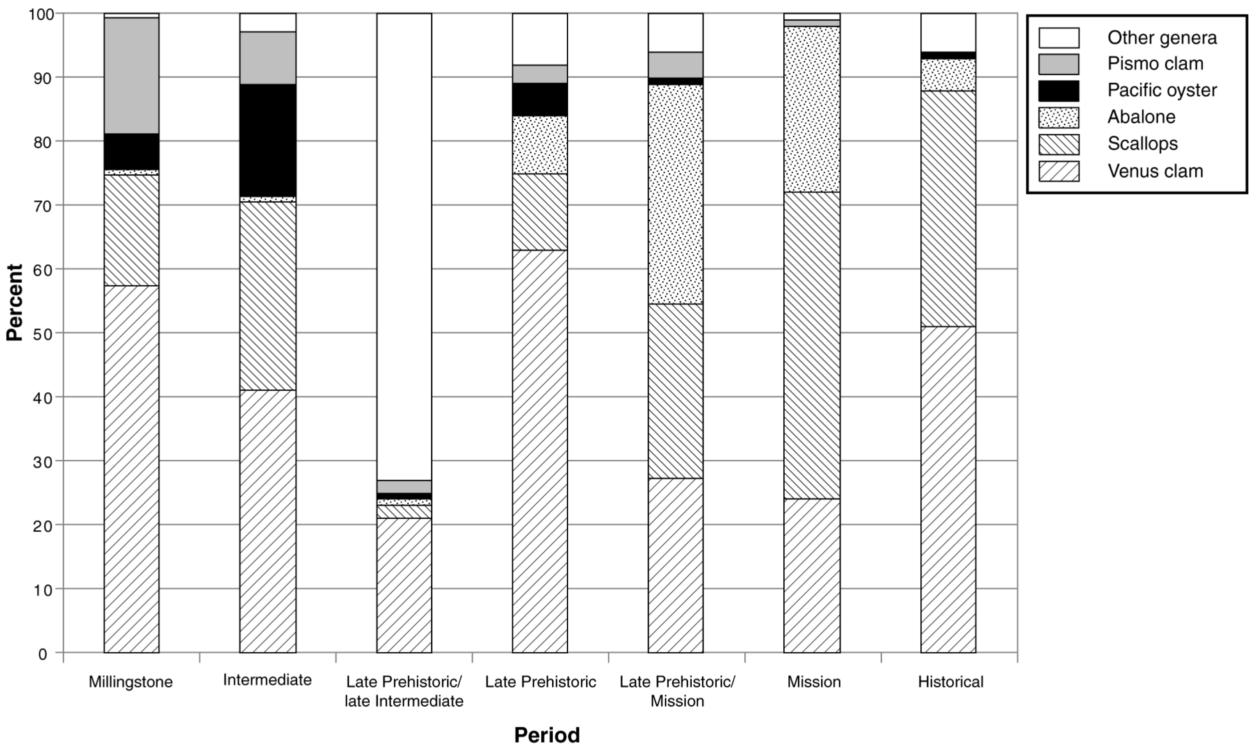

Figure 244. Dominant shellfish taxa, by period, from previous work at Ballona sites.

10,000 years, this habitat has changed from an open bay to its current state as a saltwater marsh. In addition to the Ballona Lagoon, several other habitats are present within the Southern California Bight, including rocky intertidal, shallow rocky reef, deep rocky reef, kelp beds, nearshore submarine canyon, nearshore midwater, soft-bottom, and open-coast sandy beach habitats (Salls 1988). There are also a number of deepwater habitats located farther off the coast.

Lagoon Habitats

Most of the shell taxa recovered from the PVAHP sites were likely harvested from within the Ballona Lagoon. The six most-common taxa include *Argopecten ventricosus* (Pacific calico scallop), *Chione* spp. (venus clam), *Ostrea lurida* (native Pacific oyster*), Protothaca staminae* (Pacific littleneck clam), *Tagelus californianus* (jackknife clam), and *Tresus nuttallii* (Pacific gaper). A large variety of other shellfish taxa were also either exploited or incorporated into the occupational deposits (Table 193). In many cases, shellfish species were able to be identified only to the taxonomic level of genus. Because the organisms were not identified to species, they are discussed here by their generic equivalent common names, for example, abalone instead of red/black abalone or undifferentiated abalone.

The calico scallop is typically found on the sandy or muddy bottoms of bays and lagoons below the low-tide level. Occasionally, they are found on the quiet bottoms of the open coast (McLean 1978:69). Although the calico scallop is most commonly found on the sea bottoms, McLean (1978) reported that it is also a clumsy swimmer and may occasionally be found free swimming in the open water of bays and lagoons. However, Ellis and Swan (1981:64) reported that the calico scallop found along the coast of Washington State are too heavy and not free swimming.

The calico scallop within Ballona sites is found in discrete pits and occasionally scattered throughout site matrices (Van Galder and Douglass 2005). Although little ethnographic information is available on Gabrielino scallop-processing methods, the Manhousat people of Washington State prepared scallops for consumption by boiling or steaming them in a pit. They also reported that the tribes living to the south (in California) traded for the thick shell, which was used as tokens or money or to make a dancing rattle (Ellis and Swan 1981:64). Another species of scallop, *Pectus caurinus*, was procured from a canoe by striking the water with a V-shaped alder-wood bailer. The scallops would flow or swim up from the bottom and were taken off the water’s surface (Ellis and Swan 1981:64).

Venus clams burrow close to the surface on sandy mudflats in bays and sloughs (McLean 1978). Overall, the venus clam is the most abundant species recovered from Ballona sites. The shell is found fragmented throughout the matrix at most Ballona sites. Again, we have very little ethnographic information on how the venus clam was procured and processed. It seems likely, given their habitat, that they were gathered on mudflats using a digging stick or similar tool. Lyons (1978) reported that there is evidence of year-round exploitation of *Chione undatella* at ORA-82, with a significant increase between January and

Table 193. Invertebrate Nomenclature used for the PVAHP

Taxon	Common Name
Amiantis callosa	Pacific white venus
Argopecten sp.	scallop
Argopecten ventricosus	Pacific calico scallop
Argopecten aequisulcatus	speckled scallop
Astraea sp.	turban
Astraea undosa	wavy turban
Bursa californica	California frog shell
Cerithidea californica	California horn shell
Chione sp.	venus clams (but note there are several species)
Chione californiensis	California venus
Chione fluctafraga	smooth chione
Chione undatella	wavy chione
Clinocardium sp.	cockle
Crepidula sp.	clipper shell
Cypraea spadicea	chestnut cowry
Dentalium sp.	tusk shell
Dentalium neohexagonum	six-sided tusk
Dentalium pretiosum	Indian money tusk
Donax sp.	donax
Donax californica	wedge clam
Donax gouldii	bean clam
Haliotis sp.	abalone
Haliotis cracherodii	black abalone
Haliotis rufescens	red abalone
Hinnites giganteus	giant rock scallop
Kelletia kelletii	Kellett's whelk
Lacuna unifaxciata	one-banded lacuna
Laevicardium sp.	cockle
Macoma sp.	macoma
Margaritifera falcata	western pearlshell
Megathura crenulata	giant keyhole limpet
Mytilus sp.	mussel
Mytilus edulis	blue mussel
Mytilus californianus	California sea mussel (California mussel)
Norrisia norrisi	Norris's top shell
Ocenebra sp.	dwarf triton
Olivella sp.	olivella shell (olive shell)
Olivella dama	dama dwarf olive
Olivella biplicata	purple olive snail
Orbitestella sp.	no common name
Ostrea sp.	oyster
Ostrea lurida	native Pacific oyster
Polinices lewisii	Lewis's moon snail
Protothaca staminea	common littleneck
Saxidomus nuttalli	Washington clam
Tagelus californianus	jackknife clam
Tegula sp.	turban snail
Teinostoma sp.	upright vitrinella
Tellina sp.	tellin
Tivela sp.	clam
Tivela stultorum	Pismo clam
Trachycardium quadrigenarium	giant Pacific cockle
Tresus nuttallii	Pacific gaper

April and during the period of *Gonyaulax* sp. (red dinoflagellate) infestation (May–August). The aborigines of northern Australia cooked several clams from the Veneridae family with the lips of the clam in the sand and the hinges facing upward. A fire was lit on top of the clams and allowed to burn for 8 to 10 minutes. Typically, the clams opened easily after this amount of time (Meehan 1982). The Seri, who live in Sonora along the Sea of Cortez, commonly opened clams by cracking the shells with hammerstones without cooking (Clarke and Clarke 1980; McGee 1898; Waselkov 1987).

Native Pacific oyster is commonly found attached to rocks or cement pilings near the low-tide line on mudflats and gravel bars in estuaries and bays (McLean 1978; Rehder 1996). The Manhousat collected native Pacific oyster from rocky shorelines using a stick to expose the oysters on overturned beach gravel (Ellis and Swan 1981). Once collected, the oysters were boiled or steamed in a pit. They ate only the small abductor muscle and drank the broth (Ellis and Swan 1981).

Littleneck clam is commonly found in bays and in coarse gravel under loose rocks along the open coast in the middle–lower intertidal zones (McLean 1978). The Manhousat collected littleneck clams while searching for larger clams. Similar to venus clams, littleneck clams are typically found near the surface and are easy to procure using a digging stick. Once collected, the Manhousat broke the shell to get at the edible insides, which were typically eaten raw or cooked with larger clams (Ellis and Swan 1981).

The jackknife clam is abundant in permanent burrows 10–50 cm deep on sandy mudflats in bays and offshore (McLean 1978; Morris et al. 1980). This animal is not common among the shellfish collections from Ballona archaeological sites, even though it surely inhabited the lagoon, along with the other shellfish species mentioned here.

The Pacific gaper is common on sandy bottoms at low tide in bays and on sheltered bottoms offshore, to depths of 30 m (100 feet). These clams burrow 25–100 cm beneath the surface and may be found by locating the spouts of water that they eject as they retract their siphons (McLean 1978:82; Rehder 1981:756). Again, very little ethnographic data are available for the Gabrielino as it relates to this shellfish taxon. The

Manhousat procured *Tresus copax* by using a digging stick. They had to work fast, because the gaper burrows quickly (Ellis and Swan 1981:56). They cooked and steamed the gapers in a pit or made them into chowder. They also used a shell kitchen ladle and cup to drink fish juice (Ellis and Swan 1981:56).

Sandy Beach Habitat

Two of the major shell taxa recovered from Playa sites, *Tivela stultorum* (Pismo clam) and *Donax gouldii* (bean clam), occupy sandy beach habitats. The Pismo clam is common at low tide and offshore to 9 m (30 feet) along broad sandy beaches. Another feature of its habitat requirements is that it needs constant wave action, as the agitated waters to which it is adapted carry high oxygen levels (McLean 1978; Vellanoweth and Erlandson 2004:145). This species can attain large sizes (the modern legal harvest size limit is about 12 cm) and live for a number of years even after growth stops at around 15 years of age.

The bean clam is common on sandy beaches 4–5 cm below the surface in the middle intertidal zone (Morris et al. 1980; Reddy 1996). They are most abundant in southern California during the middle of July (Reddy 1996). The bean clams likely were roasted, baked, steamed, or boiled (Reddy 1996), or possibly used in soup. Although small, bean clams provide a good source of protein (Reddy 1996). In addition, these clams were easy to procure in large numbers, because they burrow only shallowly and aggregate densely along southern California beaches.

Rocky Shore Habitat

Abalones (*Haliotis* spp.) are found in deep water in crevices or the underside of rocks between 6 and 37 m (20 and 120 feet) below the water's surface (Rehder 1981). The Yuki of northern California removed abalone from rocks by hand or with a flat iron bar and then placed them in a sack to transport them (Gifford 1939; Kroeber and Barrett 1960; Waselkov 1987). The Manhousat also used a prying stick to force the abalone off rocks. The foot was the only part typically consumed. It was usually eaten raw and also used for bait (Ellis and Swan 1981). Occasionally, the Manhousat boiled abalone and sliced it into small fillets and dried it on red-cedar bark (Ellis and Swan 1981:71). The Yuki commonly dried abalone for storage, as did the Mattole, Sinkyone, Tolowa, Wiyot, and Yurok of northern California (Gifford 1939; Greengo 1952; Kroeber and Barrett 1960; Waselkov 1987).

Methods

The list of all species that were recovered in excavated samples is long, and most of these appear only in small numbers. Therefore, in most of the tables, only the most-common species recovered from PVAHP sites are shown separately (see Appendix K.13.2 for dominant shellfish in the Ballona sites); all of the other species are combined into an "other" category. We should also note here that the taxonomic nomenclature used for shellfish varies a great deal from handbook to handbook and from one edition to the next. To clarify what nomenclature we have used in the project for each mollusk, we have included a table listing the scientific and common names of all molluscan species identified during the course of the project (see Table 193).

Shell Quantification

SRI analyzed a sample of shell from control units, burial features, nonburial features, and activity areas at each of the five major PVAHP sites, LAN-54, LAN-62 (Loci A/G and C/D), LAN-193, LAN-211, and LAN-2768. Analysis was conducted between October 2005 and June 2007.

All shell fragments larger than 1/4 inch from the sample collection were analyzed and identified to the extent possible. Previous work at LAN-62 (Keller and Ford 1998:101) showed no difference in taxonomic representation between the 1/8-inch fraction and larger sizes, despite the literature concerning vertebrate faunal remains that demonstrates such a bias (e.g., Shaffer 1992). Given the considerable effort required to analyze shell recovered from 1/8-inch screens and the tendency for the relative number of identifiable specimens to decrease with smaller screen sizes, this study includes only diagnostic shell elements that could be used for calculating the number of nonrepetitive elements (NRE) from the 1/8-inch fraction.

The shell material from each provenience was analyzed separately. Each specimen was identified to the most-specific taxonomic level possible using both standard identification guides (e.g., Brusca and Brusca 1990; Coan et al. 2000; Keen and Coan 1974; McLean 1978; Morris et al. 1980; Rehder 1996; Ricketts et al. 1985) and the SRI shell type collection. Where the guides differ in taxonomic nomenclature, we rely on Rehder's (1996) classification.

In addition to taxonomic identification, all shell pieces were weighed, and all NRE that were 50 percent or more complete were counted. NISP values were assigned to all shell fragments that could be classified to at least the family level. To determine the MNI, analysts first counted all NRE. Bivalve (Pelecypoda) quantification proceeded by counting the number of whole hinges and hinge fragments that were more than 50 percent complete, whereas for gastropods (Gastropoda), each whole shell, columella, and apex was counted. The bivalve numbers were then divided in two for an MNI count. A detailed discussion of shell quantification is presented in Appendix K.13.3.

Sampling

Sampling strategies varied by site and were guided by site character and the nature of the deposits. At each site, the analysis of the following contexts was conducted: shell from at least one control unit, items (individual shells that were collected separately) from burials and nonburial features, and items and nonitems (full analysis) from selected nonburial features. Chapter 1, this volume, presents the analyzed contexts at each site.

Invertebrate Remains from LAN-193

Four control units (CUs 11, 21, 34, and 117), two nonburial features (Features 1 and 9), and three burial features (Features 101, 214, and 216) were sampled and analyzed from LAN-193. Shell was not recovered from CU 117, nonburial Feature 1, or the three burial features. A total of 132.7 g of shell was recovered from the remaining analyzed contexts (Table 194). A detailed discussion of the analysis results is presented in Appendixes K.13.4–K.13.6.

Shell remains are extremely sparse at LAN-193, and with the exception of 5.5 g of shell (including 1.4 g of abalone and 4.1 g of unidentifiable shellfish), the remaining 127.2 g of shellfish were from early Intermediate deposits. The 5.5 g of shellfish (from CUs 11 and 21) were from late Millingstone deposits. Despite the scarcity of shell at LAN-193, the recovered shellfish are typical of Ballona archaeological sites and all but one species (abalone) could be collected nearby. CU 21 yielded relatively higher frequencies, with between 63 percent (counts) and 76 percent (weight) of the total shell from the sampled collection. CU 21 also had the highest density of shellfish (see Table 194). Although a small amount of shell was recovered from Feature 9, it did not yield any identifiable remains. Although the six main taxa were represented at the site, venus clam and Pismo clam accounted for more than 50 percent of the collection, whereas the other four were in much lower frequencies (less than 8 percent each). Both venus and Pismo could have been easily exploited from the nearby estuarine habitats. The data suggest that LAN-193 was not used for shell processing.

Invertebrate Remains from LAN-2768

This section discusses the results of shellfish analysis from two excavation areas at LAN-2768 Loci A and B. (Note that samples from Loci C and D are not included in the analysis because of the poor integrity and context of cultural deposits.) The shell data from the two loci and results of bucket auger probes taken in 1999 by SRI (Keller 1999) are compared in an intrasite analysis summary.

Locus A

A total of 9,680.6 g of invertebrate remains was recovered from four control units and 10 nonburial features (Features 10, 12, 18, 19, 20, 24, 25, 29, 30, and 31) (Table 195). Owing to the generally low frequencies of shell from the site, all shell from the analytical contexts was analyzed (i.e., there was no sampling). The three burials in Locus A did not yield any invertebrate remains.

Control Units

Over 8,400 g of shell were recovered from four control units (CUs 2/22, 3, 8, and 20/21) (see Table 195). All four control units had early Intermediate period deposits and yielded varying frequencies of the eight categories of shellfish (Figure 245). Overall, four taxa dominated (scallops, venus clam, oyster, and littleneck clam); however, there was some spatial variation. For example, scallops dominated in the CU 20/21 collection, whereas venus clams were found in higher frequencies in CUs 8, 2/22, and 3. Littleneck clam was found in higher frequencies only in CU 3. See Appendixes K.13.7–K.13.9 for detailed discussions of recovery from each control unit. Spatially, CU 20/21 yielded much higher densities of shellfish compared to the other control units, whereas CU 2/22 had the lowest density (see Table 195).

Nonburial Features

A total of 1,267.4 g of shell was recovered from 10 nonburial features (see Table 195). Of the 10 features, only 3 (Features 12, 24, and 31) yielded more than 40 g of shellfish each (see Appendix K.13.10 for details). Features generally yielded venus clam and oyster, with scallop and littleneck clam in lower frequencies (see Appendix K.13.8 for taxa recovered from each feature). Feature 24 (a structure) contained over 80 percent of the shell from the analyzed nonburial features.

Locus A Summary

The analytical contexts at Locus A yielded a shellfish collection that was composed of a variety of species, although only four were found in significant frequencies: scallop, venus clam, littleneck clam, and Pacific oyster. These four taxa were also of economic importance to the community. Overall, scallops dominated the collection, accounting for 50 percent of all shell from the analytical contexts; however the collection from CU 20/21 accounted for 93 percent of the scallops from all control units. The other three primary shellfish taxa were found in much lower frequencies: venus clams (19 percent), littleneck clam (11 percent), and Pacific oyster (8.5 percent) (see Table 195). There is spatial variation

Table 194. Shellfish Recovered from Analyzed Contexts at LAN-193

Species	CU 11		CU 21		CU 34		Feature 9		Total	
	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent
Scallop	—		1.8	1.8	—		—		1.8	1.4
Venus clam	2.3	41.8	31.3	30.9	1.3	9.2	—		34.9	26.3
Abalone	2.3	41.8	5.4	5.3	—		—		7.7	5.8
Oyster	—		5.9	5.8	—		—		5.9	4.4
Littleneck clam	—		2.9	2.9	—		—		2.9	2.2
Pismo clam	—		19.5	19.3	12.7	90.1	—		32.2	24.3
Other	0.6	10.9	4.0	4.0	—		—		4.6	3.5
Unidentifiable	0.3	5.5	30.4	30.0	0.1	0.7	11.9	100.0	42.7	32.2
Total	5.5	4.1	101.2	76.3	14.1	10.6	11.9	9.0	132.7	100.0
Volume (m^3)	2.00		2.0		2.0		1.12		7.1	
Density (g/m^3)	2.8		50.6		7.1		10.6		18.7	

Key: CU = control unit.

Table 195. Shellfish Recovered from Analyzed Contexts at LAN-2768, Locus A

Context	Measure	Scallop	Venus Clam	Abalone	Oyster	Littleneck Clam	Pismo Clam	Other	Unidentifiable	Total	Volume (m^3)	Density (g/m^3)
CU 2/22	weight (g)	22.9	223.4	1.5	15.7	66.7	2.7	1.1	97.7	431.7	2.23	193.6
	percent	5	52	<1	4	15	1	<1	23	100		
CU 3	weight (g)	88.4	145.9	0.5	13.6	100.1	19.8	24.8	49.8	442.9	1.04	425.9
	percent	20	33	<1	3	23	4	6	11	100		
CU 8	weight (g)	86	700.5	12.6	287.1	192.7	12.5	37.2	138.7	1,467.3	1.5	978.2
	percent	6	48	1	20	13	1	3	9	100		
CU 20/21	weight (g)	4,463.4	422.9	5.2	125.5	458.5	21.5	55	519.3	6,071.3	1.9	3195.4
	percent	74	7	<1	2	8	<1	1	9	100		
Features[a]	weight (g)	158.9	321.1	2.1	376.6	265.6	52.4	19.1	71.6	1,267.4	1.6	792.1
	percent	13	25	0.2	30	21	4	2	6	100		
Total	weight (g)	4,819.6	1,813.8	21.9	818.5	1,083.6	108.9	137.2	877.1	9,680.6	8.3	1,166.3
	percent	50	19	0.2	8	11	1	1	9	100		

Key: CU = control unit.
[a]Includes Features 10, 12, 18, 19, 20, 24, 25, 29, 30, and 31.

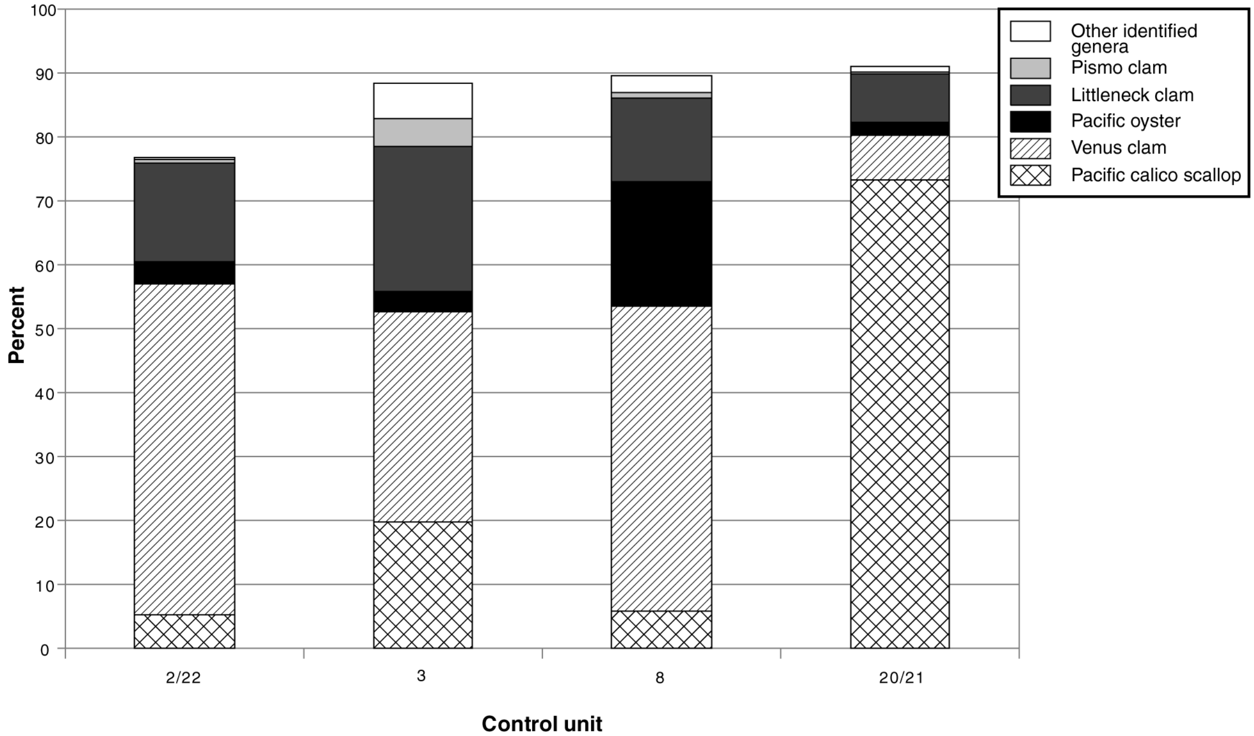

Figure 245. Identified shellfish taxa (percentage of weight) by CU at LAN-2768, Locus A.

in the distribution of the shellfish taxa, as observed with the significantly higher yields of scallops from CU 20/21 compared to the other control units.

Venus clam dominated the collections from the other control units (see Table 195). Note that it has been argued that the predominance of venus clam is an expected pattern at the Ballona sites through the entire prehistoric occupational sequence (Keller 1999:96). At LAN-2768, Locus A, venus clam is the most important shellfish, if the CU 20/21 collection is not considered. Radiocarbon dates from Locus A indicate that all tested control-unit levels and features date entirely to the early Intermediate period.

In general, rock clusters yielded higher frequencies of shellfish (85 percent), followed by a hearth (Feature 12), pits, artifact concentrations, and lastly, a structure (Feature 24) (see Appendix K.13.8). With the exception of the hearth (Feature 12), which had higher frequencies of scallop, all of the other features were dominated by venus clam. Feature 12 is within 15 m of CU 20/21, which also had higher frequencies of scallop. Both scallops and venus clams were exploited from the estuarine niches in the Ballona, and the higher recovery of scallops from CU 20/21 and Feature 12 could simply reflect an event wherein the inhabitants targeted scallops for a short time. In summary, the early Intermediate deposits at LAN-2768, Locus A, show a stable exploitation of estuarine resources with a primary focus on two species (scallop and venus clam) and less frequent use of littleneck clam, Pacific oyster, and other species.

Locus B

Two features and seven control units, all dating to the Intermediate period, were selected for analysis from Locus B. The control column contexts yielded over 3,800 g of shellfish (Table 196); for detailed data on feature contexts, see Appendix 13.10. Three of these nine contexts, CU 502 and the two features (Features 113 and 114), are located close together in the eastern part of the locus. CU 524 is on the western end of the locus, and the remaining five control units are all within an excavation block in the middle of the locus (see LAN-2768 Locus B map in Chapter 1, this volume). The distribution of shells across the site was decidedly unequal. For example, three control units in different parts of the locus (CUs 502, 504, and 524) and Feature 113 yielded 97 percent of the total shell by weight. Also, all but 4 of the 28 identified taxa were present in these same units.

Control Units

Detailed discussion of the shellfish remains recovered from seven control units are summarized in Appendix K.13.10. CU 524, the westernmost control unit within the locus and the one closest to Locus A, had the highest density of shellfish, followed by CUs 502 and 504 (see Table 196). The other four control units (CUs 509, 516, 519, and 523) had significantly

Table 196. Shellfish Recovered from Analyzed Contexts at LAN-2768, Locus B

Context	Measure	Scallop	Venus Clam	Abalone	Oyster	Littleneck Clam	Pismo Clam	Other	Unidentifiable	Total	Volume (m^3)	Density (g/m^3)
CU 502	weight (g)	297	103.5	—	117.6	204.6	3.7	18.4	56.3	801.1	1.45	552
	percent	37	13	—	15	26	<1	2	7			
CU 504	weight (g)	192.6	37.4	1.3	115.6	182.4	—	33.4	29.4	592.1	1.64	361
	percent	33	6	<1	20	31	—	6	5			
CU 509	weight (g)	13.7	—	—	10.6	21.8	—	—	4.9	51	1.47	35
	percent	27	—	—	21	43	—	—	10			
CU 516	weight (g)	4.4	1.4	—	6.1	4.2	—	1.2	—	17.3	1.49	12
	percent	25	8	—	35	24	—	7	—			
CU 519	weight (g)	0.9	—	—	1	1.3	—	—	0.3	3.5	1.57	2
	percent	26	—	—	29	37	—	—	9			
CU 523	weight (g)	3.8	9.3	—	5.7	13.3	—	0.4	2.4	34.9	1.57	22
	percent	11	27	—	16	38	—	1	7			
CU 524	weight (g)	1,291.6	125.6	0.7	211.1	192.4	1.4	65.0	61.8	1,949.6	1.74	1,120
	percent	66	6	<1	11	10	<1	3	3			
Total	weight	1,804.0	277.2	2.0	467.7	620.0	5.1	118.4	155.1	3,449.5	10.93	316
	percent	52	8	<1	14	18	<1	3	4	100		

Key: CU = control unit.

lower shellfish densities (Figure 246). As a result, there are distinct locales for shellfish processing and dumping after consumption of the meats. Scallops were found in higher frequencies relative to the other taxa, primarily owing to the collection from CU 524 (which accounted for 72 percent of the scallops). Oyster and littleneck clam were the other two taxa with higher frequencies. There was a low frequency of venus clam (in contrast to the pattern at Locus A), and abalone and Pismo clams were absent.

Nonburial Features

Shellfish were analyzed from two prehistoric rock-cluster features, Features 113 and 114 (see Appendix K.13.10 for a detailed discussion). Less than 400 g of shellfish were recovered, of which the great majority were recovered from Feature 113, whereas Feature 114 yielded only 3 g of shellfish. The Feature 113 collection was composed primarily of scallops (67 percent) and littleneck clam (15 percent), with venus clam (8 percent) and oysters (7 percent) in lower quantities (see Appendix K.13.11). Interestingly, the shellfish density from Feature 113 (6,254 g/m^3) was much higher than the control units (the highest, from CU 524, was 1,120 g/m^3). Feature 113 was a focused locale of shellfish discard during processing or after consumption. Interestingly the relative frequencies of the taxa represented in CU 524 and Feature 113 were similar, although they were not located in the same portion of Locus B.

Locus B Spatial Analysis

The analytical contexts at Locus B yielded a shellfish collection that was dominated by four taxa: scallop, venus clam, littleneck clam, and Pacific oyster. Scallops accounted for more than 50 percent of the collection, whereas the other three taxa were found in moderate quantities. A spatial difference was observed, with higher densities of shellfish in specific locales such as CU 524 and Feature 113, which may have been the focus of shellfish-processing and discard activities.

In addressing variation in shellfish distribution across Locus B, meat yields per mollusk species were estimated to determine if there was a substantial difference in the amount of meat consumed in the different areas of the locus (see Appendix K.13.12). The analyzed contexts were categorized spatially into west (CU 524), central (CUs 504, 509, 516, 519, and 523) and east (CU 502 and Features 113 and 114). Erlandson (1994:59) calculated and compiled meat and protein yields for a number of mollusk species native to California, including the four most prevalent species here: scallops, Pacific oysters, and littleneck and venus clams. The results indicate that the total meat yields per species in the three areas of the locus are not distinct from those based on shell weight alone (see Appendix K.13.12). Interestingly, the results deemphasize the economic importance of venus clams, because the species has a low meat to shell return. Overall, the meat weights demonstrate that the two ends of the site are more similar to each other in relative species abundance

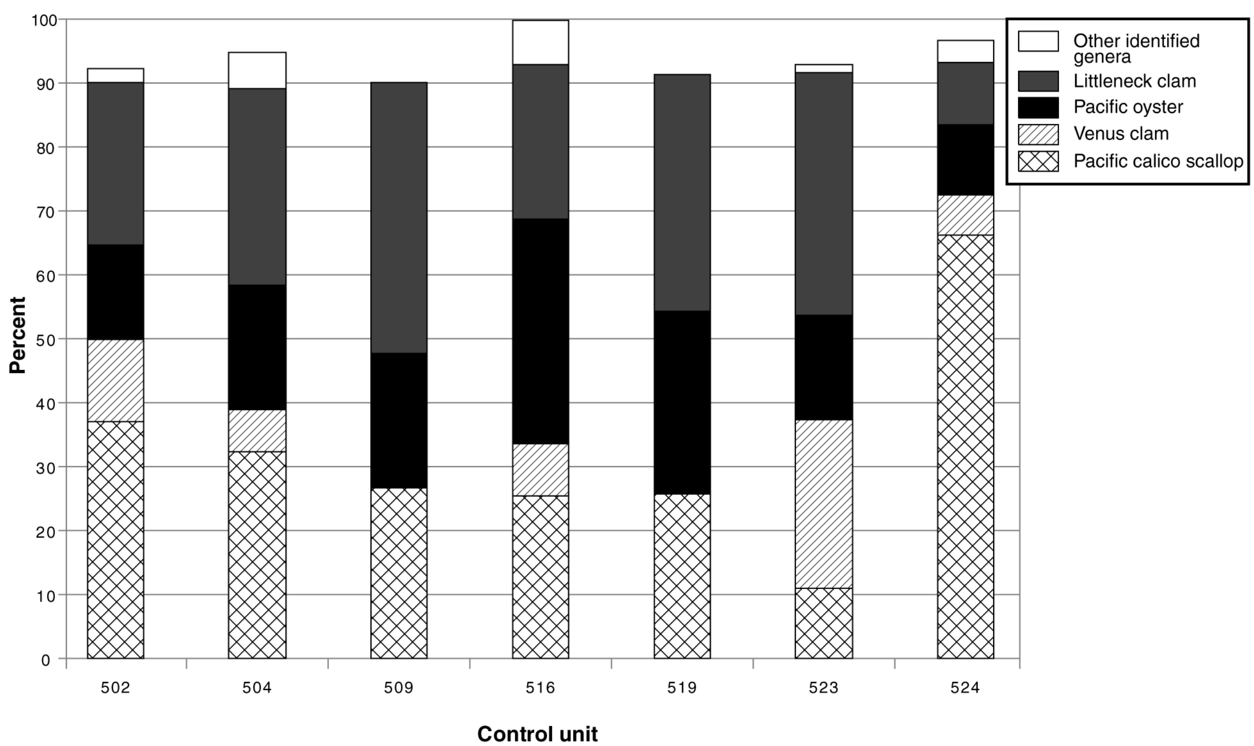

Figure 246. Identified shellfish taxa (percentage of weight) by CU at LAN-2768, Locus B.

than either are to the central portion. Given these results, it is apparent that the shell deposits at Locus B are homogenous. What remains noteworthy is that there are greater shell concentrations at the eastern and western ends as compared to the center of the locus.

Shellfish Exploitation at LAN-2768

Overall, the most important species within the analyzed proveniences at LAN-2768, Loci A and B, is the Pacific calico scallop. This single species accounted for approximately one-half of all shells recovered, including unidentifiable fragments. Keller (1999) found a similar pattern in the testing phase. The ranked importance of species (following scallops) at LAN-2768 is venus clam, littleneck clam, Pacific oyster, and Pismo clam. The preferred habitat of all five of the latter species is on sand or mudflats within protected areas, such as estuaries and bays in intertidal zones. They may also be found on coarser substrates within deeper offshore waters. Although some of these species such as the oyster may also be found on rocky or coarse sand substrates in deeper offshore waters, collections of these foods would not have required venturing far from the site. Instead, these shellfish species should have been abundant in the intertidal estuary portion of the Ballona depression.

Results from earlier investigations at the site by Doolittle (1999) and Keller (1999) (testing results at the site) were largely similar to the PVAHP results, in terms of taxonomic abundances, despite significant differences in collection methods between the projects. Scallops were consistently the most prevalent species, although finer-scale variations in the relative importance of scallops were present, as discussed above. In addition, the same four species (littleneck clam, Pacific oyster, scallop, and venus clam) made up the bulk of the collections. Examination of spatial distribution of shellfish taxa at LAN-2768 did not reveal any statistically significant differences between Loci A and B. There was no difference in the relative importance and rank order of shellfish between the two loci either. As a result, although there may have been areas within each loci with higher frequencies of discard, when the loci were combined, there was no differentiation of specialized processing areas, discrete dumping areas, or other behaviors.

In summary, the ancient Native American inhabitants consistently emphasized only a handful of shellfish species. Despite some ordinal variation between control units, overall, there is a clear pattern indicating that people mainly harvested scallops and, to a lesser extent, littleneck clams, venus clams, and Pacific oysters. This seems a classic example of a focused collecting strategy with an emphasis on just a few species. More specifically, there was a focus on a single species with the others varying in amount and rank-order place. These shellfish were all available within close foraging distance of the settlement. The singular defining signature of the shellfish remains at this site as a whole is that the people who lived here preferred to harvest and eat scallops, a phenomenon so far unique among Ballona sites.

Invertebrate Remains from LAN-54

Four control units and 10 nonburial features selected for analysis from LAN-54 yielded more than 30,000 g of shellfish. Pacific calico scallop was the only species recovered from the three burial features.

Control Units

Detailed discussion of the shellfish remains recovered from the four control units (CUs 3, 11, 30, and 31) is presented in Appendixes K.13.13 and K.13.14. Densities of shellfish varied greatly among the control units, with the highest density in CU 11 (2,080 g/m^3) and the lowest in CU 31 (3.5 g/m^3) (Table 197). These two control units are at the opposite ends of the site; CU 11 is in the midst of several nonburial features (see site map in Chapter 1, this volume). The lower deposits in the control units have been dated to the late Millingstone period, whereas the higher deposits have been dated to the early Intermediate period. Four taxa accounted for 78 percent of the collection; in particular, oyster and littleneck clam constituted more than 50 percent, whereas scallop and venus clam were found in moderate quantities (see Table 197). Figure 247 shows a comparison of the relative abundance of shellfish from all of the control units combined to the features.

Nonburial Features

The 10 nonburial features analyzed included 2 late Millingstone rock clusters (Features 1 and 23), 1 early Intermediate rock cluster (Feature 7), 5 early Intermediate artifact concentrations (Features 12, 13, 16, 29, and 36), 1 pit (Feature 24), and 1 Historical period pit (Feature 33) (see Table 197). Figure 247 shows shell abundance by feature type and time period. Detailed discussions of the analysis are presented in Appendixes K.13.14 and K.13.15. The same shellfish taxa that were found in higher frequencies in the control units are represented in higher relative quantities in the features. Feature 16 (early Intermediate artifact concentration) had a single shell of Pacific gaper that was covered with asphaltum. Although the features with the three highest densities of shellfish are artifact concentrations, there is no direct correlation between feature type and shellfish densities. When the late Millingstone and Intermediate period features are compared, the latter have a much higher relative density (9,820 g/m^3 vs. 253 g/m^3)

Table 197. Shellfish Recovered from Analyzed Contexts at LAN-54

Measure, by	Control Units					Features[a]												Total
Species	3	11	30	31	Subtotal	1	3	7	12	13	16	23	24	29	33	36	Subtotal	
Scallop																		
Weight (g)	289.6	1,434.7	6.5	—	1,730.8	15.4	—	339.6	293.8	133.7	13.7	25.6	188.8	770.8	11.1	54.8	1,847.3	3,578.1
Percent	34	14	7	—	15	44.5		20.0	9.9	12.3	25.8	33.2	5.5	8.9	5.2	21.3	10.0	12.0
Venus clam																		
Weight (g)	69.8	1,036.5	42.6	—	1,148.9	—	—	218.6	274.5	89.8	—	6.3	698.2	453.8	6.0	6.0	1,753.2	2,902.1
Percent	8	10	<1		10			12.9	9.2	8.2		8.2	20.2	5.2	2.8	2.3	9.5	10
Abalone																		
Weight (g)	0.9	3.2	—	—	4.1	—	—	2.1	0.4	—	—	—	—	7.3	7.6	7.6	25	29.1
Percent	0.1	0.03			0.04			0.1	0.01					0.1	3.6	3.0	0.1	0.1
Oyster																		
Weight (g)	224.0	2,683.2	1.6	—	2,908.8	10.6	—	281.7	1,054.6	310.7	10.7	27.4	817.1	787.2	124.6	124.6	3,549.2	6,458.0
Percent	26	26	<1		26	30.6		16.6	35.5	28.5	20.1	35.6	23.6	9.1	58.2	48.4	19.2	22
Littleneck clam																		
Weight (g)	55.9	3,030.4	20.9	0.6	3,107.8	1.5	—	299.5	413.4	320.2	2.0	—	1,399.6	4.2	34.9	34.9	2,510.2	5,618.0
Percent	7	29	23	12	27	4.3		17.6	13.9	29.4	<1		40.5	<1	16.3	13.5	13.6	19
Pismo clam																		
Weight (g)	—	1,041.9	—	—	1,041.9	—	—	17.7	214.5	116.5	—	—	66.9	1,024.9	0.3	0.3	1,441.1	2483.0
Percent		10			9			1.0	7.2	10.7			1.9	11.8	0.1	0.1	7.8	8
Other																		
Weight (g)	15.0	62.6	1.1	—	78.7	—	—	20.7	19.5	11.5	25.3	1.3	32.7	658.4	2.8	2.8	775.0	853.7
Percent	2	1	1		1			1.2	0.7	1.1	47.6	1.7	0.9	7.6	1.3	1.1	4.2	3
Unidentified																		
Weight (g)	199.6	1,106.4	17.7	4.3	1,328.0	6.3	—	517.7	698.4	105.6	0.5	15.5	254.7	4,954.4	25.7	25.7	6,604.5	7,932.5
Percent	23	11	20	88	12	18.2		30.5	23.5	9.7	0.9	20.1	7.4	57.2	12.0	10.0	35.7	27
Total	854.8	10,398.9	90.4	4.9	11,349.0	34.6	—	1,698.3	2,969.9	1,088.9	53.2	76.9	3,458.9	8,661.4	213.9	257.6	18,513.6	29,862.6
Volume (m3)	4.0	5.0	2.0	1.4	12.4	0.04	0.1	0.2	0.2	0.06	0.03	0.4	0.3	0.31	3.12	0.7	5.46	17.9
Density (g/m^3)	213.7	2,079.8	45.2	3.5	915.2	865.3		8,491.5	14,849.3	18,148.4	1,773.0	192.2	11,529.8	27,940.1	68.6	368.0	3,390.8	1672.0

[a]Feature 1 (late Millingstone rock cluster), Feature 7 (early Intermediate rock cluster), Feature 12 (early Intermediate artifact concentration), Feature 13 (early Intermediate artifact concentration), Feature 16 (early Intermediate artifact concentration), Feature 23 (late Millingstone rock cluster), Feature 24 (pit), Feature 29 (early Intermediate artifact concentration), Feature 33 (historical-period pit), and Feature 36 (early Intermediate artifact concentration).

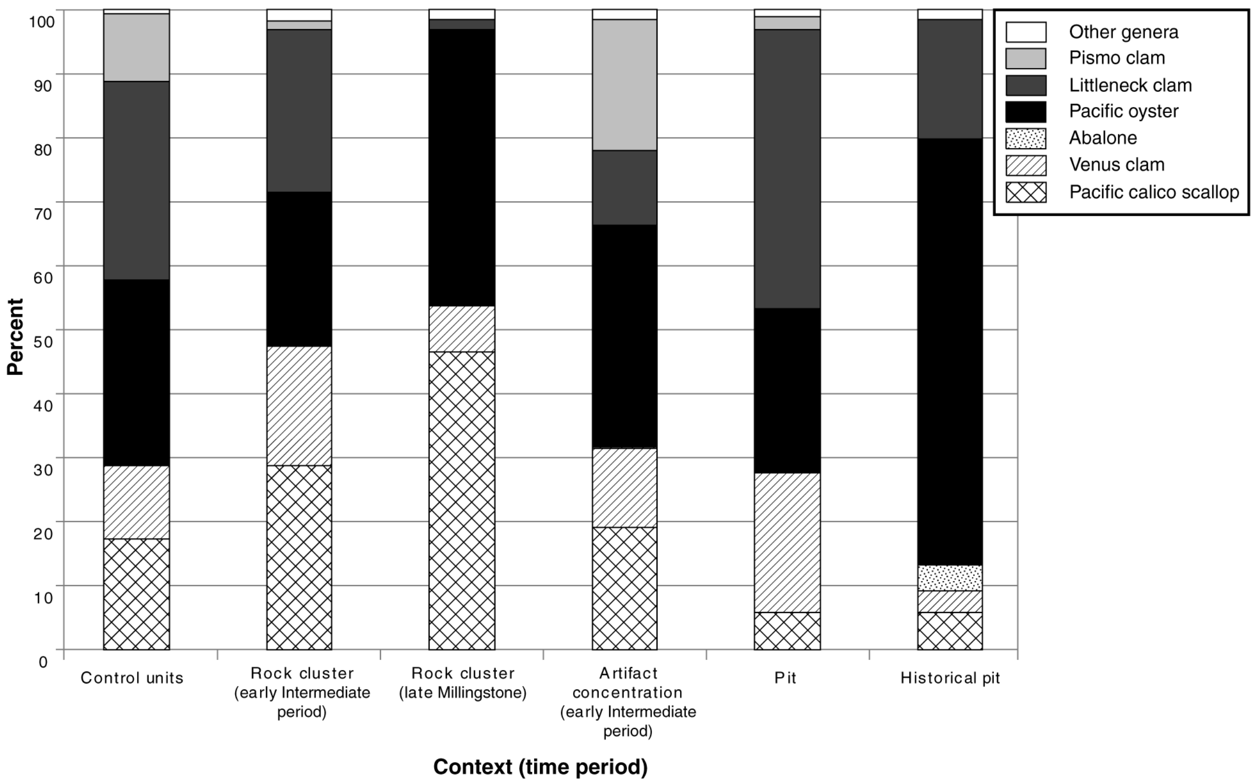

Figure 247. Dominant shellfish taxa at CUs and nonburial features from LAN-54.

(see Table 197). Given that the primary distinction in shellfish distribution is temporal, the following discussion will focus on diachronic patterns and trends.

Diachronic Analysis

Data from LAN-54 present an opportunity to examine change and continuity in shellfish exploitation from the late Millingstone through the early Intermediate periods.

First, a discussion of Native American shellfish-collecting strategies within the Millingstone and Intermediate periods is presented, followed by discussion of trends in continuity and change across these cultural periods. The temporal analysis includes shellfish data from the control units and all but two features (Features 24 and 33). Data from these two features are excluded because Feature 24 could not be placed in time and Feature 33 is a historical-period pit.

Shellfishing in the Millingstone Period

Shellfish from Millingstone period contexts were recovered from Features 1 and 23 and CU 3 (Levels 8–10), CU 11 (Levels 11–13), CU 30 (Level 5), and CU 31 (Level 6). These proveniences yielded 452 g of shell, with a bias toward scallop (32 percent) and Pacific oyster (21 percent) exploitation (Table 198; see Appendix K.13.16). The two species account for 53 percent of analyzed shells by weight. The other important species in this time period are venus clam (10 percent) and littleneck clam (15 percent).

During the late Millingstone period, the aboriginal populations exploited four main taxa. In order of decreasing importance they are scallops, oysters, littleneck clams, and venus clams. The importance of oysters is interesting, because during the late Millingstone period, these resources were not easily available close to the site. During this time period (5000–3000 cal B.P.), there was considerable change in the hydrology and environment in this area. Sedimentation from freshwater sources entering into the Ballona Lagoon changed the shellfish population after 4000 B.P. primarily because of a change from a marine-water environment to a freshwater one. Furthermore, after 3000 B.P., a sand barrier built up that eventually restricted and then blocked off the influx of seawater into the Ballona. The sedimentation changes had a devastating effect on oyster and jackknife clam beds, covering them with silt, while making the water much less saline. However, given that oysters were the second-most frequent species in the late Millingstone collection at LAN-54, it is likely that nearby mudflat niches had adequate populations of oyster and other mudflat-dwelling species, such as venus clams, littleneck clams, and scallops. It is possible that the prehistoric inhabitants traveled longer distances to harvest these shellfish, or else by 3000 B.P., the Ballona had not yet

Table 198. Shellfish, by Period, at LAN-54

Species	Late Millingstone		Early Intermediate	
	Weight (g)	Percent	Weight (g)	Percent
Scallop	143.4	32.0	3,101.1	16.0
Venus clam	44.2	10.0	2,441.6	12.0
Abalone	—		14.2	0.1
Oyster	97.1	21.0	4,934.3	25.0
Littleneck clam	65.9	15.0	5,192.2	26.0
Pismo clam	10.5	2.0	1,330.8	7.0
Other	2	0.4	156.2	1.0
Unidentified	89.15	20.0	2,470.1	13.0
Total	452.3	100.0	19,640.5	100.0

silted up to the extent that oysters could not create new beds on the lagoon's mudflats.

Shellfishing in the Intermediate Period

The Intermediate period collection was relatively much larger than that of the Millingstone period deposits and was composed of more than 19,000 g of shellfish (see Table 198; see Appendix K.13.17). Intermediate period shellfish samples were recovered from most levels in all of the control units and five features (Features 7, 12, 16, 29, and 36). In contrast to the collection from the Intermediate deposits at LAN-2768, which was dominated by scallops, the LAN-54 Intermediate deposits suggest a dual emphasis on littleneck clams and Pacific oysters, each representing one-quarter of the collection by weight. Scallops were a secondary resource (16 percent), followed by venus (12 percent) and Pismo clam (7 percent).

The abundance of mudflat-dwelling species, such as venus and littleneck clams, oysters, and scallops, in the Intermediate period collection at LAN-54 is consistent with the largely freshwater lagoon that had formed by ca. 3000 B.P. Note, however, that the species that was apparently easiest to collect in the mudflats, the venus clam, is only the third-ranked species during this period. This suggests that more than convenience determined the collection of shellfish taxa. As a result, the LAN-54 data suggest that humans made choices about not just which species to exploit but also the intensity of the exploitation.

Millingstone vs. Intermediate Period Shellfishing

Several differences were noted in the temporally distinct collections at LAN-54 (Figure 248; see Table 198). During the Millingstone period, Native Americans selected mainly scallops, with oysters as a secondary shellfish food source. Some half a millennium later, during the Intermediate period, populations focused their collecting efforts on the littleneck clam as well as the Pacific oyster.

Further, scallops that were favored during the Millingstone period continued as secondary foods during the Intermediate period. This is interesting given that they may not have been readily available in the Ballona. Their continued use suggests that they were a popular food and were therefore procured from farther distances. Although venus clams were probably readily available in the Ballona during the Intermediate period, they were not exploited in large number, perhaps because they did not provide as much meat relative to littleneck clams.

The Millingstone and Intermediate period data sets, though different from one another, are not diametrically opposed in content and species distribution. A more detailed quantitative analysis is called for before drawing all too far-reaching conclusions from the percentage and weight data. For that purpose, the Shannon-Weaver Index, which measures both (species) diversity and evenness, was used, using the formula $H' = -p_i log_e p_i$ (Reitz and Scarry 1985:20). Because the richness of shellfish taxa within these samples is rather low, with only a handful of species identified, the value of the diversity index lies in its ability to estimate equitability, that is, the degree to which a collection is characterized by a few species with similar concentrations or the same number of species with a less even concentration of remains. To perform this calculation, the natural logarithm of weights for all identified species was used, as well as the category "other" (comprising species or higher taxonomic groupings), but not the weight of unidentifiable specimens. The calculation returns results on a scale of 1.0 (specimens are represented on an absolutely even basis) to 0.0 (the sample's components are present in a completely inequitable distribution). The evenness statistics for the two samples, calculated by the formula $E = H'/H\ max$, returned the results $E = 0.63$ for the Millingstone period remains and $E = 0.55$ for the Intermediate period shells. The calculated values indicate that the Millingstone period species are more equitably distributed than the Intermediate period

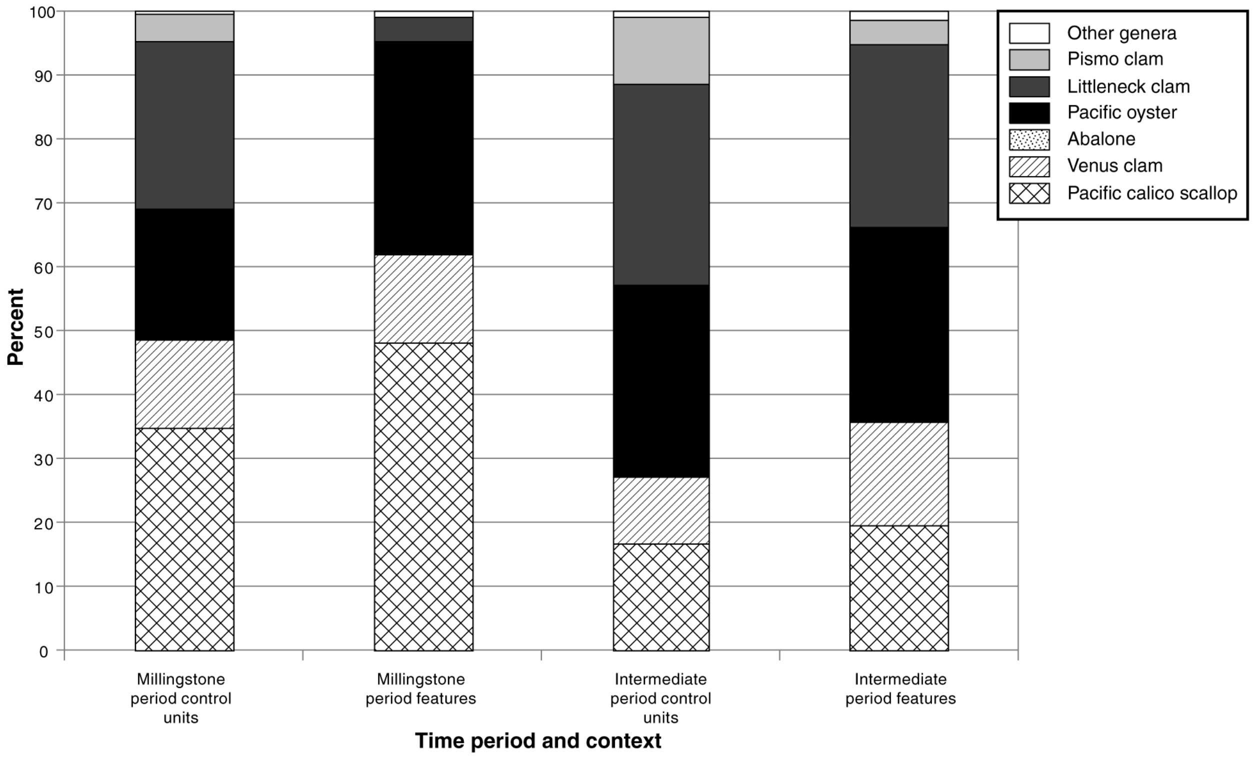

Figure 248. Dominant shellfish taxa by period at LAN-54.

ones. This may be owing to the sample size, because diversity values tend to be amplified with larger samples. Treated with caution, the evenness statistic shows that there may be a quantitative basis for arguing that the percentage and weight differences are more than observational error.

The diversity-analysis results establish the general baseline that there do exist substantial differences between the two collections but do not establish that these differences are necessarily statistically significant or that the differences are the result of anything other than sample size. In order to surmount these problems, a two-sample *t*-test was performed on the total weights for shellfish species from the Millingstone and Intermediate periods. The two-sample *t*-test made use of the trimmed means approach (Drennan 1996:20–23), in this case leaving out the total weights for shells from each sample. This was done in order to avoid biasing the *t*-test results, because the two collections are of divergent sizes. The *t*-test returned a statistically significant result, $p = .016$, demonstrating that the above-observed trends in percentage and weight do correspond to actual and not random differences in diet over time. Even when overall weights are incorporated in the *t*-test data ranges, the statistical tests nonetheless show a significant difference, $p = .077$, at least at the $p = .10$ level. We can therefore say with confidence that the shellfish sample from LAN-54 changed over time, with the Intermediate period collection becoming more focused.

This research has documented that, over time, the site's inhabitants shifted their shellfish-harvesting emphases from a generalized strategy with an emphasis on scallops and oysters to one aimed mainly at oyster and littleneck clams. However, what were the reasons for this shift? As Becker (2003:190) observed, many archaeological studies of shellfish assumed that mollusks were gathered in direct proportion to their availability within ancient ecosystems. The relative abundance of shellfish species on archaeological sites was taken to be, ipso facto, a signature by which ancient environments could be reconstructed. Here, however, the Millingstone period emphasis on oysters appears contradictory to the environmental model of the Ballona currently in favor. The study of sediment cores from the eastern portion of the Ballona Lagoon argued that oyster and jackknife clam beds were abruptly silted over after 4000 B.P., and subsequently, these species disappeared from the cores for a significant amount of time (see Volume 1 of this series). The implication is that the large influx of silt was brought by increased discharges of freshwater into the lagoon, which by this time had been cut off from the sea. Based upon this study, it appears that the paleoenvironmental model may be in need of revision. Perhaps the siltation event was more localized or of shorter duration than previously thought. Alternatively, the Native American population, wanting to harvest oysters and other more saltwater-adapted shellfish, ventured outside the lagoon and brought them back to lagoon-edge habitation sites.

In any event, the above findings do highlight the problems of an explanation focused strictly on finding environmental explanations for human diets as opposed to also examining the role of human agency. Instead of a strictly environmental approach, Becker (2003) suggested that researchers should also think about why humans may have favored one or another mollusk species for reasons other than propinquity. In particular, Becker recommended an adaptation of foraging theory as delineated by Winterhalder (e.g., Winterhalder 1981), such that the diversity, or lack thereof, of shellfish species is the data set used to hypothesize that Native Americans pursued a "generalized" or "specialized" subsistence strategy (Becker 2003:194). Such an application of foraging theory is certainly intriguing but should be tested with a greater diversity of data.

This is not the place to debate the merits of archaeological applications of Darwinian evolutionary theory, but it is worth emphasizing that the Ballona populations did not solely eat shellfish but rather hunted and gathered a wide variety of other plants and animals, possibly on the same outings during which shellfish were gathered. In fact, it is inappropriate to draw conclusions about the orientation of prehistoric foraging strategies solely on shellfish. To begin with, some authors have cautioned that, rather than food remains, shellfish were sometimes harvested to serve as fish bait, an idea proposed for California among other places (Claassen 1998:253). Some of the smaller shellfish came attached to other shellfish or in the stomachs of fish. Even if eaten by people, shellfish are mass harvest foods that, in the case of the most abundant Ballona species, do not represent a great investment of energy to harvest or process when compared to other animal foods (Jones 2004). Characterization of economic behavior as generalized or specialized based on shellfish remains, or any one class of dietary data, is misleading, and should therefore be applied only to ecofact assemblages as a whole or at least examined on a niche-by-niche basis.

Invertebrate Remains from LAN-62

Invertebrate remains from four loci at LAN-62 were analyzed, including Loci A, C, D, and G, and results are presented by Locus A/G and Locus C/D (please refer to Chapter 1, this volume, for explanation).

Locus A/G

The LAN-62, Locus A/G, shellfish collection is large and diverse, and sampling methods were tailored to accommodate the spatial and contextual complexity of these two loci. Over 97,000 g of shellfish were collected from six major contexts. The analytical contexts include control units, burial features, nonburial features in the burial area, nonburial features outside the burial area, and features and excavations units from FBs 3, 4, and 7 (Table 199).

Table 199. Summary of Invertebrate Remains from Analyzed Contexts at LAN-62, Locus A/G

Context	Weight (g)	NRE
Control units	15,969.8	3,543
Burial area		
Burial items	3,136.6	91
Burial-area nonburial features	919.9	199
Burial-area items	3,315.4	93
Outside burial area		
Sitewide nonburial features	3,183.5	684
FB 3		
Excavation units	7,051.8	406
Nonburial features	1,091.5	142
Subtotal	8,143.3	548
FB 4		
Excavation units	11,746.0	686
Nonburial features	10,934.2	1,994
Subtotal	22,680.2	2,680
FB 7		
Excavation units	4,869.4	608
Nonburial features	19.4	4
Subtotal	4,888.8	612
Total	97,949.8	12,290

Key: FB = feature block; NRE = number of nonrepetitive elements.

Control Units

Shellfish from six control units (CUs 141, 316, 323/321, 682, 853, and 1048) were analyzed to assess the density and diversity of invertebrate remains at LAN-62, Locus A/G. Detailed discussions on the invertebrate remains in each control unit are presented in Appendix K.13.18, and their data are in Appendixes K.13.19–K.13.24. Spatially, CU 682 had the highest shellfish density (5,547 g/m^3), most of which was recovered from the upper levels representing later temporal periods (Table 200). Two early Intermediate period strata in CU 682 yielded less than 150 g. In general, the younger deposits had higher shellfish densities. Similarly, CU 316 had a higher shellfish density relative to CU 141. In both control units, the early Intermediate and Intermediate occupations had a lower density of shell compared to the Late to Mission period ones. Similar trends in shellfish densities were observed in all control units such that shell density increased over time.

Temporally, the great majority of the shellfish in the control units were from Late to Mission period contexts (see Table 200). To elucidate diversity in shellfish species in a comprehensive manner, the species' weights were compared on a general level. Thus, the relative abundance of the taxa is addressed. Furthermore, their rank order, based on weight, is compared on a general level, both within the unit and by strata between units. Rank order of shellfish species by unit and time period is provided in Table 201.

Table 200. Distribution of the Six Main Shellfish Taxa from All Control Units, by Period

Period	Scallop		Venus Clam		Abalone		Oyster		Littleneck Clam		Pismo Clam		Total	
	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent
Late to Mission	1,617.7	61.3	4,051.5	64.5	203.9	88.6	1,163.6	83.1	2,429.9	72.3	1,143.1	61.6	10,609.7	67.3
Late to Millingstone	37	1.4	26.4	0.4	—		11.8	0.8	51.1	1.5	22.5	1.2	148.8	0.9
Early Intermediate	657.8	24.9	1,065.7	17.0	12.6	5.5	203.6	14.5	660.7	19.7	480.8	25.9	3,081.2	19.5
Early–late Millingstone	324.5	12.3	1,137.6	18.1	13.7	6.0	20.7	1.5	219.8	6.5	209.7	11.3	1926	12.2
Total	2,637.0	16.7	6,281.2	39.8	230.2	1.5	1,399.7	8.9	3,361.5	21.3	1,856.1	11.8	15,765.7	100.0

Table 201. Rank Order of Shellfish Species, by Control Unit and Stratum, at LAN-62, Locus A/G

Control Unit/Stratum	Scallop	Venus Clam	Abalone	Oyster	Littleneck Clam	Pismo Clam
	Control Unit					
141	5	1	6	4	2	3
316	2	1	6	5	3	4
323/321	2	1	5	6	2	4
682	4	1	6	3	2	5
853	2	1	3	6	4	5
	Stratum					
I (Late to Mission period)	4	1	6	3	2	5
II/I (Late to Mission period)	4	1	5	2	3	6
II (Late to Mission period)	3	1	6	5	2	4
IV/I (Millingstone to Late period)	2	3	—	5	1	4
III (early Intermediate period)	3	1	6	5	2	4
IV (early–late Millingstone period)	2	1	6	5	3	4
V/IV (early–late Millingstone period)	2	4	5	6	3	1
V (early–late Millingstone period)	4	1		3	2	

Millingstone period deposits yielded less than 13 percent of the collection, and early Intermediate deposits accounted for a little less than 20 percent. The Millingstone period deposits were characterized by dual dominance of venus clams (40 percent) and littleneck clams (29 percent), with oysters found in moderate quantities (18 percent). Early Intermediate deposits contained the second largest sample of shellfish, with venus clams being the dominant shellfish (35 percent) and scallops and littleneck clams in moderate frequencies (21 percent each). Of the six principal shellfish species, there was a gain over time in the relative abundance of four taxa, whereas venus clams decreased in abundance over time (although there was a marked increase at the start of the Late to Mission period). The importance of scallops (17 percent) fluctuated through time. The importance of Pismo clams increased through time, as did littleneck clams and oysters. Although venus clams dominated all of these samples, their contribution declined overall, whereas the weight returns of oysters, littleneck clams, and Pismo clams increased. These data show a trend toward diversification of shellfish diet later in time.

Burial Features

More than 3,000 g of shellfish from 80 burial features were collected as items and analyzed. To elucidate patterns in the distribution of shellfish in the 80 burials, two main categories were discerned: quantities of shellfish and presence or absence of abalone. Based on the shellfish items' weights, the 80 burials were grouped into nine categories (Groups 1–9) (see Appendixes K.13.25–K.13.27). Trends and distribution of shell in the burials are discussed below.

Burial Groups by Total Shell Weight

The nine groups allowed for the identification of spatial patterning and association (Table 202). The grouping was done with visually defined breaks along a continuum. All groups included multiple burials, with the exception of Group 1, which included a single burial feature. That feature (burial Feature 112) yielded 352.5 g of shell, which was significantly higher than any other burial. Note that NREs were not used for this grouping, primarily because they were not the more-reliable indicator of relative abundance (see Appendix K.13.18 for more-detailed discussion of why NREs are not as useful in this discussion).

Unfortunately, no spatial patterning was discerned in how the nine groups were distributed in the burial area. For example, the burial features with no shell are located within a cluster of burials with higher quantities of shell. This lack of patterning could be due to a couple of reasons. Perhaps total shell weight is not a good predictor of sociocultural differences expressed in burial goods. Alternatively, shell weight may be a predictor of temporal relationships. Burials containing different amounts of shell may date to different time periods.

In terms of taxonomy, the burials, for the most part, contained only abalone shell, which is noteworthy, because the analyzed control units from this locus generally contained small quantities of this shellfish. It seems that either the abalone meat or its shell, or perhaps both, were purposefully selected as burial goods. Abalone shell overwhelmingly dominated the recovered collection (86.5 percent) (Table 203).

Grouping by Abalone Shell Weight and Presence or Absence

Of the 80 burials, exactly 50 percent of them contained abalone shell (see Appendix K.13.27). However, there was no spatial patterning in the distribution of burial features with and without abalone. Instead, the two "types" of burial features (with and without abalone) were interspersed together, both within and outside of the main cluster of burials. Half the sampled burials had abalone and the other half did not. Mortuary analysis in Volume 5 of this series discerns whether this pattern is meaningful in terms of sociocultural differentiation (gender, status, and time).

Table 202. Shellfish Recovered from Burials, LAN-62, Locus A/G

Burial Group	Weight Variance (g)	Included Burials (Feature No.)	Number of Burials
1	>200	112	1
2	150–200	9, 234, 245, 257	4
3	100–150	149, 167, 274, 284	4
4	50–100	10, 11, 14, 38, 50, 101, 128, 141, 178, 223, 282, 438, 457, 600	14
5	10–50	36, 42, 58, 82, 85, 117, 165, 184, 204, 213, 220, 228, 248, 249, 261, 266, 268, 300, 403, 430, 497, 505, 513, 531, 543, 594, 610	27
6	5–10	7, 217, 276, 396	4
7	1–5	8, 52, 57, 67, 197, 227, 349	7
8	0.1–1	5, 103, 105, 145, 147, 529	6
9	no shell	4, 148, 175, 180, 214, 222, 243, 265, 327, 369, 408, 453, 557	13

Table 203. Shell Items from Burials and the Burial Area, LAN-62

Species	Burials		Burial Area			
	Weight (g)	Percent	Weight (g)	Percent (Weight)	NRE	Percent (NRE)
Scallop	10.8	0.3	109.4	3.3	22	23.7
Venus clam	74.2	2.4	64.9	2.0	5	5.4
Abalone	2,711.9	86.5	2,124.1	64.1	20	21.5
Oyster	29.8	1.0	72.3	2.2	11	11.8
Littleneck clam	6.5	0.2	25.9	0.8	14	15.1
Pismo clam	61.3	2.0	80.3	2.4	5	5.4
Other	163.4	5.2	754.6	22.8	—	
Unidentifiable	78.7	2.5	83.9	2.5	16	17.2
Total	3,136.6	100.0	3,315.4	100.0	93	100.0

Key: NRE = number of nonrepetitive elements.

Shell from the Burial Area

Several complete shells and clusters of shell were recovered from the general burial-area midden at LAN-62, Locus A/G. It is possible that these clusters and whole shells may have been placed here for symbolic reasons or as mortuary gifts. Because this discussion involves complete or nearly complete shells, as well as clusters made up of several shells, numerical discussions are based on NRE counts rather than fragment weights. A total of 93 shell items was recovered, including examples from each of the six principal shellfish species (see Table 203). The most-frequent two species were scallop and abalone, with littleneck clams and oysters fairly common. Interestingly, despite the overall abundance of venus clams at the site, this shellfish is rather uncommon in burial contexts.

Nonburial Features

Shell from 18 nonburial features in the general burial area was analyzed. Three of these features did not have any shell. The remaining 15 features all date to the Mission period. In general, the nonburial features yielded less than 800 g of shellfish (Table 204; see Appendix K.13.28). Two features yielded higher frequencies of shellfish relative to the others: Feature 129 (45 percent of collection from nonburial features) and Feature 29 (19 percent). Shellfish from the remaining 13 nonburial features constituted 8 percent or less of the collection.

The most abundant species within these features was venus clam (36 percent), followed by littleneck clam (15 percent) and oysters (12 percent). Venus clams were the most prevalent species in the analyzed control units within LAN-62, Locus A/G, so their prominence within the nonburial features is a continuation of that pattern. Within the nonburial features, abalone was found in very low frequencies (5 percent of the collection). However, when present (for example in Features 29 and 252), it accounted for more than 35 percent of the nonburial feature collection. If indeed higher frequencies of abalone are associated with burial features, it is possible that features such as these may have some mortuary association.

Some patterning was also discerned in the distribution of scallops. Overall, this species constituted only 7 percent of all the shell from the 15 nonburial features, but it was by far the single most abundant species within Feature 407 (41 percent), a feature that contained one of the larger collections of shell (44 g). Although Feature 68 also contained a high percentage of scallops (31 percent), it did not produce a reliably large sample (only 1.3 g). When measured by NRE counts, scallops contributed well over half of the shellfish in the feature (58 percent). Therefore, abalone and, secondarily, scallops were dominant in burials and surrounding midden, whereas venus clams were dominant in all other contexts.

Nonburial Features outside the Burial Area

Shellfish from 19 nonburial features outside the burial area were also analyzed. More than 3,000 g of shell were recovered from these features (see Appendix K.13.29). The collection contained a preponderance of venus clams, the overarching pattern at LAN-62, Locus A/G, in general, albeit this species did not dominate the cumulative weights in the same way it did in other contexts at the site. For example, venus clams were only 8 percent more prevalent than littleneck clams. Scallops were also fairly abundant within these features (12 percent) and ranked third in relative abundance.

Relative abundance of species within each of the 19 nonburial features was not even. Abalone was present in only 5 features and constituted 47 percent of the Feature 51 collection. Feature 169 yielded the highest frequencies (nearly 1.4 kg of shell), and this feature closely mirrored the overall relative

Table 204. Shellfish Taxa from Analyzed Nonburial Features within and outside of the Burial Area, LAN-62

Species	Nonburial Features within the Burial Area		Nonburial Features outside of the Burial Area	
	Weight (g)	Percent	Weight (g)	Percent
Scallop	68.1	8.8	393.3	12.4
Venus clam	327.1	42.1	955.9	30.0
Abalone	50.5	6.5	51.8	1.6
Oyster	107	13.8	183.5	5.8
Littleneck clam	139.1	17.9	698.1	21.9
Pismo clam	53	6.8	258.1	8.1
Other	32.2	4.1	127.7	4.0
Unidentifiable	0.2	<0.1	515.1	16.2
Total	777.2	19.6	3,183.5	80.4

abundances and ranking of shellfish taxa in all these features: venus clam, littleneck clam, scallop, Pismo clam, and oyster.

Feature Block 3

FB 3 dates sometime within the Protohistoric to Mission periods, although it was probably used most intensively during the Mission period and is located at the western edge of the burial area. This group of features may represent an area of mourning ceremonies related to the burial area. Shellfish from 26 excavation units and 13 features within FB 3 were analyzed. The analysis revealed that, with the exception of 1 EU (EU 772), most of the excavation units had relatively similar frequencies of shellfish (see Appendixes K.13.30 and K.13.31). Two units (EUs 783 and 825) yielded large amounts of shell and also a relatively small quantity of abalone. EU 783, located near the center of FB 3, contained 37 g of abalone (7 percent of the excavation unit's collection). EU 825, on the western side of the feature block, produced 29 g of abalone shell (11 percent). The data from the 26 excavation units indicate that FB 3 was an area of intensive shellfish processing, and based on the recovery of abalone, it was used for mourning and mortuary activities. The focus of the shellfish analysis in FB 3 was on the nonburial features, and shellfish speciation was done only on the FB 3 nonburial features.

Nonburial Features

In addition to these excavation units, 13 nonburial features were selected for analysis from FB 3 (Table 205). Collectively, we recovered just over 1 kg of shell from the features (see Appendix K.13.31). Among these, Feature 384 had the greatest shell content, 462 g, which was approximately 25 percent more than the next-largest collection (Feature 331) and four times as much as the third-ranked sample (Feature 672). Overall, the most-important shellfish species—comprising the same percentage of the total collection whether measured by weight or by counts—was venus clam (37 percent). Only one other species, abalone (19 percent), accounted for a substantial portion of the shell collection from these features. All other principal species each accounted for 6 percent or less. However, those percentages are in a sense suppressed, because a relatively large proportion of the shells from these features were unidentifiable (23 percent).

Among the 13 features, 3 yielded all of the abalone in the collection. Feature 331 contained the greatest proportion of abalone, 47 percent (NRE = 2, or 8 percent), followed by Feature 672 (17 percent) and then Feature 384 (10 percent). The presence of abalone is interesting, because its distribution is closely linked to burials (see above). The fact that abalone shell was found in fairly large amounts within FB 3 but was extremely rare within the excavation units outside of FB 3 and the burial area reinforces that connection.

Although venus clams were not identified within the collection of shell from the FB 3 excavation units, they were found in higher quantities within the features in this part of LAN-62. The feature having the greatest amount of the shell by weight was Feature 384 (46 percent). Two others, Features 471 and 671, had much higher percentages of venus clam, but each contained less than 10 g of shell, resulting in percentages that were not reliable. One of the two other features with a large amount of shell, Feature 331, also contained a substantial amount of venus clam (31 percent). In general, venus clam was common throughout the sampled features and was absent only in Feature 456. All other shellfish species varied in their contribution to the features much more so than did venus clam. Scallop, oyster, and littleneck clam varied in their percentage contributions by as much as 44 percent between features. Pismo clam, in addition to varying just as much as the latter three species, was present in only five features but was the single most common species recovered from Feature 673 (41 percent).

Features 331, 384, and 458 were the largest features defined in FB 3. However, Feature 458 yielded less than 50 g of shell compared to 306 g and 461 g from the other two features. The differences in shell quantities in the three features is not related to volume of the feature; instead, it is indicative of different levels of shellfish processing and discard.

Table 205. Shellfish from Feature Block 3 Nonburial Features, LAN-62, Locus A/G

Feature No.	Scallop		Venus Clam		Abalone		Oyster		Littleneck Clam		Pismo Clam		Other		Unidentified		Total
	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)
331	3.6	6	96.3	24	143.0	70	21.2	52	7.2	21	8.4	15	0.6	2	25.8	10	306.1
373	—		—		—		0.6	1	—		—		—		0.9	0.4	1.5
384	34.1	53	214.0	53	44.0	21	6.6	16	13.0	38	4.5	8	21.4	63	124.0	50	461.6
433	2.3	4	16.4	4	—		1.4	3	3.9	11	—		—		13.6	5	37.6
454	0.8	1	1.0	0.2	—		—		4.5	13	—		2.9	9	0.6	0.2	9.8
456	1.7	3	—		—		0.9	2	0.9	3	—		—		6.7	3	10.2
458	0.3	0.5	16.6	4	—		—		2.3	7	3.9	7	8.9	26	12.8	5	44.8
467	6.7	10	15.4	4	—		1.0	2	0.8	2	—		—		10.8	4	34.7
471	—		6.3	2	—		1.2	3	0.5	1	—		—		1.9	1	9.9
475	0.4	1	4.6	1	—		5.5	13	—		—		—		3.9	2	14.4
671	—		7.9	2	—		—		—		—		—		1.0	0.4	8.9
672	3.8	6	16.4	4	18.2	9	2.7	7	0.4	1	23.0	40	—		44.2	18	108.7
673	10.2	16	12.2	3	—		—		0.8	2	17.6	31	—		2.5	1	43.3
Total	63.9	5.9	407.1	37.3	205.2	18.8	41.1	3.8	34.3	3.1	57.4	5.3	33.8	3.1	248.7	22.8	1,091.5

Feature Block 4

Shellfish from 12 excavation units and 12 nonburial features within FB 4 was analyzed (Table 206). FB 4 dates to the Intermediate period and was defined with three-dimensional provenience data. Shell remains from only one to two 10-cm levels of the 12 excavation units were chosen for analysis, and 13.5 percent of the sample from the selected contexts and levels was analyzed. Relative-abundance estimates discussed in the following text is based on shell weight, but NRE relative-abundance estimates are also provided in the accompanying tables.

Excavation Units

The 12 excavation units selected for analysis within FB 4 produced a large collection of shells (see Appendix K.13.18 for detailed analysis results and Appendixes K.13.22–K.13.44 for data from each excavation unit). Nearly 90 percent of the collection (by weight), however, was composed of unidentifiable shell. The shells were highly fragmented and poorly preserved. One pattern worth noting is the near absence of abalone, which was only present in a very small amount within a single level (Level 57) of three excavation units (EUs 280, 390, and 409). The near absence of that species is remarkable, because these excavation units are above the burial features. Abalone was present in half of the analyzed burials, often in large amounts. The absence of abalone from overlying excavation-unit levels reinforces the idea that the shell was reserved for mortuary rituals.

Because of the highly fragmentary nature of the collection, relative species abundance (based on the number of NRE) reveals clearer patterns in the data than shell weights. Note that sample sizes varied between the excavation units both for NRE and shell weights, but there was more variation in NRE. For example, EU 390 alone accounted for 21 percent of the individuals from all excavation units, followed by EU 409 (17 percent of the individuals) and EU 386 (14 percent). In other words, these three excavation units accounted for over half of all individual shells identified (see Appendix K.13.44). Based on NRE, scallops (7 percent), littleneck clams (6 percent), venus clams, and oysters (5 percent each) were represented in relatively higher frequencies compared to Pismo clams (1 percent).

The NRE data indicate variability in the distribution of the five shellfish within the FB 4 excavation units, with some excavation units having higher frequencies (30–40 percent of collection from the excavation units of FB 4) of one shellfish over others. Oysters and littleneck clams generally covary with scallops when all three were found in high percentages within the same excavation units, and vice versa. No NRE data are available for abalone.

Nonburial Features

Twelve nonburial features from within FB 4 were selected for analysis, and together they yielded nearly 11 kg of shell. The 12 features had widely varying quantities of shell, with some containing several hundred grams or even a few kilograms, whereas others had less than 100 g (see Table 206; see Appendix K.13.45). Only 3 percent of the shell from features could not be identified to any taxonomic category. In contrast to the excavation units, shells must have been either deposited whole (or nearly so) in the features or the context (features) provided lower postdepositional fragmentation.

Overall, the most abundant species was scallop. This species was the dominant taxon, accounting for 78 percent of all shell recovered by weight (79 percent according to the NRE count). This pattern is distinct considering that venus clams were the most abundant species elsewhere at the site, venus clams were more abundant than scallops within several of the excavation units of FB 4, and in other cases, the two species were found in nearly equal amounts. Venus clams were a distant second most important species (6 percent) within the nonburial features, despite their absence from three features. These were followed closely by littleneck clam (5 percent). Other species were of only nominal importance, making up a combined 4 percent or less of identified shell fragments.

Feature 419 was the only one with abalone shell (103 g). This feature also had the largest amount of shell of any of the sampled features (over 5 kg), more than double the amount of the next-largest collection. Feature 419 also yielded 3.5 kg of scallop shell (NRE = 811). Despite the high weight, scallops made up no more than 67 percent of all shells in the feature, substantially less than in many other features. In three other features, scallops constituted well over 90 percent of the sample, and several more features contained around 75 percent scallop. All other species were present in low numbers throughout the sample of features, with the exception of Feature 613. Scallops accounted for only 6 percent of the shells in Feature 613, and venus clams and oysters were entirely absent. Instead, littleneck and Pismo clams together accounted for nearly 90 percent of the shell from this feature (44 percent each). These numbers should be treated with great caution, because only a very small amount of shell (less than 9 g) was recovered from this feature.

Feature Block 7

FB 7 dates to the Millingstone period and is located to the northeast of the burial ground. Four nonburial features and the four Millingstone levels from 10 excavation units were selected for analysis in FB 7. These excavations together produced approximately 4 kg of shell. See Appendixes K.13.46–K.13.57 for detailed discussion of the data from FB 7.

Excavation Units

Data from the 10 excavation units revealed that much like the rest of the site, venus clams were the most abundant species,

Table 206. Shell Content of Excavation Units and Nonburial Features from FB 4, LAN-62, Locus A/G

Measure, by Species	Excavation Units	Feature No.												Total
		413	419	483	509	535	536	541	542	563	571	572	612	
Scallop														
Weight (g)	336.4	15.1	3,500	992	259.3	287	23.1	149	191	415.8	2,315	398	0.5	8,545.8
Percent	2.9	24.7	66.8	88.8	72.5	72.3	51.6	77.8	94	91.8	97.7	80.7	5.7	78.2
Venus clam														
Weight (g)	522.8	5.9	529.7	14.9	36.6	24.7	—	8.2	—	16.7	13.2	32.1	—	682
Percent	4.5	9.6	10.1	1.3	10.2	6.2		4.3		3.7	0.6	6.5		6.2
Abalone														
Weight (g)	1.5	—	103.4	—	—	—	—	—	—	—	—	—	—	103.4
Percent	<0.1		2.0											0.9
Oyster														
Weight (g)	167.3	1.5	107.6	26.2	4.9	10	3.4	4.2	2.9	7.4	2.1	11.3	—	181.5
Percent	1.4	2.5	2.1	2.3	1.4	2.5	7.6	2.2	1.4	1.6	0.1	2.3		1.7
Littleneck clam														
Weight (g)	401	18	363	40.6	29.4	41.9	6.1	15	0.5	8.3	25.1	19.9	3.9	571.7
Percent	3.4	29.4	6.9	3.6	8.2	10.6	13.6	7.8	0.2	1.8	1.1	4.0	44.3	5.2
Pismo clam														
Weight (g)	341.5	16.6	323	18.5	16.5	5.8	9.3	9.3	8.5	0.2	9.6	12	3.9	433.2
Percent	2.9	27.1	6.2	1.7	4.6	1.5	20.8	4.9	4.2	<0.1	0.4	2.4	44.3	4.0
Other														
Weight (g)	142	—	56.4	2.2	1.8	9.4	0.7	—	—	—	0.4	4.1	—	75
Percent	1.2	—	1.1	0.2	0.5	2.4	1.6				<0.1	0.8		0.7
Unidentified														
Weight (g)	9,821.7	4.1	253	22.7	9.2	18.1	2.2	5.7	0.3	4.5	5.3	16	0.5	341.6
Percent	83.7	6.7	4.8	2.0	2.6	4.6	4.9	3.0	0.1	1.0	0.2	3.2	5.7	3.1
Total														
Weight (g)	11,734.2	61.2	5,236.1	1,117.1	357.7	396.9	44.8	191.4	203.2	452.9	2,370.7	493.4	8.8	10,934.2
Percent	10	0.6	47.9	10.2	3.3	3.6	0.4	1.8	1.9	4.1	21.7	4.5	0.1	10

followed by littleneck clams (Table 207). Oyster was present only in very small amounts, and abalone was absent. The distribution suggests a focused collection strategy based on the dominance of four shellfish species. The "other" category, made up of shellfish usually rare on Ballona-area sites, was practically devoid of identified shells. Further, in contrast to FB 3, which dates to the Protohistoric to Mission periods and is located on the western side of the burial area, FB 7 contained only a relatively small amount of unidentifiable shell (less than one-third of the total collection by weight).

Nonburial Features

Four features from FB 7 were selected for analysis (see Table 207). The features contained very little shell (less than 20 g). The small sample size precluded rigorous comparisons between collections from features and excavation units in FB 7. Feature 449 (dated to the Millingstone period) yielded the largest quantities of shellfish. A total of 13 g of shell was recovered with Pismo clam (32 percent), scallop (29 percent), and littleneck clam (25 percent) in relatively higher frequencies. The only other feature that yielded adequate shell to provide insight into shellfish use was Feature 573. Approximately 6 g of shell was recovered from the feature, most of which was unidentifiable (60 percent), with scallop (27 percent) and littleneck clam (13 percent) in lower frequencies. The remaining two features (Features 574 and 623) were represented by 0.1 g each of shell. In general, venus clam, the most-common shellfish species among the collections derived from FB 7 excavation units, was not present in any of the features. Abalone was also absent in the features. In general, abalone was often rare in excavation units but either frequent or present in measurable quantities within most features or groups of features, even nonburial features.

Comparing Analytical Contexts

Differences in the importance of the various principal shellfish species across LAN-62, Locus A/G, are observed, especially when comparing the midden collections (excavation units) from FB 4 and FB 7 and the collections from features in the feature blocks and nonburial features within the burial ground. This comparison provides insight into temporal and spatial differences.

Feature Blocks 4 and 7: Comparing Excavation Units

Shellfish collections from the excavation units in FBs 4 and 7 are broadly similar to one another, despite that they date to different time periods (Table 208; Figure 249). Results from both feature blocks indicate an emphasis on mudflat-dwelling shellfish, in particular the venus clam. Nonetheless, the emphasis on venus clams is significantly more pronounced within FB 7 than in the later FB 4. In general, the shellfish analysis from FB 7 reveals a somewhat more focused gathering strategy (few species in overwhelming quantity) in comparison to the Intermediate period (several species in similar quantities). Oysters, in particular, were several times more frequent within FB 4 than FB 7 (9 vs. 2 percent), which is surprising given that the lagoon was more open during the Millingstone period.

In contrast to the Millingstone sample, there was no overwhelming concentration on venus clams, or any other single species, in the Intermediate period collections from FB 4. In the Millingstone period, there was a secondary focus on sandy beach environments, where Pismo clams were collected. In the Intermediate period, littleneck clams were slightly more common than scallops and Pismo clams, whereas oysters and abalone were comparatively unimportant foods. Both of the latter taxa require rocky substrates, and abalone prefers relatively deep water. Of the four most prominent species in FB 7, three are native to mudflats or sand flats, such as those found in marshes, bays, and sounds. Pismo clams, however, prefer sandy beaches with strong tides. The estuary itself would not have been a suitable area for the species to colonize, but the nearby beaches along the shore of Santa Monica Bay would have been both suitable and within easy reach of the inhabitants of this site. Given that FB 4 dates to the Intermediate period, shellfish data are consistent with the environmental reconstruction, which suggests that the Ballona had formed into an attractive estuary by this time with a suitable environment for these shellfish species. Taken together, the three mudflat species, scallops, venus clams, and littleneck clams, provided two-thirds of the shellfish diet at this time.

FB 7 dated to the Millingstone period and was characterized by venus clams, which accounted for half of the identified shell, followed by Pismo clams (see Table 208). Yet, when other mudflat-dwelling shellfish are added to the venus clam total, for a sum of 76 percent, the exploitation is similar to that noted at FB 4. The total portion of the collection accounted for by venus clam, littleneck clam, and scallop was 66 percent in the Intermediate period. This suggests that during the Millingstone period, the Ballona Lagoon was formed and hosted lagoonal shellfish, but the sandy beaches where Pismo clams were collected were also accessible during this time period. It nonetheless seems that, prior to a certain amount of alluvial infilling of the lagoon, the rocky substrates required by oysters were still available during the Intermediate period, such that the species was present in some quantity (9 percent).

Comparing Nonburial Features from the Feature Blocks and the Burial Area

Comparison of data from midden and features of the feature blocks is not possible because of the widely divergent sample

Table 207. Shell from FB 7 Excavation Units and Features, LAN-62, Locus A/G

Context	Scallop		Venus Clam		Abalone		Oyster		Littleneck Clam		Pismo Clam		Other		Unidentified		Total Weight (g)
	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	
Features																	
449	3.8	69.1	—		—		—		3.2	80.0	4.1	100.0	—		1.9	32.8	13
573	1.7	30.9	—		—		—		0.8	20.0	—		—		3.7	63.8	6.2
574	—		—		—		—		—		—		—		0.1	1.7	0.1
623	—		—		—		—		—		—		—		0.1	1.7	0.1
Subtotal (features)	5.5	28.4	—		—		—		4	20.6	4.1	21.1	—		5.8	29.9	19.4
Excavation units	562.3	11.5	1,785.6	36.4	21.4	0.4	56.2	1.1	434.2	8.8	765.4	15.6	31.1	0.6	1,253	25.5	4,909.2
Total	567.8	11.5	1,785.6	36.2	21.4	0.4	56.2	1.1	438.2	8.9	769.5	15.6	31.1	0.6	1,258.8	25.5	4,928.6

Table 208. Shellfish from Excavation Units from FBs 4 and 7, LAN-62, Locus A/G

Feature Block No.	Scallop		Venus Clam		Abalone		Oyster		Littleneck Clam		Pismo Clam		Other		Total	
	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent	Weight (g)	Percent
4	336.4	17.6	522.8	27.3	1.5	0.1	167.3	8.7	401.0	21.0	341.5	17.9	142.0	7.4	1,912.5	100.0
7	562.0	15.4	1,785.6	48.8	21.4	0.6	56.2	1.5	434.2	11.9	765.4	20.9	31.1	0.9	3,655.9	100.0
Total	898.4	16.1	2,308.4	41.5	22.9	0.4	223.5	4.0	835.2	15.0	1,106.9	19.9	173.1	3.1	5,568.4	100.0

Note: Does not include unidentifiable shell.

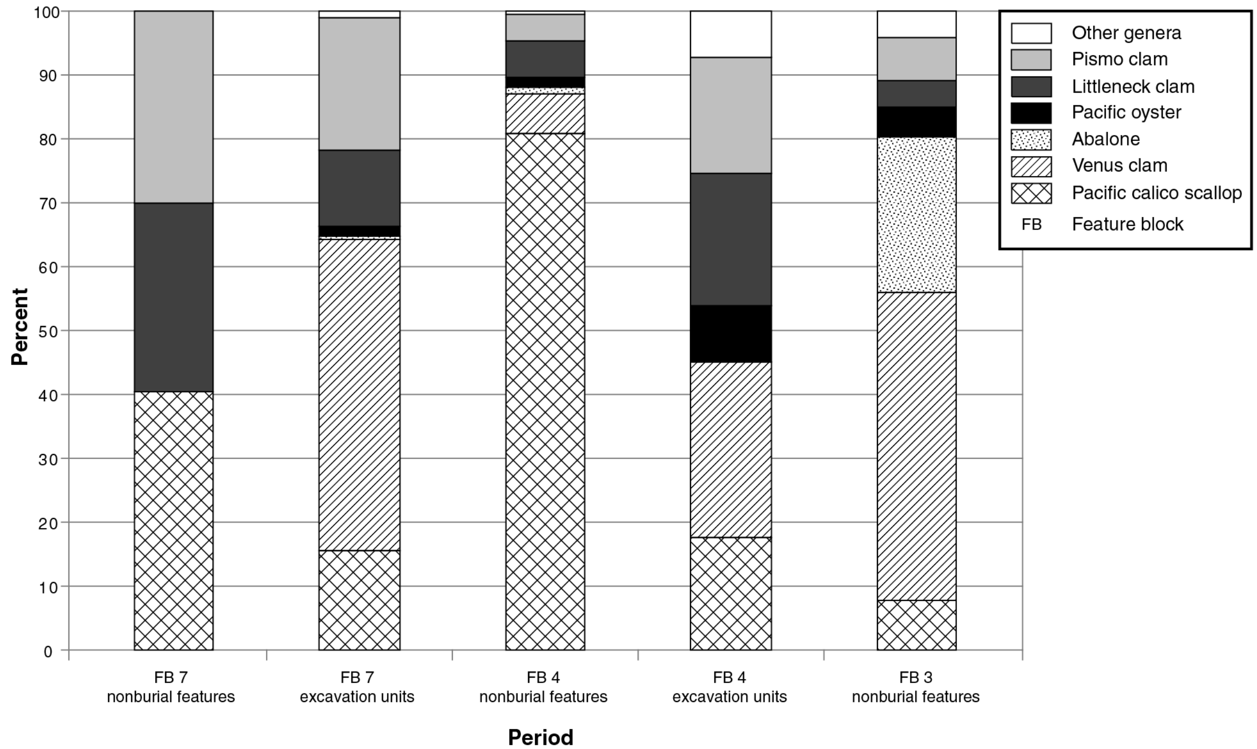

Figure 249. Dominant shellfish taxa in FBs 3, 4, and 7 at LAN-62, Locus A/G.

sizes. For example, features of FB 7 yielded only 19 g of shell, which makes comparison to the excavation-unit collection challenging. Similarly, comparing data from FB 7 features to the data from FBs 3 and 4 is not possible. However, data from features in FBs 3 and 4 provide an interesting comparison, and three patterns were noted (see Figure 249). (Note that shellfish speciation was done only on the FB 3 nonburial features.)

First, in the Intermediate period FB 4, an emphasis on scallops was observed. This is an unexpected pattern for the Ballona, especially given that venus clams were dominant in the control units of FB 4 but account for only 6 percent in the FB 4 features. There was, however, an overarching continuity between FB 4 excavation units and nonburial features, in that both contexts demonstrated a concentrated collecting effort aimed at a particular species: venus clam in the excavation units and scallop in the nonburial features.

Second, an intriguing pattern between the features of FBs 3 and 4 is the relative importance of venus clams. As discussed above, venus clams were relatively rare within the Intermediate period FB 4 features, but they are the single most abundant species (37 percent) within the Late to Mission period FB 3 features.

Finally, the amount of abalone found in features of FBs 3 and 4 is very distinct. FB 3 features yielded a relatively sizable amount of abalone (19 percent) in comparison to the quantities from FB 4 features (1 percent). The two feature blocks were otherwise similar, containing nearly the same amounts of oyster, littleneck clam, and Pismo clam. Still, these observations should be viewed with some caution, because the overall sample sizes from the two sets of nonburial features were quite different. FB 4's shell sample weighed a total of nearly 11 kg, a stark contrast to the approximately 1 kg recovered from the nonburial features of FB 3.

The nonburial features from the burial area are more difficult to compare, because they could not be dated. However, it is interesting that the relative abundances of several shellfish species in that context are similar to those calculated for the nonburial features within FB 3. Venus clams were the most abundant species in these contexts, 37 percent within the burial-area nonburial features and 36 percent within those from FB 3. Very close species abundances are also evident for scallops (7 percent for the burial area; 6 percent for FB 3) and Pismo clams (6 percent for the burial area; 5 percent for FB 3). Despite those strong similarities, differences are also apparent, such as the relative prominence of abalone in FB 3 (19 percent) instead of the small amount (5 percent) present in the nonburial features found in the burial area. In addition, there was also a higher profile of both oysters (12 percent) and littleneck clams (15 percent) within the nonburial features in the burial area, as opposed to FB 3, where the latter two species accounted for only 4 and 3 percent, respectively.

Locus A/G Shell Density by Occupational Period

In this portion of the chapter, we evaluate changes in shell deposition across the site, which can be related to disposal patterns, processing areas, or harvesting goals. These factors, of course, must also be placed into their temporal contexts, such that we may observe how the shell collection formed over time. Calculated densities are also compared in this section to see how intensively different areas of LAN-62, Locus A/G, were used either over time or even within the same era.

The following discussion addresses shell densities across LAN-62, Locus A, only, because the sole control unit in Locus G was not dated, making the calculated density difficult to compare with dated contexts. It is sufficient to observe that the overall density calculated for CU 1048 (Locus G) was rather low, at 205 g/m^3 (see Appendix K.13.24), which suggests that this was not an area intensively used as a dump or food-preparation area. Nonetheless, it is possible to pick out patterning within the 13 arbitrary levels selected for analysis. In general, it seems that this area of the site may have been more heavily used in earlier time periods: 5 out of the 6 levels between Levels 93 and 98 contained greater than 100 g of shell, but the only level above Level 93 to surpass the 100 g level was Level 87.

A comparison of density estimates within the two feature blocks (FBs 4 and 7) for which we have calculated soil volumes and artifact densities, shows a significant but unsurprising difference between the two areas (see Appendixes K.13.58 and K.13.63). The estimated total soil volume for analyzed portions of excavation units in FB 7 is 5.7 m^3, which produced nearly 5 kg of shell. These figures translate to an estimated 861 g/m^3, a relatively low density of shell. A low density indicates, generally, that either occupation of a site, or a portion of a site, was sparse, concomitant with a less than intense level of shellfish harvesting and processing. Therefore, the low density of shell demonstrates that LAN-62 was not subject to intense settlement and use during the Millingstone period.

By way of contrast, it seems occupation of the site during the Intermediate period was more intense. This is visible, first of all, purely from the amount of shell collected from FB 4, which totaled almost 12 kg. The resultant density estimate for the analyzed excavation units of the feature block is quite high, at 3,801 g/m^3. Clearly, Intermediate period human populations were either larger or visited this site much more often than in the preceding period, because the amount of harvested shell is so much higher at this time. Population fluctuation and its effects on food gathering, along with processing intensity has been an item of discussion with respect to the Ballona area. Altschul et al. (1993) and Altschul et al. (2005) have proposed that a significant population increase occurred during the Intermediate period, caused by environmental shifts that made the area more attractive to human populations migrating westward from the desert areas.

Density data from the control units, however, suggest a different history of site occupation and use (Table 209; Figure 250). The early Intermediate period registered the second-highest shell density (812 g/m^3) of any of the strata for which well-bracketed dates and density estimates are available. Yet, the estimated density for late Millingstone period deposits is also quite high, at 782 g/m^3. Each of the latter estimates is approximately twice that calculated for the Late to Mission period deposits, whose density is only 346 g/m^3. Some of the control units contained levels that could be dated only to the combined Late to Mission period. These combined strata produced the highest density of all (869 g/m^3).

The variation in densities within the chronologically distinct strata in the control units is similar to those identified in the excavation units. The excavation units show a dramatic increase in density that is presumably related to increased populations living at or near LAN-62, A/G, between the Millingstone and Intermediate periods. The control units show this as well, given that for each of the main shellfish taxa there is a significant jump in abundance by weight, from the Millingstone to the Intermediate period, and again, from the latter period to the Late to Mission period (see Table 209). Density estimates for control units' shellfish content in some cases go down over time and in other cases go down in the Intermediate period but recover in the Late to Mission period, go down in the Mission period after steady increases, or follow other patterns (see Appendixes K.13.19–K.13.23).

Locus A/G Shell Density by Spatial Unit

The density of shell varies across Locus A/G, although as a general rule one can observe that the amount of shell per volume of soil was high. Despite the fact that the greatest amount of activity at the site occurred during the Late to Mission periods, when the burial area and associated features were used, this period did not yield the greatest shell densities. Instead, which is also remarkable, the Millingstone period occupations of FB 7 contained estimated shell densities up to two to three times the levels calculated for the Late to Mission periods. This feature block is situated to the north of the burial area, toward CU 1048, which produced the lowest density of any context within Locus A/G. The high density registered in FB 7 is also surprising, as population density within the Ballona was very low during the Millingstone period according to current models.

The control units, of course, were selected to sample different portions of the midden, such that it is difficult to judge relative densities of various areas on the basis of these single, spread-out units. Nonetheless, it is worth noting the particularly high density of CU 682 (5,547 g/m^3), well over twice that of CU 316, another unit located on the periphery of Locus A/G, approximately 20 m to the north of CU 682, and an equal distance from the burial area. CU 323/321 produced a lower but still fairly high density (1,105 g/m^3), which is again interesting given the control

Table 209. Relative Abundance of Species through Time and by Context, LAN-62, Locus A/G

Context	Period	Scallop (%)	Venus Clam (%)	Abalone (%)	Oyster (%)	Littleneck Clam (%)	Pismo Clam (%)	Other (%)	Unidentifiable (%)
Burial features			2.0	86.0	1.0		2.0	5.0	3.0
Burial area		7.0	36.0	5.0	12.0	15.0	6.0	4.0	
Shell items from burial area		3.0	2.0	64.0	2.0	1.0	2.0	23.0	3.0
FB 3 nonburial features	Late to Mission	6.0	37.0	19.0	4.0	3.0	5.0	3.0	23.0
FB 4 nonburial features	Intermediate	78.2	6.2	0.9	1.7	5.2	4.0	0.7	3.1
FB 7 nonburial features	Millingstone	28.4				20.6	21.1		29.9
FB 4 excavation units	Intermediate	3.0	4.0		1.0	3.0	3.0	1.0	84.0
FB 7 excavation units	Millingstone	11.0	36.0		1.0	9.0	16.0	1.0	26.0
Control units		4.8	35.5	2.6	15.9	25.2	4.4	0.6	11.0
	Late to Mission	1.5	20.3	0.1	12.2	8.8		17.3	39.8
	Late to Mission	14.2	33.4	1.7	8.9	20.1	10.1	1.5	10.1
	Late to Millingstone	17.2	12.3		5.5	23.7	10.5	5.1	25.8
	early Intermediate	18.2	29.6	0.3	5.6	18.3	13.3	3.4	11.2
	early–late Millingstone	14.6	54.3	0.2	0.8	10.0	8.6	1.8	9.8
	early–late Millingstone	22.5	10.9	9.0	1.5	12.3	33.2	0.4	10.1
	early–late Millingstone	4.6	36.6		8.2	8.4		1.4	40.7
Subtotal (control units)		14.0	34.0	1.0	8.0	18.0	10.0	3.0	12.0
Total		22.70	18.66	10.02	3.78	9.16	6.72	3.15	25.79

Key: FB = feature block.

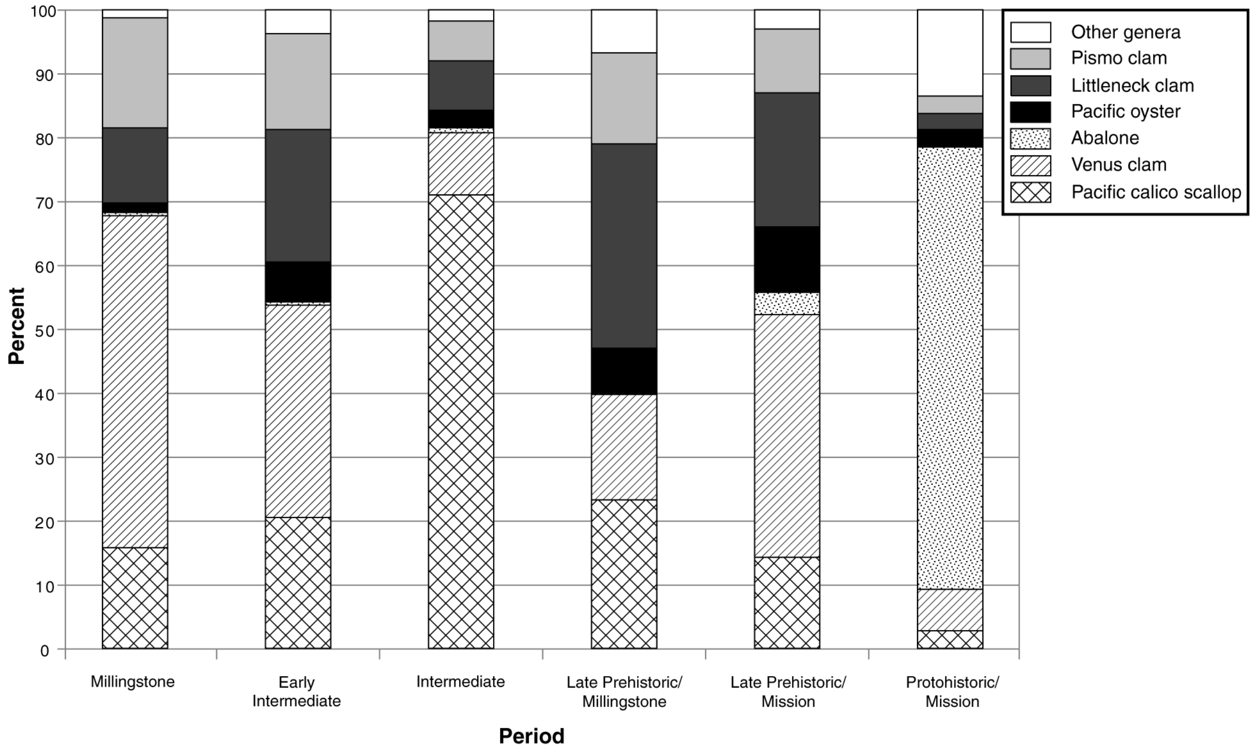

Figure 250. Dominant shellfish taxa, by period, at LAN-62, Locus A/G.

unit's position to the northwest of the main portion of the site. On the other hand, CU 853, located nearly 30 m west of the burial area, had a low density of just 297 g/m^3, which may indicate that the site tapers off faster to the west than in any of the other cardinal directions. The lowest density of any control unit was that of CU 1048 (205 g/m^3). This control unit, in Locus G, appears to be outside the principal area of occupation at the site, although its deeper levels do show higher densities, such that it may be this portion of the site that was more heavily used during an earlier era or the occupation surface dipped down toward the lagoon at the northern edge of the site. At first glance, it seems most inexplicable that CU 141, located within the burial area, should have only a moderate calculated density of 938 g/m^3. However, a closer look at the unit's statistics shows that shell density increases over time, reaching its peak in the Late to Mission period (1,246 g/m^3).

Shell densities from LAN-62, Locus A/G, reveal an intensive occupation over a long period of time, but that was especially the case in the Millingstone period and at the northern edge of the area. The relatively high shell density of FB 4 in the area's center, as well as those of several of the surrounding control units, shows a generally highly active area stretching some 10–20 m to the north, east, and south. To the west, CU 853's low density shows that the site's limits were sooner reached in this direction than in any other direction.

Comparison of Burial Features to Nonburial Features from the Burial Area and Feature Blocks 3, 4, and 7, and Shell Items from the Burial Area

Comparison of shell data from burial and nonburial features shows that the two groups are distinct. The most obvious difference is the amount of abalone present. Whereas nonburial features in most cases contained small amounts of abalone (FB 7 produced none), it is the most common shell by far (86 percent) within burial features (see Figure 249). FB 3 yielded more abalone shell (19 percent) than any other context (apart from the burial features), although three-quarters of that species' shell came specifically from Feature 331. A second difference between the two groups is more subtle but no less striking: rare species placed within the "other" category in the table do not form a large percentage of any of the compared contexts' collections. However, although rare species constitute only 5 percent of the shell from the burial features, they are the second most important shellfish category when examined in terms of rank order. This is far from the case with respect to the nonburial features, where these rare species are consistently the least important taxonomic group, or nearly so. The remaining distinctions between these two groups of features, burial and nonburial, are less striking but no less consistent.

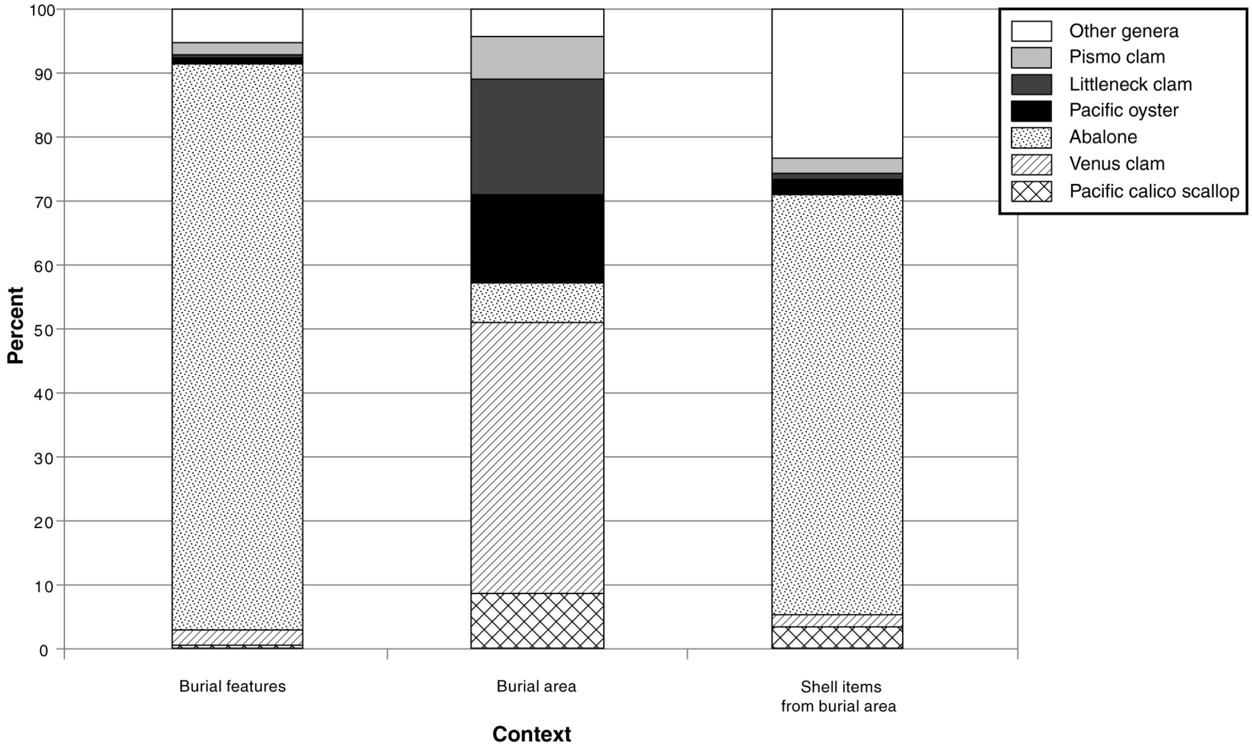

Figure 251. Dominant shellfish taxa from the burial area, by context, at LAN-62, Locus A/G.

The fact that abalone was so dominant within burial features caused the percentages of all other shellfish species to be very low, especially in comparison to the other feature groups (Figure 251). Even when abalone are left out of percentage estimates, the relative abundance of shellfish species in burial features is still divergent from the pattern displayed by nonburial features. First, the "other" category becomes the dominant one, whereas venus and Pismo clams take up the second and third places, respectively. Although both the burial area midden and FB 3 nonburial feature group collections are dominated by venus clams, neither contained a substantial amount of Pismo clam; none of the groups of nonburial features did.

Another interesting comparison can be made between the shell items (individual collected shell that was found outside of features) and the feature groups. The shell items were made up overwhelmingly of abalone shells (64 percent), and were again reminiscent of the burial features, with the "other" category containing the second highest amount of shell (23 percent). With such dominant amounts of shell by weight, the latter two taxonomic categories quite naturally suppressed the percentages of all other shellfish taxa to no greater than 3 percent. Still, even when abalone is not considered, the rank order of the remaining species is certainly unusual when compared to the other feature groups. After the "other" category, the next most important taxon is the scallop, followed by Pismo clam, oyster, and venus clam, in that order. That rank order is not reproduced within any group of nonburial features, nor among the analyzed control units or feature blocks.

There is a sharp, clear distinction between features formed as the result of food preparation, disposal, or other tasks involving shells, and human burials. Clearly, abalone, which usually requires some effort to harvest as it is found in marine environments requiring diving, was considered beautiful and precious because of its nacreous quality. Thus, it may have been present as a funerary donation but not as daily food. Abalone shell was also used as serving bowls for food and for containing other artifacts. Thus, abalone may have been deposited in burials as a container. It is of course quite possible that abalone was a funerary feast food, and the dead were buried with the beautiful shells. What is also interesting is that, as discussed earlier in this chapter, only half of the 80 burials analyzed contained any abalone, and the 40 that did had widely varying amounts. One wonders whether presence, absence, and abundance of abalone within burials therefore correlates with some human social distinction, such as age, gender, or specialization (see Volume 5, Chapter 6, of this series).

Locus C/D

This section presents the analysis of the shell from LAN-62, Locus C/D. Seven control units and a single nonburial feature (Feature 201) were selected for analysis. The control units included three from Locus C (CUs 534, 922, and 937/560) and two from Locus D (CUs 998 and 1000). See Appendix K.13.64 for detailed analysis results. Figure 252 shows the dominant shellfish taxa by weight from each control unit.

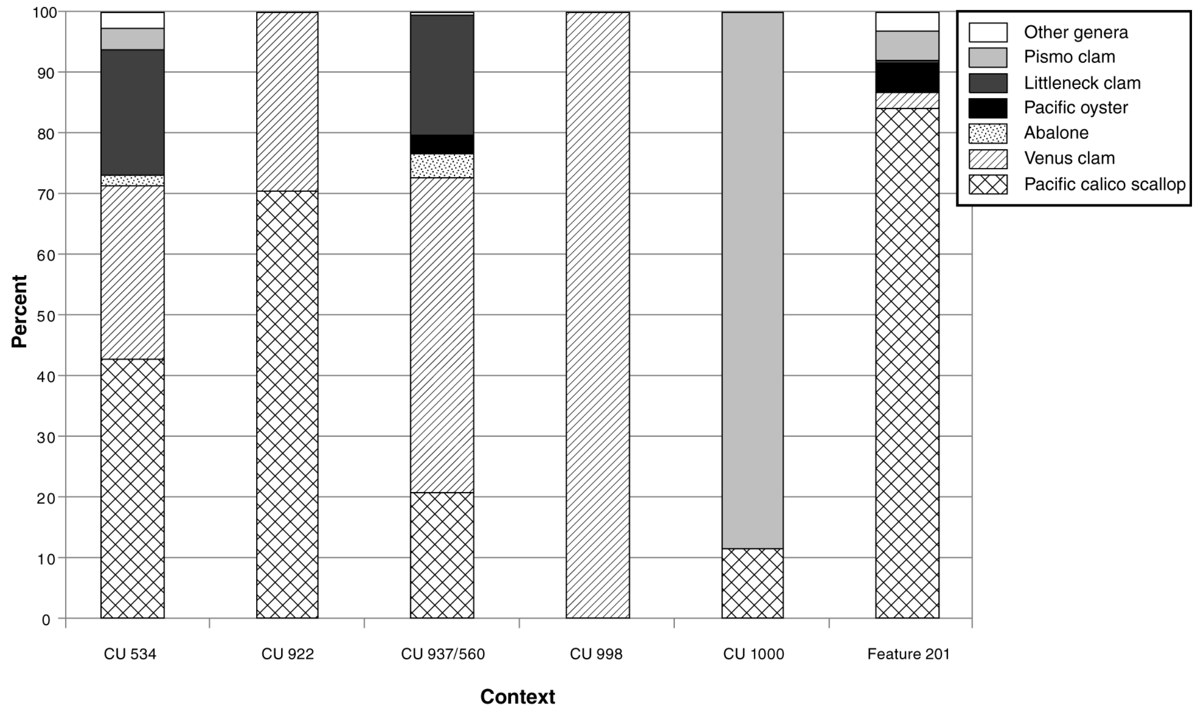

Figure 252. Dominant shellfish taxa, by control unit and feature, at LAN-62, Locus C/D.

Table 210. Shellfish from Analytical Contexts at LAN-62, Locus C/D

Context	Scallop		Venus Clam		Abalone		Oyster		Littleneck Clam		Pismo Clam		Other		Unidentified		Total		Unit Volume (m^3)	Density (g/m^3)
	Weight (g)	%	Weight (g)	%	Weight (g)	%	Weight (g)	%	Weight (g)	%	Weight (g)	%	Weight (g)	%	Weight (g)	%	Weight (g)	%		
CU 534	64.4	27.0	43.1	18.0	2.5	1.0	0.1		31.4	13.0	5.1	2.0	4.1	2.0	55.6	23.0	239.4	31.7	2.6	92.1
CU 922	4.3	46.0	1.8	19.0	—		—		—		—		—		3.2	34.0	9.3	1.2	0.9	10.3
CU 937/560	78.5	18.0	196.9	46.0	15.2	4.0	11.3	3.0	74.0	17.0	0.6	<0.1	1.9	<0.1	48.7	11.0	427.1	56.6	2.5	170.8
CU 998	—		6.8	81.0	—		—		—		—		—		1.6	19.0	8.4	1.1	0.2	42
CU 1000	2.4	10.0	—		—		—		—		18.6	81.0	—		2.0		23.0	3.0	1.7	13.5
Feature 201	28.5	60.0	0.9	19.0	—		1.5	3.0	0.2	4.0	1.7	4.0	1	2.0	13.6	28.0	47.4	6.3		
Total	178.1	23.6	249.5	33.1	17.7	5.0	12.9	1.7	105.6	14.0	26.0	3.4	7.0	0.9	124.7	16.5	754.6	100.0	7.9	95.5

Key: CU = control unit.

These analytical contexts yielded a small shell sample weighing a total of 755 g (Table 210; see Appendixes K.13.65–K.13.71). The most abundant species according to weight was the venus clam (33 percent), followed by the scallop (24 percent). That numerical order is largely a product of the relatively large sample from the combined CU 937/560, which contained nearly 200 g of venus clam shell fragments, approximately half the total weight of shell in the control unit. Outside of that unit, scallop predominated in all contexts, with the exception of CU 1000, where Pismo clams made up nearly the entire sample (81 percent). This result is the opposite from that generated by the NRE count, where scallops were much more abundant than all other species, including the venus clam. In any event, it is difficult to draw much in the way of conclusions from these data, given the very small sample size. In general, the emphasis on scallops and venus clams is reminiscent of other Ballona sites and indeed of other portions of LAN-62. Scallops dominated the shell collection of LAN-2768, which is located farther up Centinela Creek from LAN-62. At many other sites in the area, the shell collections were more often dominated by venus clams. Therefore, in regard to the two most important species present, the shell from Locus C/D fit well within the established shellfish exploitation pattern. Therefore, it seems that the population of this portion of LAN-62 generally relied mainly upon the Ballona Lagoon for the shellfish beds they exploited for food.

Shell Density

In general, the occupational intensity of this area of the site was quite low, with none of the control units producing more than 500 g of shell (see Table 210). The control unit with the highest density was CU 937/560, which had a density value of 171 g/m^3. The score is deceiving, however, in that the vast majority of the shell from this combined unit came from CU 937 rather than CU 560. Thus, the two combined squares, located in the central, narrow portion of LAN-62, do not show a continuous and relatively intense sequence of deposition. Instead, it is within the levels of CU 937, a later depositional sequence than what is contained within CU 560, which produced evidence for a significant amount of occupational activity.

CU 534 produced the second highest density value (92 g/m3). The height of occupational intensity here seems to have been at an early point in time, when the lower layers of the control unit were deposited. Those layers, mainly Levels 94–101, contained more than half the total weight of shells recovered from the control unit.

Location also impacted the degree to which dense deposits of shellfish were encountered. CU 922, in the center of the long site, produced a low density of shell, only 10 g/m^3. This is close to the density estimate for CU 1000, located near the far-eastern tip of LAN-62, Locus C/D, whose density was calculated at 10 g/m^3. In between these two areas, there appears to have been, perhaps at different times, an area of moderate occupation and use.

Shell Taphonomy

There may be a number of explanations for the observed variations in shell density across Locus C/D, including post-depositional destructive forces, such as the creek eroding away deposits from certain areas of the site over time or historical-period human activities destroying more of this portion of the site than elsewhere. The principal differences between control units, however, are density and sheer amount (total weight) of shell, rather than percent of unidentifiable shell. If differential postdepositional destruction were the primary force acting upon the shell remains, rather than the collection being the result of a sparse occupational history, the relative amount of unidentifiable shell should have varied consistently from one portion of Locus C/D to another. CUs 998 and 1000 had two of the lowest percentages of unidentifiable shell in the sample (see Table 210), but the latter control unit contained none and the former contains 19 percent, a wide amount of variation given that both control units are located at the eastern end of LAN-62.

The remaining control units and Feature 201 are located in the middle area of this portion of Locus C/D and had unidentifiable shell proportions ranging from 11 to 34 percent. CU 922, located at a midpoint between CU 937/560 to the west and CU 534 and Feature 201 to the east, contained a substantially higher proportion of unidentifiable shell, 34 percent, than any of the examined contexts to the east or west. It is true, however, that CU 534 and Feature 201, located near one another within the same excavation block, had similar amounts of unidentifiable shell, 23 and 28 percent, respectively. If there is any pattern to the unidentifiable shell proportions, it is that the amount of unidentifiable shell increased from east to west. However, that observation is most likely merely a function of overall sample size, which also generally increased, along with density, in the same direction.

The best explanation for the discrepancy in density and amount of unidentifiable shell in Locus C/D is that the area was used sparingly over a long period of time, as indicated by the fact that small amounts of shell were found in both upper and lower control-unit levels through each of the widely spaced control units. Essentially, the intensity with which the site was used drops off in a west–east direction, a pattern indicated by shell-density estimates and total shell weights per analyzed context.

Summary of LAN-62

The two loci, Loci A/G and C/D, are very different from one another. Locus A/G was very clearly an area of concentrated activity and occupation not just in the Late to Mission periods but also much earlier, in the Millingstone and Intermediate periods as well. This is visible from the sheer amount of shell, whose total weight in the examined units and features was more than 54 kg, as well as the density calculated for all periods together (1,500 g/m^3). By way of contrast, the total weight of all recovered shell from Locus C/D was only 755 g, albeit a much smaller number of units and features was selected for analysis. Nonetheless, the total density estimate for all contexts at Locus C/D (96 g/m^3) is far from that calculated within Locus A/G. It is worth noting that, within each of the loci, the density drops off in different directions. In Locus A/G, the density of shell most notably drops off to the north and, to an extent, at the western extreme of the area. Within Locus C/D, as discussed above, density of shell, such as there is, tapers off to the east. In part, this is a pattern most likely created by sampling error. If more squares had been excavated in the long area in between the easternmost Locus A/G context, CU 682, and the westernmost Locus C/D square, CU 937/560 (the two being separated by some 600 m), the results would likely have shown a noticeable drop in shell density in that direction as well.

The density distributions also help define the boundaries of the site or sites. The boundaries of LAN-62, Locus A/G are the easiest to define, as a very concentrated deposit of shells drops off to a much sparser deposit at least to the north and west, and at some undefined point, to the east as well. Because of the overall scattered nature of the deposit in Locus C/D, the boundaries are more difficult to define. There is the discussed decline in shell density to the east of the site's middle section, where a bulge following the creek points to the south, but beyond this, the limits are difficult to define. Is there some point at which the relatively rich area of CU 937/560 peters out to the west, or is this shell concentration the tail end of the Locus A/G deposit? The northern and southern boundaries of the area are resolved by other means. The southern boundary of the site is of course delimited by the bluff, and the northern border was truncated by road construction.

Despite the stark difference in shell density and, by implication, intensity of occupation, the two areas of LAN-62 are similar in species makeup and relative abundance. In both sections of the site, venus clams and scallops were the two most important species. The relative importance of the two species may vary between the two areas, however, depending on whether one views all contexts together or not. When all contexts—nonburial features, burial features, excavation units, and control units—are examined together, scallops (23 percent) were somewhat more abundant than venus clams (19 percent) (see Table 209). The opposite is the case in Locus C/D, where venus clam (33 percent) was more common than scallop (24 percent) (see Table 210). Abalone (in all contexts at LAN-62, Locus A/G) was fairly common, comprising 10 percent of the total shell sample.

However, when we leave out from the relative abundance calculations of Locus A/G the shell from features, which in many cases contained anomalous amounts of abalone or unusually large contributions of scallops, the LAN-62 loci appear more similar. In that scenario, venus clams rank first (34 percent), followed by littleneck clams (18 percent) and then scallops (14 percent). Littleneck clams were also relatively common in the LAN-62, Locus C/D area, where they made up 14 percent of the sample.

Finally, it appears that preservation was fairly equal across the site, perhaps slightly better within LAN-62, Locus A/G, because the unidentifiable total there was only 12 percent within the control units alone, as compared to 17 percent at Locus C/D. Within LAN-62, Locus A/G, the unidentifiable component of the sample was actually much higher when burial and nonburial features were added to the total, reaching 26 percent. The difference within Locus A/G between control units alone and control units together with features is surprising given that many of the burial features contained readily identifiable whole shells. One apparent explanation is that the nonburial features, hearths, and rock clusters appear, in part, to be related to food preparation, which may have necessitated shell breakage. Certainly, the nonburial features from FBs 3 and 7 contained relatively high amounts of unidentifiable shell, comprising around one-quarter of those collections. Nonetheless, those unidentifiable amounts pale by comparison to the extremely poorly preserved shell collection from the FB 4 excavation units, from which a large amount of the shell (84 percent) could not be identified.

The shell sample from LAN-62 was a complex collection from domestic and ritual contexts, earlier and later time periods, as well as intensive and scattered occupations. Although shell deposits from Locus C/D depicted an occasionally occupied site or a portion of a site well removed from the main locus of activity, those from Locus A/G depicted the opposite, a long and intensive occupation with—at least toward the end of the site's use by aboriginal peoples—varied domestic and ritual activities taking place there. Therefore, the first visible division of the site is according to space, with the western end of the site, Locus A/G, being the area of intense and differentiated occupation, whereas the eastern end seems to long have been an area of scattered, peripheral activity. Nonetheless, the two areas were united in the sense that the shell collections were similar in taxonomic composition, with both containing a focus on lagoon-dwelling species living on sandy or muddy substrates.

Even within Locus A/G some subdivisions are possible. The burial features are easily differentiable from the nonburial features by their frequent content of abalone, a shell rare in all other contexts at this and other Ballona sites. Looked at from another viewpoint, the shell samples from nonburial features, excavation units, and control units contained an assortment of species, whereas the burial features generally contained little shell except abalone. In general, the nonburial feature sets seemed distinct in taxonomic composition from the excavation units in the same area. Thus, although the nonburial features of FB 4 contained 78 percent scallops, the excavation units of that feature block showed only a 3 percent contribution from that species. Similarly, the FB 7 nonburial features have 28 percent scallop, but that species makes up less than half that amount (11 percent) within the feature block's excavation units.

Note that many of the nonburial features at LAN-62 with large quantities of scallop are scallop-filled pits that appear to be locations were scallops were either steamed or discarded after processing. They contain little else (see Volume 2, Chapter 4, of this series). Other features are more-eneralized discard areas. Thus, the concentration of scallops in features may reflect differences in the ways that scallops were processed relative to other shellfish.

Temporally speaking, although there are not great differences in taxonomic emphases, there are some differences in the intensity of occupation. If the greatest shell densities are associated with the Millingstone period contexts, then that indicates that the most-intense domestic use of the site was at that time. Clearly, however, during the Late to Mission periods, Locus A/G was the focus of a different category of activity, primarily ritual in nature. The shell-density estimates for these later periods belie that heightened activity, no doubt because this statistic is more appropriate as a measure of domestic occupation rather than ritual use. Clearly, shell-density estimates should be viewed with caution in such situations and combined with other measures (number and types of worked-shell items, etc.) in order to understand the intensity of occupation and use within a nondomestic or mixed context such as LAN-62, Locus A/G. Shellfish density is used, cautiously, as a measure of occupational intensity. As such, LAN-54 and LAN-62 appear to have been specialized shellfish-processing camps in the Millingstone. By contrast, LAN-193 was rarely used for shellfish processing, but was used intensively for mammal processing.

What the shell collection from LAN-62 does reveal is that the site was a domestic locale over a long period of time, where residents harvested locally available resources and did not take pains to collect what could not be taken from the lagoon. The solitary exception to the latter statement is the abalone gathered for what was clearly, given the shell's peculiar distribution, ritual purposes as items used for burials. The occupational history of this site indicates that people had already settled the edges of the Ballona Lagoon during the Millingstone period and, perhaps contrary to Altschul et al. (1993), the shell-density evidence does not suggest a move away from the lagoon at any time but rather continued and consistently intensive occupation of at least this water's-edge site.

Invertebrate Remains from LAN-211

The LAN-211 shellfish collection was large and diverse. Over 19,000 g of shellfish were collected from four major contexts. The analytical contexts included control units, burial features, and excavation units and features inside and outside of FB 1 (Table 211). The highest recovery of shell was from contexts within FB 1, whereas the lowest recovery was from the three burial features.

Table 211. Summary of Shell Abundance from All Contexts, LAN-211

Context	Weight (g)
Control units	
119	412.4
120	1,040.3
274	932.7
353	229.7
359	2,586.0
Subtotal (control units)	5,201.1
Burial features	43.8
Nonburial features outside FB 1	2,924.7
FB 1	
Items	813.4
Subfeatures	334.4
Checkerboard* excavation units	12,119.2
Noncheckerboard items	715.4
Subtotal (FB 1)	13,982.4
Total	19,183.5

Note: See Volume 2 Chapter 10, of this series for details on sampling.
Key: CU = control unit; FB = feature block.

Control Units

A total of five control units was excavated in different parts of the site, two of which are located within FB 1 (CUs 119 and 120), and three of which fall outside it (CUs 274, 353, and 359) (see Appendixes K.13.73–K.13.77 for data from control units). CU 353, located outside and west of FB 1, had the lowest density (37 g/m^3). Although CU 119 had relatively low shellfish density (295 g/m^3),which is surprising given that it is located within FB 1, the later deposits (Late to Mission period) had a significantly higher density (968 g/m^3) compared to the Intermediate period deposits (471 g/m^3) in the control unit. CU 359, located to the east of FB 1, yielded the highest density of shellfish (1,521 g/m^3), and most were from the late Intermediate period levels (99 percent). Given this distribution, it appears that the thrust of prehistoric occupation and activity was at the eastern end of the site during the Intermediate period. In terms of shell taxonomy, scallops were more important later in time, accounting for one-third of the collection in the Mission and Late periods (Table 212; Figure 253; see Appendix K.13.72). Both littleneck and venus clams were important in the Intermediate and late Intermediate period but not later. Abalone was primarily recovered from contexts associated with the later time periods.

Table 212. Shellfish Distribution, by Temporal Period in Control Units, LAN-211

Measure, by Context	Mission	Late to Mission	Late	Late Intermediate and Late	Late Intermediate	Intermediate and Late Intermediate	Intermediate	Total
Scallop								
Weight (g)	180.7	126.2	—	20.9	67.2	11.5	80	486.5
Percent	37.1	25.9		4.3	13.8	2.4	16.4	100
Venus clam								
Weight (g)	58	40.2	—	11.1	1,404.2	13.1	106.8	1,633.4
Percent	3.6	2.5		0.7	86	0.8	6.5	100
Abalone								
Weight (g)	97.9	49.3	—	3.5	1.1	—	—	151.8
Percent	64.5	32.5		2.3	0.7			100
Oyster								
Weight (g)	—	1.8	—	—	71.3	—	11.3	84.4
Percent		2.1			84.5		13.4	100
Littleneck clam								
Weight (g)	33.6	37.1	—	5.7	1,084.3	1.1	117.4	1,279.2
Percent	2.6	2.9		0.4	84.8	0.1	9.2	100
Pismo clam								
Weight (g)	2	1.3	—	—	32.4	—	3.3	39
Percent	5.1	3.3			83.1		8.5	100
Other								
Weight (g)	5.3	31	—	0.7	64	—	0.6	101.6
Percent	5.2	30.5		0.7	63		0.6	100
Unidentified								
Weight (g)	102.3	63.9	3.1	14.5	693.6	7.4	158.2	1043
Percent	9.8	6.1	0.3	1.4	66.5	0.7	15.2	100
Total								
Weight (g)	479.8	350.8	3.1	56.4	3,418.1	33.1	477.6	4,818.9
Percent	10	7.3	0.1	1.2	70.9	0.7	9.9	100
Unit volume (m^3)	0.2	0.7	0.1	0.1	1.5	0.1	2.2	4.9
Density (g/m^3)	2,399	501.1	31	564	2,278.7	331	217.1	983.4

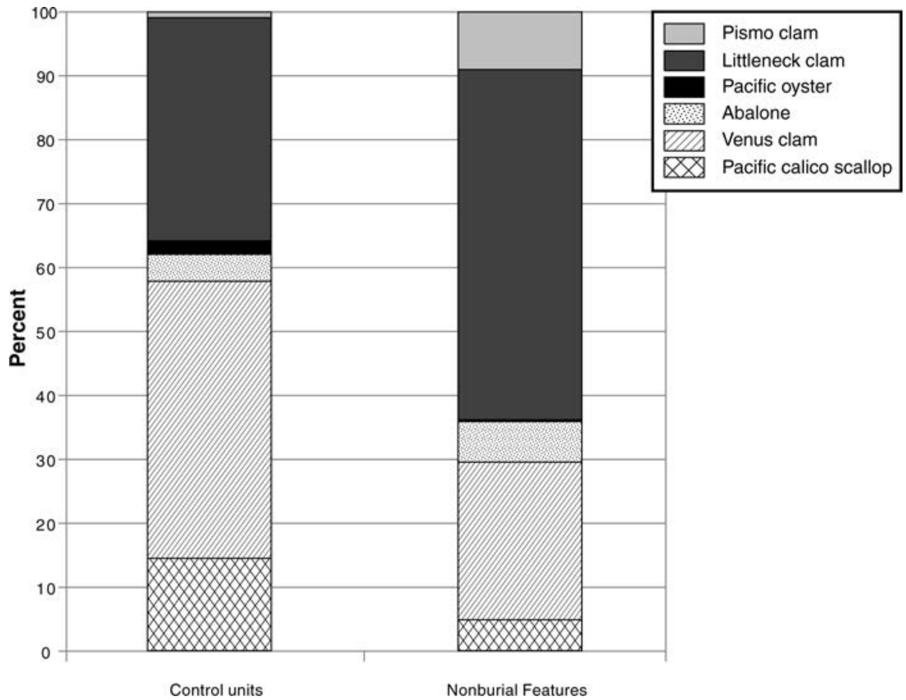

Figure 253. Dominant shellfish taxa, by context, outside FB 1 at LAN-211.

Burial Features

The three burial features (Features 27, 33, and 49) yielded only a small amount of shell (43.8 g) (see Appendix K.13.78). Two of these features were located within FB 1, with Feature 27 located in the north-central portion of the area and Feature 49 situated near the feature block's southern margin. Feature 33 sits at the eastern edge of a large excavation block located east of FB 1. Only one of the three burials, Feature 33, contained any shell at all (44 g, or 365 g/m^3). Somewhat more than half the shell (24 g) was from littleneck clams, with most of the remainder being scallops.

Outside of Feature Block 1

Thirteen features located outside of FB 1 were selected for shellfish analysis, six of which did not yield any shellfish (Table 213; see Appendix K.13.79). Of the eight features with shellfish, two are dated to the late Intermediate period, five to the Late to Mission period, and one was not datable. Together, the features yielded almost 3,000 g of shellfish, with an overall density of 1,129 g/m^3. The frequencies were widely varied between the features; for example Feature 2 yielded 94.3 percent of this collection, whereas Features 46 and 53 each contained a total of approximately 1 g of shell. Overall, the late Intermediate period collection from two features accounted for only 3 percent of the collection, with the majority being from the five Late period/Mission and Protohistoric period features.

The shellfish collection from the late Intermediate period features (Features 15 and 31) was dominated by venus clam (58.7 percent) with a secondary contribution of littleneck clam and small amounts of scallop and Pismo clam (see Table 213). The collections from features dating to both the Late to Mission period and the Protohistoric period were characterized by dominance of littleneck clam followed by venus clam. However, Feature 2 (Protohistoric period) contained only relatively small amounts of the principal species, with littleneck clam being the most prominent. However, nearly 80 percent of this feature's large sample was composed of shellfish that are typically rare in the Ballona and were categorized as "other" shellfish. Three shellfish taxa were identified in this category, including *Macoma* sp. (14.9 g, NRE = 8), *Tagelus* sp. (0.6 g, NRE = 0), and *Tresus* sp. (2,150 g, NRE = 42). *Macoma* sp. are common in intertidal habitats, but prefers muddy sand substrates in quiet waters. These shellfish have been recovered in Chumash sites in Los Osos Bay (Rick and Erlandson 2000). *Tresus* sp. (horse clam) inhabit the Pacific coast intertidal zones, and *Tresus nuttallii* are found in California. Early exploitation of the horse clam is documented at Chumash sites in San Luis Obispo County, particularly as a scoop implement (Mikkelsen et al. 2000).

Table 213. Shell from Nonburial Features Outside of FB 1 at LAN-211

Measure, by Context	Mission Period	Protohistoric Period	Late to Mission Period				Late Intermediate Period			Total
	Feature 53	Feature 2	Feature 40	Feature 46	Feature 52	Subtotal	Feature 31	Feature 15	Subtotal	
Scallop										
Weight (g)	—	10.3	—	—	18.9	29.2	1.1	0.6	1.7	30.9
Percent		0.4			27.0	1.0	6.6	1.0	2.2	1.1
Venus clam										
Weight (g)	—	95.3	—	—	13.8	109.1	12.3	33.8	46.1	155.2
Percent		3.5			19.7	3.8	74.1	54.6	58.7	5.3
Abalone										
Weight (g)	—	23.9	—	—	15.7	39.6	1.2	—	1.2	40.8
Percent		0.9			22.5	1.4	7.2		1.5	1.4
Oyster										
Weight (g)	—	1.7	—	—	—	1.7	—	—	—	1.7
Percent		0.1				0.1				0.1
Littleneck clam										
Weight (g)	0.8	332.7	—	—	1.1	334.6	—	10.4	10.4	345.0
Percent	100.0	12.1			1.6	11.8		16.8	13.2	11.8
Pismo clam										
Weight (g)	—	54.9	—	—	—	54.9	—	2.0	2.0	56.9
Percent		2.0				1.9		3.2	2.5	1.9
Other										
Weight (g)	—	2,165.5	—	—	0.7	2,166.2	—	2.8	2.8	2,169.0
Percent		78.5			1.0	76.1		4.5	3.6	74.2
Unidentified										
Weight (g)	—	73.8	16.0	1.4	19.7	110.9	2.0	12.3	14.3	125.2
Percent		2.7	100.0	100.0	28.2	3.9	12.0	19.9	18.2	4.3
Total										
Weight (g)	0.8	2,758.1	16.0	1.4	69.9	2,846.2	16.6	61.9	78.5	2,924.7
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Unit volume (m^3)	0.01	0.22	1.44	0.02	0.10	1.8	0.04	0.12	0.20	2
Density (g/m^3)	80.0	12,536.8	11.1	70.0	699.0	1,590.1	415.0	515.8	490.6	1,499.8

Note: No shellfish were recovered from Features 11, 29, 30, 39, 45, and 56.

Table 214. Shell from Features and Excavation Units Inside FB 1 (Items and Nonitems), LAN-211

Measure, by Taxon	Excavation Units (Items and Nonitems)	Items from Features[a]	Feature No.							Total
			4	5	13	14	21	51	Subtotal	
Scallop										
Weight (g)	1,934.5	155.1	32.5	1.7	2.6	10.6	41.8	0.5	89.7	244.8
Percent	15.1	19.1	19.6	34.7	43.3	16.6	44.9	45.5	26.8	1.1
Venus clam										
Weight (g)	750.9	106	16.8	—	—	24.6	9.1	—	50.5	156.5
Percent	5.9	13.0	10.2			38.6	9.8		15.1	1.1
Abalone										
Weight (g)	2,441.5	257.2	81.7	1.2	—	6.3	6.7	—	95.9	353.1
Percent	19.0	31.6	49.4	24.5		9.9	7.2		28.7	1.1
Oyster										
Weight (g)	6.5	0.4	—	—	—	—	—	—	—	0.4
Percent	0.1	0.05								1.1
Littleneck clam										
Weight (g)	589.8	5	—	—	0.7	15	2	0.6	24.3	29.3
Percent	4.6	0.6			11.7	23.5	2.1	54.5	7.3	1.1
Pismo clam										
Weight (g)	239.9	13.8	—	—	—	—	—	—	—	13.8
Percent	1.9	1.7								1.1
Other										
Weight (g)	454.9	39.3	9.1	—	1.7	0.2	10.7	—	21.7	61
Percent	3.5	4.8	5.5		28.3	0.3	11.5		6.5	1.1
Unidentified										
Weight (g)	6,416.6	236.6	19.4	2	1	7.1	22.8	—	52.3	288.9
Percent	50.0	29.1	11.7	40.8	16.7	11.1	24.5		15.6	1.1
Total										
Weight (g)	12,834.6	813.4	165.5	4.9	6	63.8	93.1	1.1	334.4	1,147.8
Percent	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	1.1
Unit volume (m^3)		0.94	0.22	0.02	0.02	0.04	0.13	0.03	0.463	1.403
Density (g/m^3)		865.3	752.3	245.0	300.0	1,595.0	716.2	36.7	722.2	818.1

Note: All features dated to Mission period. Feature 8 did not yield any shellfish.
[a] Features 6, 12,16, 17, 19, 22, 24, 25, 26, 28, 41, 42, and 50.

Inside Feature Block 1

Six features inside FB 1 were selected for analysis, and all of them date to Protohistoric to Mission periods (Table 214). In addition to the features, shellfish from excavation units were also analyzed. The excavation units inside FB 1 were sampled so that 25 percent of shell collected from alternative excavation units (the checkerboard sample) was analyzed (see LAN-211 figure in Chapter 1, this volume; and Volume 2, Chapter 9, of this series for discussion on sampling). With this sampling strategy, approximately 13.5 percent of the shell within the feature block was analyzed. In addition, all shell items from all excavation units and 14 unanalyzed features in FB 1 were included in the analysis.

More than 12,000 g of shellfish were recovered from the excavation units, and unidentifiable fragments accounted for half of the collection (Figure 254; see Table 214). The other half was composed of abalone (NRE = 21) and scallops (NRE = 434) in moderate quantities with the other main shellfish in low to very low frequencies. Note that scallops were present only in very low frequencies outside of FB 1 but relatively common in most contexts within the feature block. The large proportion of unidentifiable shell (>900 individual specimens) may imply a high degree of shell processing or other activity resulting

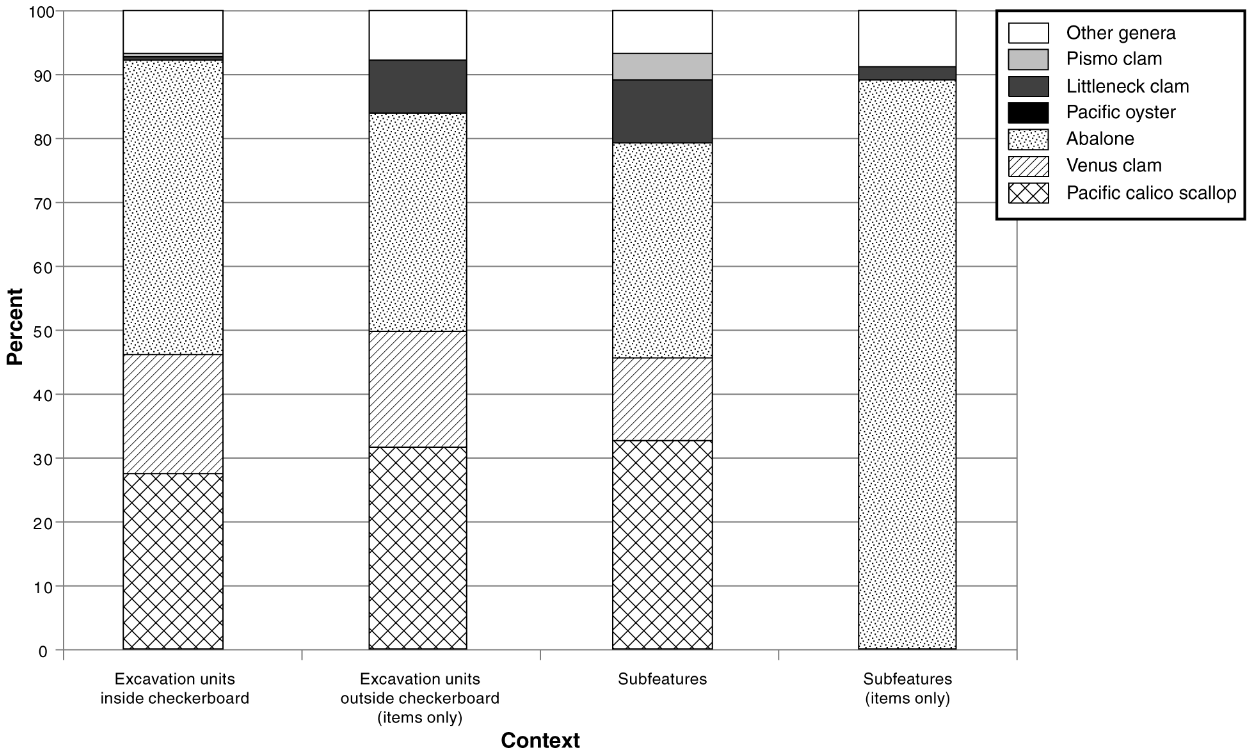

Figure 254. Dominant shellfish taxa, by context, within FB 1 at LAN-211.

in the destruction of shells. A similar observation was made for vertebrate remains, in that a very large number of animal bones could not be identified, even to class.

Features inside FB 1

Shell items (individual shell typically large in size) from the 14 unanalyzed subfeatures within FB 1 (813 g) primarily included abalone, scallops, and venus clams (see Table 214 and Figure 254; see Appendixes K.13.80–K.13.83). Abalone was particularly prevalent in three features (Features 26, 42, and 50). The first two of those three features produced the largest individual collections among the features with shell items. Although oysters, littleneck clams, and Pismo clams were present in very low frequencies or absent in each feature, the three more-prevalent species (scallops, venus clams, and abalone) varied considerably in their prominence within the different contexts. Venus clams, for instance, were absent from all but five features (Features 16, 22, 26, 28, and 42) but were prominent in Features 16, 26, and 42. Scallops, on the other hand, were more evenly distributed throughout the features.

Seven subfeatures dating to the Mission period were selected for analysis from within FB 1. They yielded 334 g of shellfish (see Table 214) of varying quantities. For example, Feature 8 had no shell and Feature 51 yielded only 1 g of shell. In contrast, almost half of the shellfish collection from these contexts was recovered from Feature 4. Features 4 and 14 had much higher shellfish densities, and Feature 14, in particular, was composed primarily of shellfish and not much sediment. Although the emphases on the various shellfish species varied from subfeature to subfeature, as did estimated densities, all of these features contained no oysters or Pismo clams.

The relatively large sample of Feature 4 consisted mainly of abalone (49 percent), with smaller amounts of scallop, venus clam, and littleneck clam (see Table 214). Within the next largest sample, from Feature 21, scallops dominated (45 percent), followed by venus clams, abalone, and littleneck clams. Feature 14 contained another relatively large collection that had a different pattern, with venus clams being the dominant shellfish (39 percent) with littleneck clams in moderate frequencies (24 percent). Interestingly, despite the fact that scallops were either the primary or secondary species in five of the six subfeatures containing shell, they ranked third, with 17 percent, in Feature 14. Abalone consistently appeared within these subfeatures as an important component (based on weight). This pattern is similar to that observed in the burials at LAN-62, where abalone was frequently recovered.

In addition to these six main shellfish, *Tresus* sp. (4.4 g) and *Amiantis* sp. (4.5 g) were recovered from Feature 4, and *Margaritifera* sp. (10.4 g, NRE = 1) was recovered from Features 21. *Margaritifera* is a freshwater pearl mussel, and *Amiantis* sp. (sea cockle) is found at extreme low tide on open beaches or near the entrance to bays but never in great abundance. Overall, 12 NRE of *Margaritifera* sp. (117.9 g) were recovered from FB 1 contexts (19 from excavation units and

3 from features). The recovery of this shellfish is intriguing given that it is associated with freshwater habitats.

As a group, these Mission period features were characterized by dominance of two species: abalone and scallop, accounting for 29 and 27 percent of the collection, respectively. Venus and littleneck clams, the most important shellfish species within many other contexts at this site, are of secondary importance here, comprising 15 and 7 percent of the overall sample, respectively.

Site Taxonomy

The most-prominent shellfish species at LAN-211 were scallops, littleneck clams, and venus clams. There is some variation in their popularity over both the spatial extent of the site and through its duration of occupation. Much of the spatial variation may, however, in fact be related to temporal change: the various contexts of FB 1, which all date to the Protohistoric to Mission periods, contain mainly scallops in addition to venus clams. Dated contexts outside of FB 1 contained sparse amounts of shell, and even less were from Protohistoric to Mission period strata. Therefore, we are left with what is certainly a temporal difference between the inside and the outside of the feature block, as well as a de facto spatial distinction. Presumably, time is the relevant factor, because in CU 119, located within FB 1, the Protohistoric to Mission period levels were dominated by scallops. In that same control unit, the late Intermediate and Intermediate layers contained mainly venus clams. Stratigraphically, there was also something of a difference in CU 120, which also is within FB 1. There, scallops constituted the main portion of the Protohistoric to Mission period collection, whereas both scallops and venus clams were prominent in Intermediate period levels. Outside of FB 1, where the bulk of recovered remains date to the Intermediate period, littleneck clam was the dominant species.

In terms of habitat exploited, there is little difference over time, despite the shift in species harvested. Most of the prevalent species at this site inhabit environments compatible with what probably existed in prehistory. That is, venus clams and scallops, as well as littleneck clams and even oysters, are common in bays with sandy or muddy bottoms. Although oysters prefer hard substrates, they can make do and build reefs even in soft-bottomed bodies of water. Only Pismo clams and abalone would not have been likely species endemic to the Ballona bay or lagoon. The clams inhabit sandy beaches at the intertidal zone, whereas abalone is, of course, found only in relatively deep waters, firmly attached to rocks. Pismo clams were among the species identified within the FB 1 checkerboard, although not among the top three taxa in terms of abundance. They could have been collected along some of the nearby beaches, perhaps even those just west, south, or north of the Ballona Lagoon. Gathering abalone, on the other hand, would have required a concerted effort and practiced divers. These mollusks could have been pried off of rocks some distance from the shore, or else near the rocky coasts north and south of the Ballona or on the Channel Islands. Nonetheless, there were not large numbers of abalone shells recovered, and the numbers are probably somewhat inflated, because the shells are large and easy to spot, and so they may have been recovered as items in greater numbers relative to other species.

Intrasite Analysis

Taphonomic processes are not readily observable at this site using shell as the source of information. Because of the way in which the site was sampled, as well as the distribution of shells across it, it is difficult to disentangle the threads of taphonomy, segregation of activities across space, and temporal change. Relying on shell densities in different contexts, we can see that shell was to a greater or lesser extent uniformly dense across the site. The principal exceptions to the dense shell pattern, with an arbitrary density threshold of >500 g/m^3, are CUs 119 and 353, in addition to some of the features, which perhaps should not be directly compared to the control units.

Features

For the purposes of discussing shell density, the features have been divided into three groups: burial features, nonburial features outside of FB 1, and nonburial features and subfeatures inside of FB 1. The burial features contained very little shell. Most of the nonburial features outside of the feature block also contained little shell, with the exception of Features 2, 15, and 52. Of these, 2 features date to the Protohistoric to Mission periods (Features 52 and 2, respectively), and 1 feature (Feature 15) dates to the late Intermediate period. The features and subfeatures of FB 1 generally contained large amounts of shell. In fact, there seems to be a particular concentration of shell-rich features in the feature block's southwestern quadrant; of the 15 features and subfeatures located in that area, all but 3 contained large amounts of shell.

Summary of inside FB 1

A shell-density pattern was evident in both the control units and features. However, the pattern may be temporal rather than taphonomic or, as argued earlier, spatial. Essentially, contexts dated later and contexts located within or very near to FB 1 had high densities of shell. Because few contemporary contexts exist between the outside and the inside of the feature block, it is difficult to determine whether the variation is due to spatial variation or different activities designated for different areas. Certainly, given the density of recovered artifacts, including shells, FB 1 was a locus of activity. However, that does not mean that the area was a special activity area; rather, based on what we can tell from the sampling strategy, it seems to have been the center of settlement, with areas outside of it used much less intensely.

Summary of LAN-211

The shell remains from LAN-211 mainly reveal two things about the prehistoric population's use of the site and the surrounding area: (1) the degree to which this site was occupied during different time periods and (2) which habitats the shell harvesters targeted to obtain mollusks. LAN-211's deposits date as far back as the Intermediate period, and yet, deposits of that early era contained only sparse amounts of shell. The volume of shell was quite a bit more impressive within some of the late Intermediate deposits, most notably in CUs 274 and 359, which are both located at the eastern end of the site, spaced approximately 10 m apart from one another. In the following period, during the Protohistoric to Mission period, evidence for longer-term use or occupation by a larger population is even easier to spot based on examination of shell densities. As per the area's definition, FB 1, located in the center of the site, was clearly the locus of concentrated activity starting in the Protohistoric period and continuing into the Mission period. The shell densities also demonstrate that the site was not immediately abandoned, nor its population wiped out, immediately upon the arrival of Spanish missionaries and settlers. What is also interesting is the spatial distribution of dense shell deposits. There seems to have been a slight westward shift and concentration of activity over time. Although none of the Intermediate period deposits was particularly dense, contexts containing significant amounts of shell dating to that period were found across the site and were not limited to any particular area. By contrast, the dense late Intermediate period shell collections came from the eastern end of the site, within a block of excavation units. With the exception of the massive and dense Feature 2, which yielded 2,150 g of *Tresus* sp. (very unusual for the Ballona), all of the contexts with high shell densities were within the centrally located FB 1 area. Feature 2 dated to the Protohistoric to Mission period but is located within the eastern block of excavation units (and outside of FB 1).

The habitat that the population of the site apparently liked best for harvesting mollusks was the estuarine waters of the Ballona. The species that made up the vast majority of the recovered shells—scallops, littleneck and venus clams, and oysters—all prefer, frequently inhabit, or at least tolerate the semisaline shallow waters of such bays. Certainly, the proximity of the Ballona estuary to LAN-211 and other settlements, along with its calm and shallow waters, would have made it logical to focus shell harvesting there. That is precisely what the population did throughout the long period of occupation, such that there is almost no change over time—or space—visible through the various contexts explored at LAN-211. What little change in terms of aquatic habitats explored for gathering mollusks was found only to a limited extent, numerically speaking, within the Late to Mission period. Within the excavation units of FB 1, one can see the appearance of two shellfish species, which were very unlikely to have inhabited the Ballona lagoon, namely the Pismo clam and abalone. It is interesting that both of these species, which typically inhabit beach zones (Pismo clams) or offshore rocky outcroppings deep under water (abalone) appear only within deposits dated to the later periods.

Invertebrate Faunal Remains from the Runway Sites: LAN-1932 and LAN-2676

LAN-1932 and LAN-2676 were discovered during removal of fill burden from the former Hughes Aircraft Company runway (see Appendixes K.13.85–K.13.92). These sites are in secondary context and associated with LAN-211 and LAN-62; therefore, the following discussion is a summary of the findings and detailed discussions are presented in the appendixes.

LAN-1932

Almost 380 g of shell was recovered from four excavation units at this site. The shellfish collection was small and poorly preserved, mostly consisting of unidentifiable shellfish fragments. The most abundant identified shellfish included venus clams, oysters, and littleneck clams associated with sandy- or muddy-bottomed waters.

If indeed this site is redeposit of a part of LAN-211, then it explains the similarity between the collection of LAN-1932 and LAN-211, with both having substantial quantities of oysters and venus clams. One key difference between the two collections is that LAN-211 also had a substantial collection of scallop shells, which was present in lower frequencies at LAN-1932. However, as previously noted, scallop shells are relatively fragile, and the collection from LAN-1932 appears to be very broken up, such that it is possible that greater numbers of scallops were once present but are now obscured by postdepositional disturbance.

LAN-2676

This site produced a much larger collection of shellfish than did LAN-1932 and included just over 7 kg of shell. The analytical contexts included augers and four excavation units. The shellfish collection from the site reveals that the population focused on harvesting venus clam and oysters that are endemic to the Ballona's calm water and soft substrate environment, with significant contributions also from littleneck clams and scallops. Abalone and the Pismo clam were found in low frequencies. In addition, California jackknife clam consistently was found in small numbers.

The LAN-2676 collection does resemble that of LAN-62 in that it was dominated by venus and littleneck clams.

Nonetheless, given the Ballona environment and the relative ease with which any population living in the vicinity would have had access to these two estuarine species, that similarity is not particularly surprising. It is therefore difficult to judge whether there exists a convincing case to be made that the material originated at this particular site rather than deposits from one of the surrounding sites. Still, what can be said, based on examination of shellfish species at LAN-62, is that there are strong similarities between that site and LAN-2676, especially within the Late to Mission period levels. In those levels, scallops fade from their former prominence in the Millingstone and Intermediate periods, and oysters gain in importance. Oysters are more prominent in the Intermediate period levels at LAN-62 than at LAN-2676. Any late emphasis on oysters contradicts Becker's (2003:190) and Van Horn and Murray's (1985:2000) assertions that a decrease in amount of oysters observed at various Ballona-area sites, including LAN-61, was related to increased siltation of the lagoon after ca. 4000 B.P. Either that assertion is simply wrong, needs to be modified in some way (perhaps oyster beds remained in one or more areas of the Ballona, such as the less-well-understood western side), or the inhabitants of the area simply went elsewhere to collect the oysters we see at these sites.

Summary of the Invertebrate (Shellfish) Remains from the PVAHP

The invertebrate collection from the PVAHP included shellfish from seven lowland archaeological sites, all of them located on or near the edge of formerly significant bodies of water, either the Ballona Lagoon or Ballona Creek/Los Angeles River. The collection included more than 150 kg of shell, representing nearly 22,000 NRE from the analyzed contexts (Table 215). In this summary, the main patterns of shellfish exploitation over time at each of the five main sites (LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768) are presented, and the emerging temporal trends are identified, along with discussions of their implications. The focus of the discussion is on trends and the relative abundance of the six principal shellfish taxa (scallops, venus clams, abalone, Pacific oysters, littleneck clams, and Pismo clams).

LAN-54

The analytical contexts at LAN-54 included 4 control units and 10 features that represent Millingstone and Intermediate period deposits. During the Millingstone period, the focus was on scallops (32 percent) and oysters (21 percent), although littleneck and venus clams were also consumed (10 and 21 percent, respectively). Other species were less important. Most of the collection from the site was recovered from contexts dating to the Intermediate period (98 percent) (see Table 198). In this period, the prehistoric shellfishing changed focus to different species, perhaps owing to both cultural preference and/or natural changes that affected species subhabitats in the local area. Nonetheless, the focus remained on lagoonal shellfish; what changed was whether the muddy bottoms were being exploited or the more-open rocks and shallow waters. Oysters and littleneck clams become more prominent, and each accounted for approximately 25 percent of the total collection for the period. In contrast, the scallops—which were the most abundant species in the preceding Millingstone period—accounted for only 15 percent of the collection. Exploitation of venus clams remained largely similar in both time periods, whereas abalone and Pismo clams remained small contributors to the diet.

Table 215. Summary of Analyzed Shell, by Site (Dated and Undated Contexts)

Site No.	Analyzed Shell Totals				Volume (m^3)	Density (g/m^3)[a]
	Weight	Percent (Weight)	NRE	Percent (NRE)		
LAN-54	21,881.7	14	5,371	23	12.4	1,764.65
LAN-62	97,949.8	65	12,290	52	46.8	2,092.94
LAN-193	132.8	<1	49	<1	7.0	18.97
LAN-211	19,183.5	13	3,320	14	7.2	2,664.38
LAN-2768	3,846.5	3	951	4	17.6	218.55
Subtotal	142,994.3	<1	21,981	<1	91.0	
LAN-1932	1,036.3	1	170	1		
LAN-2676	7,144.4	5	1,353	6		
Total	151,175.0	100	23,504	100		

Key: FB = feature block; NRE = number of nonrepetitive elements.
[a] Densities calculated on particular contexts.

LAN-62

LAN-62 is a complex site with deposits dating from the Millingstone through the Mission period. The site has a habitation area (domestic refuse and features) and a burial area, probably in use over a long period of time but more intensively during the Late to Mission periods. The burial area has an associated mourning area (FB 3). The shellfish collection from the site was large and diverse. Shellfish from the following contexts were analyzed: six control units, burials, FB 7 (dating to the Millingstone period), FB 4 (dating to the Intermediate period), and FB 3 (the mourning area that dates to the Mission period).

Within Locus A control units, venus clams were the most important species by weight through time, with littleneck clams being the second most abundant species, followed by scallops. Oysters were never an important contributor at this site. Both Pismo clams and abalone contributed very little.

The FB 7 (Millingstone period) collection was represented by shellfish from 10 excavation units and 4 features. About 26 percent of the collection was composed of unidentifiable shell, and the remaining identified shellfish were dominated by venus clams (49 percent), scallops (15 percent), and littleneck clams (12 percent). Although there may have been oyster beds in the Ballona estuary, they were not exploited heavily, as evident by their low recovery (accounting for no more than 2 percent). Almost no shell was recovered from the 4 features.

The FB 4 (Intermediate period) collection was from 12 excavation units and the 12 nonburial features. The collections from these two contexts were very distinct, with 90 percent of the collection from the excavation units being unidentifiable, and only 3 percent of the nonburial feature collection being unidentifiable. This is most likely owing to postdepositional processes and impacts. The identifiable shellfish in the excavation units were composed primarily of venus clams, littleneck clams, scallops, and Pismo clams. The nonburial features yielded a large and relatively well-preserved shell collection. Scallops consistently dominated the nonburial features (98 percent, by weight, in one of the features) and accounted for 78 percent of the collections. All of the other species were present in rather low amounts, especially abalone, which was present in only one of the many features. During the Intermediate period, the Ballona population's shellfish diet focused primarily on scallops.

The collection from FB 3 (Mission period) was dominated by venus clam shells and small amounts of all other species, with three exceptions. These exceptions included Features 331, 384, and 672, which had fairly large amounts of abalone shell (by weight). Nonetheless, the NRE counts for the abalone amounted to no more than two specimens per feature. In this context, the abalone may have been associated with mourning activities and represent containers or ritual offerings. The dominance of venus clam and the paucity of other species within the ritual feature is unique.

The shellfish collection from the burial-area portion is different from that of the midden. First, the burials did not yield high densities of shell; for example, less than 100 shells (NRE) were recovered from the 80 burial features (which is very low compared to the midden). Second, the most frequent species within the burials was abalone, which is rare in the midden and nonburial features. The abalone shells were included with the deceased at the time of interment, as grave goods or containers. Alternatively, abalone shell and meat were offered as food during the funerary rites. There is no spatial patterning in the distribution of burials with abalone in the burial ground.

The shellfish collection from the nonburial features within the burial area had distributions similar to those from the control units. Venus clams were the most abundant species, followed by littleneck clams. However, oysters were relatively abundant and ranked immediately after littleneck clams and well ahead of scallops. Abalone was rare, as were Pismo clams. The nonburial features outside of the burial area revealed essentially the same trends that other contexts other than the burial features did. Venus and littleneck clams were the most prominent species, followed by scallops. The remaining species, abalone, Pismo clams, and oysters, were present only in low numbers.

Several trends are evident in the shellfish collections from LAN-62. First, abalone was largely present in notable quantities in the Mission period and primarily in burial contexts. Second, scallops were generally more abundant early in the sequence, especially in the Intermediate period, and it became infrequent by the Late to Mission periods. Venus clams increased in frequency over time, and perhaps replaced scallops. Although oysters were most likely available, the Ballona populations either did not focus much of their shellfish exploitation on them, or oysters were not available in large enough quantities to make them a viable food source. Littleneck and Pismo clams varied through time in frequency without any discernible pattern. Although Pismo clams were infrequent, littleneck clams may have been a supplemental shellfish and harvested to provide variety in a diet generally focused on either scallops or venus clams.

LAN-193

This site yielded the smallest and least-dense shell collection of the PVAHP sites. The total sample, derived from three control units and a single feature, produced only 133 g of shell (density of approximately 19 g/m^3) from late Millingstone and early Intermediate period deposits. Over 30 percent of the collection was unidentifiable, and only 4 percent of the collection (5.5 g) was from the late Millingstone period. The early Intermediate period collection was characterized by venus clam and Pismo clams, which both accounted for more than 50 percent. The remainder of the collection consisted, in order of descending abundance, of abalone, oyster, littleneck clam, and scallop. Note that although abalone (6 percent by weight) was recovered from CU 11, it was composed of small fragments that were likely from a single specimen. The small shellfish sample from LAN-193 did not lend much evidence to the shellfish use at the site, and interpretations cannot be made regarding changes in subsistence.

LAN-211

The shellfish collection from LAN-211 was primarily from Intermediate and Mission period contexts (the latter constituting the majority). The contexts included five control units, three burial features, nonburial features outside FB 1, and nonburial features and excavation units inside FB 1. The Intermediate period collection was characterized by venus clam (38 percent) and littleneck clam (30 percent).

The Mission period shellfish collection at the site was dominated by abalone (64.5 percent), followed by scallops (37 percent) and other species in low frequencies. Note, however, that the abalone shell was represented by only a few specimen. Of the three burials, only one (burial Feature 33) yielded shellfish, including littleneck clams and scallops.

Shellfish from within and outside FB 1 was distinct. The collection from the nonburial features inside of FB 1 (dated to the Mission period) was dominated by abalone (32 percent), scallops (19 percent), and venus clams (13 percent). Note that 29 percent of the collection was composed of unidentifiable shellfish fragments. Abalone was prominent only within the Mission period contexts at this site and was almost entirely within FB 1. FB 1 at LAN-211 was the only context other than the human burials at LAN-62, Locus A, that contained a substantial amount of abalone shell.

The overall pattern at LAN-211, similar to other sites dating primarily to the Mission period, is that soft substrate-tolerant shellfish predominated, including scallops, littleneck clams, and venus clams. What is unusual within this site, specifically visible within all of the FB 1 contexts, was the large amount of abalone, at least as measured by weight. Abalone, which attaches to submerged rocks in rough seas, had to have been traded or otherwise brought in from a considerable distance to this site, as well as to LAN-62. Their abundance raises two other questions. First, why does abalone appear in significant numbers only during the Mission period? Second, is the association of abalone with human burials at LAN-62 indicative of their use in ritual contexts, whereas their disposal in domestic midden context at LAN-211 indicative of their consumption, possibly during particular specialized feasts associated with mortuary ceremonialism? Related to this is whether LAN-211 was the locale of preparing burial "kits," including abalone to be included in the burials at LAN-62.

LAN-2768

LAN-2768 had four loci (Loci A, B, C, and D); however, collections from only Loci A and B were analyzed, based on the integrity and character of cultural deposits. The collections from Locus A were from 4 control units and 10 nonburial features, all of which were dated to the early Intermediate period (see Table 195). There was considerable variation in the collections of the 4 control units, but overall, scallops dominated the Locus A control units and accounted for 55 percent of the collection, followed by venus clam (18 percent), littleneck clams (10 percent), and oysters (5.3 percent), The remaining 11.7 percent was represented by abalone, Pismo clam, and other species. The collection from Locus A features had a very different composition of shellfish, with oysters (30 percent) being the most abundant, followed by venus clams (25 percent), littleneck clams (21 percent), and scallops (13 percent).

The Locus B collection was from seven control units and two nonburial features, all of which were dated to the late Intermediate period. The control units of Locus B had similar taxonomic abundances as those identified at Locus A (see Tables 195 and 196). This collection was also dominated by scallops (52 percent), but in this case, the second most abundant species was the littleneck clam (18 percent), followed by the oyster. Abalone and Pismo clams, as in the other locus, were rare here as well. Scallops dominated the small collection from the nonburial features and accounted for two-thirds of the collection, followed by littleneck clam (15 percent), venus clams (8 percent), and oysters (7 percent). Pismo clams were absent, and abalone contributed less than 1 g. LAN-2768 is the only site within the PVAHP that had scallops as the dominant shellfish.

Temporal Trends

Using shellfish data from contexts with strong chronostratigraphic data, temporal trends in shellfish exploitation in the PVAHP are summarized in this section (Table 216; Figure 255; see Table 215). Shellfish-harvesting habits within each period are presented in Appendixes K.13.93–K.13.95, and Appendix K.13.96 presents the relative abundance of species through the various eras of human habitation in the Ballona area. The focus of the discussion below is on the six major shellfish taxa, and data presented in Table 216 does not include the unidentified shellfish fragments. Shellfish in the "other" category were generally minor contributors to the diet.

Millingstone Period

Shellfish exploitation during the Millingstone period was characterized by a focus on three shellfish taxa, including scallops, venus clams, and littleneck clams, although the first two were recovered in slightly higher frequencies compared to littleneck clams (see Table 216). Nonetheless, these three shellfish account for 71 percent of the Millingstone period collection from PVAHP. Oysters and Pismo clams are secondary shellfish, which is surprising because oyster beds should have lined the Ballona estuary at this time, according to the environmental reconstruction and concomitant predictions for shellfish harvesting (Becker 2003; Homburg et al. 2015). Given that oysters accounted for only 15 percent of the

Table 216. Relative Abundance of Principal Shellfish Taxa within Each Period (Datable Contexts Only), not including Unidentifiable Shell

Period	Scallop (%)	Venus Clam (%)	Abalone (%)	Oyster (%)	Littleneck Clam (%)	Pismo Clam (%)	Other (%)
Protohistoric and Mission	44	23	18.0	0.4	12	0.3	3
Late	12	49	9.0	5.0	14	3.0	8
Late Intermediate	3	51	0.04	4.0	37	3.0	2
Early Intermediate	16	16	0.4	30.0	26	10.0	1
Intermediate (all phases)	30	19	1.0	18.0	22	8.0	3
Millingstone	27	24	1.0	15.0	20	10.0	3
Total	27	22	7.0	11.0	18	8.0	7

Note: Percentages within each temporal period.

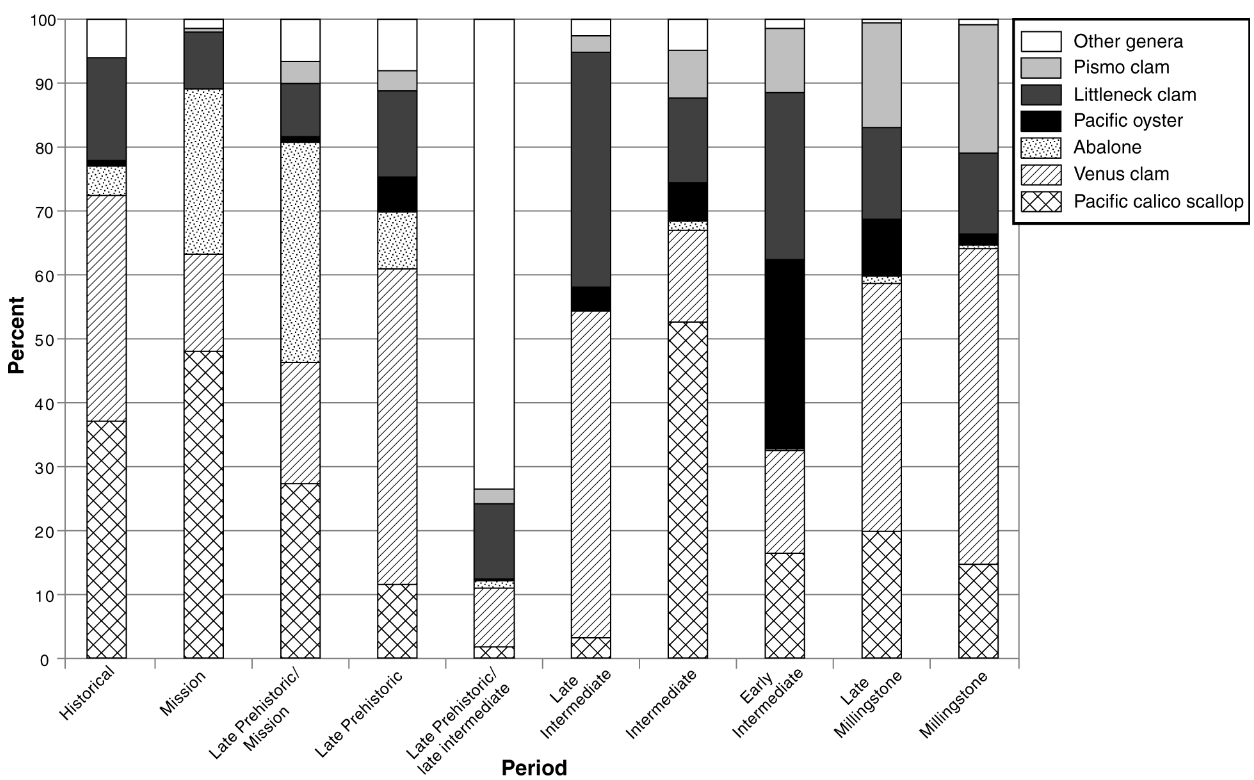

Figure 255. Dominant shellfish taxa, by period, for all sites.

collection, perhaps they were not as abundant as predicted by the paleoenvironmental model, or there was a preference by the prehistoric populations to target other shellfish. Pismo clams are typically found near sandy beaches with rough tides, and their recovery (10 percent) suggests that the sandy beaches were most likely targeted opportunistically during forays to the ocean. Abalone was found in very low frequencies and was not an important food source. Note that Pismo clams, although in low frequencies in this time period, were found in greatest abundance during this time period relative to later time periods (with the exception of the early Intermediate period) (see Table 216). This is important, because this shellfish food resource would have been available along the Pacific coast beaches throughout the sequence. Their low frequencies is perhaps an indicator of their relatively low meat yield (see Erlandson 1994), which may not have been effective for the Ballona's human population to invest in their collection in terms of labor investment per energy returns.

Intermediate Period

The Intermediate period collection was represented by collections from contexts dating to the early Intermediate, late Intermediate, and the entire Intermediate period (including contexts that did not have sufficient chronological resolution to determine whether they were from the early or late Intermediate period). There are discernible differences in the shellfish exploitation between these three temporally distinct collections. The early Intermediate period collection was dominated by oysters (30 percent) and littleneck clams (26 percent), followed by scallops and venus clams in similar frequencies (16 percent each). The Ballona would have been an hospitable niche for oyster beds (similar to the Millingstone period). The relative abundance of oysters during this period (but not the earlier Millingstone period) suggests that they may have been more readily available at this time.

The late Intermediate period collection was characterized by venus clam (51 percent) and littleneck clam (37 percent) dominating the shellfish foods. Oyster, which was found in high frequencies in the early Intermediate period contexts, accounts for only 4 percent of the late Intermediate period collection. Similarly, exploitation of scallops and Pismo clams also dropped in the late Intermediate period. The drop in Pismo clams suggests a change in resource exploitation of sandy beaches, although the other shellfish changes are not indicative of habitat or niche changes; therefore, the changes are related to availability and abundance of the shellfish in the environment.

Overall, the Intermediate period collection (buoyed by the collections from LAN-2768 which did not have sufficient resolution to be categorized as early or late Intermediate period), was dominated by scallops (30 percent) and littleneck clam (22 percent), with venus clam (19 percent) and oyster (18 percent) as secondary shellfish foods. Neither of the two nonlagoon species, abalone and Pismo clam, were prominent in the Intermediate period. Abalone made up no more than 1 percent of Intermediate period collections, and there is no significant change in Pismo clam use from the previous period.

Late Period

The Late period shellfish collection was small and was dominated by venus clam (49 percent), with the other shellfish in lower relative frequencies. Abalone accounted for 9 percent, and they were primarily from LAN-211.

Mission Period

The shellfish collection from this time period was primarily from LAN-211 and LAN-62 and had scallops and venus clams in higher frequencies (see Table 216). Oyster and Pismo clam were rarely used and accounted for less than 1 percent of the collection. Littleneck clam was a secondary shellfish food source. Abalone accounted for 18 percent of the collection, which was the highest in the sequence. Many abalone shells were recovered from burials and ritual features at LAN-62 and also from within FB 1 at LAN-211. The frequent occurrence in mortuary contexts suggests that they may have been ritual food offerings, and/or the shell was used as containers for offerings. They abundance in the later periods (Late and Protohistoric–Mission periods) suggests that either the habitats (rocky ocean bottoms and kelp beds) were more accessible during these periods or that these shell were obtained through trade with the inhabitants of the Channel Islands during these periods.

Overall, the Ballona populations focused on three main shellfish across the cultural sequence: scallop, venus clam, and littleneck clam (in order of relative abundance). Oysters, Pismo clams, and abalone were less frequent. Scallops generally contain a moderate amount of meat, more than venus clams. Littleneck clams appear to have been the focus of harvesting early on in the sequence but started tapering off starting in the Late period. Pismo clams were consumed in relatively higher frequencies in the earlier periods, but their exploitation decreased dramatically in the Late and Protohistoric–Mission periods. There were low frequencies of oysters from the Millingstone and late Intermediate periods and an increased exploitation during the early Intermediate period. This could be due to a lack of availability in the Ballona at specific times. Alternatively, the early Intermediate populations may have ventured farther away to harvest oysters, perhaps to the south side of the Palos Verdes peninsula, a source that was later cut off via either human or natural causes?

Abalone exploitation was noted only in the Late and Protohistoric–Mission periods. Given their habitat, their recovery implies possible seafaring into the kelp-bed areas and/or trade with the inhabitants of the Channel Islands. The nearest offshore rocky bottom habitats would have been the Palos Verdes Peninsula to the south and Topanga and Malibu to the north.

In summary, although there is obvious change over time in shellfish exploitation, there are two key trends. Within each period, even if there was a dominant species, there was at least one or two secondary, supplemental species. In most cases, the primary or secondary species was the Pacific calico scallop—the shellfish taxon that the Ballona populations most consistently collected—and then either venus or littleneck clams. That this shellfish trio should have formed the backbone of the shellfish paleodiet is not surprising, given that all three commonly inhabit environments similar to the protected waters and soft substrates of the Ballona and tolerate a range of salinity. The large PVAHP shellfish collection therefore provides us with evidence of both continuity and change in diet over time, as well as the possible emergence of trade (for abalone) with the inhabitants of the Channel Islands later in the sequence.

Prehistoric Plant Use and Intensification in the Ballona Lowlands

Seetha N. Reddy
with contributions from John M. Marston

An important component of interpreting human-land relationships in the Ballona, as identified in the research design (Altschul et al. 1991:23–25), is to discern the relationship between subsistence systems and foods. Use of plant foods by ancient populations is delineated through the study of carbonized macrobotanical remains. Paleoethnobotanical studies can provide the theoretical bridge between macrobotanical remains in the archaeological record and social practices that may reflect cultural identity expressed through food consumption. Also, use of food to signal group identity is well theorized in anthropological literature (Bush 2004; Rozin 1982; Wrangham et al. 1999). When recovered from discrete cultural contexts, macrobotanical remains provide valuable signatures of ancient subsistence systems and consumption practices. In addition, macrobotanical remains also provide insight into how people organized themselves within their built and natural environments.

This chapter presents the macrobotanical data from the five sites studied in the PVAHP. More than 4,700 liters of sediment from 275 samples were processed for macrobotanical remains, which resulted in the recovery of 590 g of charcoal and over 530,000 carbonized seeds (Table 217). Major objectives of the paleoethnobotanical study and this chapter are

- to reconstruct and model diachronic plant use in the Ballona,
- to identify the major trends in plant use associated with the major cultural periods, and
- to explore the relationship between food and social identity as expressed in the macrobotanical data.

The chapter has four major sections. The first section considers the place of plants in a regional context and presents models of prehistoric plant use. The next section presents a background to plant use in the Ballona through a discussion of habitats and previous paleoethnobotanical research. Subsequently, the macrobotanical data from each of the major sites in the PVAHP are presented and discussed. The final section of the chapter presents interpretations of the macrobotanical data and the implications for subsistence systems, sociocultural practices, and adaptations. For additional information regarding the information presented in this chapter, please see Appendixes L.14.1–L.14.10.

Plants and Humans in a Pan-Californian Prehistoric and Ethnohistoric Context

Paleoethnobotanical research in coastal southern California has several recurring research themes: intensity of plant use over time, role of plants in subsistence systems along the coast versus inland highland areas, the importance of acorns in the diet, and the use of annual grasses (Hammett and Lawlor 2004; Popper 2002; Reddy 1999a, 2004a; Wohlgemuth 1996, 2002).

There is considerable ambiguity as to whether stability or change characterizes plant utilization in coastal southern California from the Paleocoastal period to the Mission period. Much of the ambiguity is due to the dearth of standardized and rigorous macrobotanical recovery, analysis, and comparative studies (but see Klug and Popper 1995; Martin and Popper 1999; Reddy 1996, 1997a, 1997b, 1999a, 2004b, 2004c; Wigand 2005; Wohlgemuth 1996, 2002). Therefore, elucidation of basic plant-utilization patterns across coastal southern California over time is still in its infancy.

The second research topic, the varied role of plants in subsistence systems along the coast versus inland highland areas, is closely related to continuity and change in plant utilization. Much of what is presented as interpretations of plant use are inferences based on secondary evidence, such as ground stone and bedrock-milling features, typically tied to direct analogies of ethnohistoric accounts of plant gathering, seasonal exploitation, and utilization. For example, Erlandson (1991) argued that the presence of mortars and pestles at sites along the Santa Barbara coast was evidence of acorn use. Similarly, True (1993) developed a function classification of bedrock-milling features in northern San Diego County and then categorized sites based

Table 217. Macrobotanical Remains Recovered in the PVAHP

Site	Sediment Floated (liters)	Charcoal		Carbonized Seeds	
		g	g/liter	n	n/liter[a]
LAN-54	742.41	0.08	0.0001	106	0.1
LAN-62	1,625.03	287.00	0.2000	492,803	248.0
LAN-193	49.00	0.04	0.0010	208	3.3
LAN-211	954.90	303.48	0.3000	44,137	46.2
LAN-2768	1,385.00			1,464	1.1
Total	4,756.34	590.60	0.1000	538,718	94.3

[a] Based only on contexts with volume data.

on the types of bedrock-milling features present. Based on this evidence, he argued for a subsistence orientation that ranged from generalized seed processing to specialized processing of acorns. Both of these studies were done without any substantiating macrobotanical data.

Subsequently, Reddy (1997a) tested True's (1993) bedrock-milling inferences by collecting macrobotanical data from a series of inland sites with substantial bedrock-milling features. For example, application of True's (1993) model to bedrock-milling features at SDI-5139 in the Case Spring highlands of northern San Diego County indicated that the site was focused on acorn processing. The macrobotanical data, however, revealed a high carbonized-seed density (108 seeds per liter of sediment) in which grasses predominated but acorns were infrequent. This study demonstrated the importance of gathering direct plant data from macrobotanical remains and integrating these results with data from plant-processing tools and features. In the long term, such an integrated approach facilitates the development of more accurate reconstructions that eschews simple correlations between tools or bedrock-milling elements and food-processing techniques and highlights the importance of using both direct data and secondary evidence in understanding variability in plant use.

The role of acorns in prehistoric diets, particularly the timing of their incorporation into subsistence systems and whether they were intensively exploited as a primary plant-food resource, is an active research topic in California. Notably, Basgall's (1987) article on the antiquity of acorn economies generated considerable interest regarding acorn exploitation in California. Basgall (1987) argued that acorn use can be expected to emerge as a consequence of very specific socioeconomic conditions and not because of some inherent quality of the resource itself. Basically, the resource was unutilized and underexploited because of the high processing costs until increased production at the expense of productivity became necessary. He also suggested that when grasses were abundant, acorn exploitation would have been viewed as a high-cost subsistence practice, because acorn use is very labor intensive with high time-energy costs.

What remains unaddressed in coastal southern California is identifying what other factors could have played a role in acorn exploitation becoming a viable strategy. As per Basgall (1987) and Bettinger et al.'s (1997) labor-energy calculations, an investment in acorn exploitation would not have been an optimal strategy when other resources were readily available. What has not been empirically resolved in coastal southern California is whether acorns could have been supplemental resources to grasses (the primary plant resource). Additionally, the theory of acorn intensification associated with increased socioeconomic need is intriguing and has much potential. However, it needs evidence from archaeological data, particularly in deciphering a socioeconomic need that would encourage and necessitate a high-cost strategy and how such a threshold could be calculated.

There is no doubt that acorns were a staple in the diet of some aboriginal California Protohistoric and historical-period populations (Baumhoff 1963; Gifford 1931; Kroeber 1925). Scholars, however, have varied perceptions of prehistoric acorn use; some have argued for intensive use starting in 4000 B.P. in northern and central-valley California (Hildebrandt and Mikkelsen 1993:34; Wohlgemuth 1996) and later, in the late Holocene, in Santa Barbara Channel and southern California (Glassow 1996; Reddy 1999a). There has been a penchant to argue, potentially unconsciously, for early (middle Holocene) incorporation of acorns into the subsistence economy throughout California, rather than focusing on whether different regions would have had varying adaptive trajectories.

Two major macrobotanical studies have highlighted the potential for varied regional trajectories in acorn use. Wohlgemuth (1996, 2002) argued for diachronic variability in subsistence patterns based on macrobotanical remains from 11 sites in the North Coast Ranges and the Central Valley in central California. (Note that the chronological sequence that he used is different from that used for the PVAHP.) High quantities of small seeds and few acorns characterized Early period sites (ca. 4500–2800 B.P.). Middle period sites (ca. 2800–1200 B.P.) were dominated by acorns, and small seeds decreased, and Late period sites (1200–100 B.P.) still contained large quantities of acorns, but there was an increase in the quantities of small seeds. Wohlgemuth's (1996) explanation for the decline in importance of small seeds in the Middle period followed by their increased utilization in the Late period centered around his assumption that people making more intensive use of acorns may have sacrificed some other resources in favor of acorns, in contrast to groups using a more diverse gathering strategy. Groups making more intensive use of plant resources in addition to acorns also were predicted to have had more varied seed assemblages. Therefore, he argued that the subsistence systems changed from a generalized to a specialized system, and then back to a generalized system. Furthermore, the need to exploit more small seeds in the Late period was considered to be directly related to increasing needs of a larger population, because acorns alone cannot support larger populations. Therefore, small-seeded plants became more important to the subsistence system, and this was further supported by the controlled burning reported ethnohistorically.

By contrast, macrobotanical data from coastal southern California (more than 31 sites on Marine Corps Base Camp Pendleton) did not mirror the intriguing pattern observed by Wohlgemuth (1996) in central California (Eisentraut 1996; Klug and Popper 1995; Martin and Popper 1999; Reddy 1997a, 1997b, 1999a, 1999b, 2000a, 2000b, 2004b, 2004c). Instead, a very different picture emerged that involved an increase in acorn exploitation during the middle part of the late Holocene (starting approximately 500 B.P.). The sites included occupations from the early Holocene through the late Holocene. Moreover, the sites sampled included a wide range of prehistoric settlements: coastal villages with thick middens, features, and burials; small coastal camps; midland villages and small camps; and highland residential and short-term camps. Thus, it is conceivable that different subsistence strategies and cultural processes were at play and that in coastal southern California (particularly the Camp Pendleton area), acorns did not become an important resource until very late in the cultural sequence, if at all. Instead, other resources, including grasses and legumes, open-coast and lagoonal shellfish and fish, and a wide range of terrestrial animals were more important resources. Therefore, we need to consider whether acorns (and particularly from coast live oak and Engelmann oak in coastal southern California) might not have been the preferred food when other resources were available.

Could these divergent findings from two regions in California be the result of the inherent invisibility of acorns in the archaeological record, or were different cultural processes and adaptations at play? Furthermore, how can one determine which of these two scenarios is at play? Given the high quantity of sediment floated for macrobotanical remains and the number of sites in the coastal southern California sample (Camp Pendleton), sample sizes were not a factor. Because plant use was generally high in coastal southern California, based on the high recovery of grasses, legumes, and small seeds (as demonstrated by the various studies), the low densities of acorns suggest that they might not have been used intensively when grasses, legumes, and small seeds were sufficient to fulfill the dietary needs of the population. The increased recovery of acorn shells ca. 500 B.P. suggests that acorns were incorporated into the subsistence system to a higher degree in order to widen the resource base.

To explore late Holocene intensification related to acorns versus grasses or legumes, it is imperative to develop models that go beyond our knowledge of the local and often scanty ethnohistoric record. Furthermore, we need to explore the strong possibilities that different regions of California had different subsistence strategies and that certain resources played different roles in the past. Acorns need not have had a similar role and status in the prehistoric subsistence systems throughout the vast and environmentally diverse region we call California. Plant use, much like material culture, was not in stasis through prehistory, nor has it been homogenous over a region, and the modeling of subsistence systems and plant utilization should move beyond panregional homogeny and ethnohistoric analogy. New models need to be developed that both account for regional variations in diachronic patterns and provide explanatory insights into why changes in plant use took place.

In terms of the PVAHP, prehistoric plant use in the Ballona has been addressed only marginally in previous research by Brooks and Johnson (1992) at LAN-47 and by Miksicek (1994) at LAN-60 (see Appendix L.14.1). More recently, there has been paleoethnobotanical work on the Pleistocene terraces immediately to the south of the Ballona by Wigand (2005) at LAN-63, LAN-64, and LAN-206. Through the study of grab samples from excavation units, Brooks and Johnson (1992) concluded that seasonally wet, woody-shrub grasslands were exploited by the Late period occupants at LAN-47. The study had severe limitations because sample volumes and seed densities were not reported. Miksicek's (1994) research at LAN-60 (a single sample from an Intermediate period hearth) revealed very low seed densities (0.2–1.8 per liter), and edible roots accounted for 26.4 percent of all plant remains recovered. Grasses were the second-most-abundant class of plants recovered and accounted for 25.9 percent of the sample. They included *Hordeum pusillum* (little barley), *Phalaris* sp. (maygrass), and *Panicum* sp. (panicgrass). Miksicek (1994) concluded that local flora was exploited primarily from the immediate surroundings. Wigand's (2005) paleoenvironmental research on the bluff tops south of the Ballona lowlands suggested that aboriginal populations in the Intermediate period were focusing their gathering on the rich plant resources associated with the vernal pools and the surrounding Coastal Prairie. Overall, these previous studies in the Ballona and its vicinity did not have robust data sets to elucidate continuity and change in plant use accurately, and little was known about the long-term trends in plant use and the exploitation trends in the local area prior to this project.

Objectives of Playa Study

The primary objective of the PVAHP paleoethnobotanical research is to reconstruct prehistoric plant use at five sites (LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768) through the study of carbonized macrobotanical remains. The study incorporated results from previous studies in the

Ballona by Wigand (2005) at LAN-63, LAN-64, and LAN-206A; by Brooks and Johnson (1992) at LAN-47; and by Miksicek (1994) at LAN-60 as relevant and when data were comparable. Diachronic changes and continuity in the exploitation of local plant resources were elucidated, along with consideration of uses as food, medicine, and fuel and their roles in ritual and ceremonial contexts. In investigating the relationship between humans and plants within the Ballona landscape, the study explored the targeted exploitation of particular plant resources. The results were then used to model prehistoric human behavior as pertinent to plant use in the Ballona starting around 7000 B.P.

Specific research questions that were addressed at each of the five sites in the PVAHP through the study of carbonized macroremains included (1) What is the nature of plant use, including changing intensity overtime? (2) Are there contextual associations between plant resources and features? (3) What are the sources of seeds, and are there varying roles of plants in different contexts? and (4) Can plant exploitation over time be characterized as a generalized or a specialized strategy? The answers to these questions were used to address the three main objectives of the study as defined earlier and to explore the dependence on high-cost resources, such as small seeds, by populations who were logistically organized. Building on the results of the reconstruction of plant use in the Ballona lowlands, this study also addressed the debate on the role of acorns in southern California prehistory and the intensification of the use of grasses in the Late period. A model for change and continuity in plant use over time for the coastal southern California area represented by the Ballona lowlands will ultimately be developed.

Analytical Methods

Intensive sampling and strong contextual information are necessary for a paleoethnobotanical study to be effective. In particular, a rigorous yet manageable sampling strategy is the key to facilitating a thorough understanding of the variation and similarity in activities related to food procurement, consumption, and disposal at a site (or series of sites). "Adequate" sampling involves the sampling of sufficiently large numbers of contexts rather than large samples from a few contexts. In the PVAHP, bulk sampling was implemented and involved collection of samples from specific/discrete areas. Such a sampling method is best suited for addressing questions related to spatial patterns and specialized activity areas and is particularly relevant when research issues are related to food procurement, preparation, consumption, and disposal rather than paleoenvironmental reconstruction. In discussing the methods employed in the PVAHP paleoethnobotany, there are four main issues that will be considered: sampling, sorting methods, criteria for seed selection, and postdepositional disturbance.

Given the complexity of the PVAHP in terms of depositional history, contextual richness, and temporal occupation, the archaeobotanical sampling was tailored to accommodate the characteristics of each site. In general, sample selection was geared to address the research questions successfully. For example, it was necessary to include samples from habitation and nonhabitation contexts at each site. Based on the nature of the five sites, the following rationale was implemented:

- When possible, at least one column sample from each site was analyzed to establish the correlation between depositional history and recovery of carbonized plant remains.

- Samples from particular contexts (i.e., mortuary at LAN-62) were analyzed in higher volumes because of their unique contexts.

- When possible, samples from habitation contexts were analyzed to provide subsistence data.

The sediment was processed with a Flot-Tech machine. All light and heavy fractions were sorted in a similar method. Each light fraction was first sieved through nested geological sieves with mesh sizes of 4.75 mm (Sieve A), 2 mm (Sieve B), 1 mm (Sieve C), and 0.5 mm (Sieve D). Such presorting is an effective way to remove modern rootlets and leaves and to isolate small flakes, bones, and shell. If the sample size was large (>10 liters), a subsample representing 10 liters of sediment was taken immediately from each sieve size. Each fraction was sorted under a binocular microscope (5×–15×). Charcoal was collected only from Sieves A and B (i.e., charcoal larger than 2 mm). Carbonized seeds were collected from all sieves and stored in vials. When all sorting was completed, the charcoal was weighed, and the sorted light fractions were ready for curation and/or repatriation. Identification of the carbonized seeds was done through comparison with comparative materials and identification manuals (Martin and Barkley 1973; Musil 1963) and consultation with the botanists at the Seed Herbarium in Sacramento (California Department of Agriculture).

This paleoethnobotanical study only considered carbonized seeds. In general, when uncarbonized (uncharred) plant parts are recovered from archaeological sites, it is important to determine whether they were associated with cultural activities in the past or whether they entered the site through natural processes in more recent times. Paleoethnobotanists typically consider the carbonization of plant seeds to be the most reliable and conservative indication of antiquity. In other words, uncharred plant materials at archaeological sites are generally considered unrelated to prehistoric human use of plants, because they would not be expected to have been preserved in typical open-air sites (Minnis 1978). (Note that cave sites are an exception to this.) Charred specimens, on the other hand, are often assumed to be related to intentional or unintentional prehistoric human use of fire. Of course, there are situations when such dichotomy is not possible; for example, consider *Chenopodium-Amaranthus*–type seeds. It takes a highly trained eye to discern charring on these naturally black seeds, especially when they are not swollen or broken open for an interior view. In this study, a conservative and scientifically reliable approach was adopted, and only carbonized seeds were included in the analysis and interpretation. Previous studies by Wigand (2005) and Brooks and Johnson (1992) did not take this conservative approach.

Postdepositional disturbance was measured through a qualitative-categorical method. It is crucial to note postdepositional disturbance in paleoethnobotanical studies so that association of low densities of particular taxa can be explained effectively as cultural or biological. Although only carbonized seeds were recovered from the light fractions, the presence of uncarbonized seeds was noted. Other organic materials noted included rodent fecal matter, insect parts, worms, and land snails. All of these organics were quantified as shown in Table 218. The data were ultimately utilized in determining postdepositional disturbance in each sample, which was critical for interpretation.

Discerning patterns in the macrobotanical data from the five sites was done through the use of density, percentage, and taxonomic richness. At the basic level, a presence/absence or ubiquity approach was used to provide summary information for comparing how common each taxon was in each sample/context/period. One of the goals of the analysis was to measure the intensity with which a plant resource was used, not just the mere use of the specific resource(s), because it is important in understanding competitive replacement of adaptive strategies. Densities, percentages, and taxonomic richness indexes are instrumental for such measurement.

- Charcoal densities are used to define varying preservation contexts at and between the sites as well as the intensity of activities involving plants and fire.

- Seed densities define the intensity of plant use.

- Percentages of different taxa reflect the relative abundance of a specific taxon in a collection.

- Ubiquity or presence analysis (each taxon is scored as present or absent in a sample and then given a frequency measure) provides information on the relative importance of taxa. Ubiquity measures the number of accidents (incidents when there was accidental spillage or disposal during processing, preparation and consumption) associated with the taxon and, therefore, the degree of use.

- Taxonomic richness is a qualitative measure of plant-taxa diversity (high diversity suggests a generalized assemblage and low diversity is indicative of a specialized assemblage; both are used to define plant-exploitation strategies).

Table 218. Postdepositional Disturbance Indexes Used in the Study

Index	Qualification	Quantification
0	absent	0
1	few	less than 15 items per sample
2	moderate	15–30 items per sample
3	high	30–50 items per sample
4	abundant	>50 items per sample

Results

More than 4,700 liters of sediment were floated for macrobotanical remains, resulting in the recovery of more than 538,000 carbonized seeds (94.3 seeds per liter) and 590.6 g of charcoal (0.1 g per liter) (see Table 217). The majority of the sediment (2,580 liters, or 54 percent) and carbonized seeds (n = 536,940, or 99.7 percent) was from Mission period contexts at LAN-62 and LAN-211. The carbonized seeds were represented by 31 families, 63 taxa, and unidentifiable fragments (see the chapter glossary and Appendix L.14.2, the basis for the glossary). Most of the 31 families were represented by 1 or 2 taxa, with the exception of 2 families: Fabaceae (legumes; taxa = 8) and Poaceae (grasses; taxa = 15). Of the 63 taxa, 13 were introduced plants, including six domesticated crops (*Cicer* cf. *arietinum* [chick pea], *Pisum* cf. *sativum* [garden pea], *Avena* cf. *sativa* [oats], *Hordeum vulgare* [cereal barley], *Triticum* cf. *aestivum* [wheat], and *Zea mays* [corn]). Two of the introduced plants, cf. *Dactyloctenium* sp. (crowfoot grass) and *Lolium temulentum* (darnel), probably are weeds associated with the Old World crop fields of *Hordeum vulgare* and *Triticum aestivum*. *Brassica* sp. (mustard) was brought by the Spanish into California. Four taxa could be either native or introduced, depending on the species (*Chenopodium* sp. [goosefoot], *Lathyrus* sp. [peavine], *Trifolium* sp. [clover], and *Viola* sp. [violet]). Most of the seeds were identified to the genus rather than to species, because seed-morphology criteria necessary to assign a seed to a particular species were typically distorted in or absent from carbonized seeds. The common names of the different plant taxa are presented in Appendix L.14.2; however, the discussion primarily uses the Latin names. Common names can be misleading, because often one common name has been used for different taxa; for example, *Calandrinia breweri* (Brewer's redmaids) and *Calandrinia ciliata* (fringed redmaids) are both called "redmaids." Similarly, *Phalaris* sp. has been referred to as "maygrass" and "canarygrass" by different paleoethnobotanists (Popper 2002; Wohlgemuth 2002). This report uses "maygrass," but this usage does not reflect a preference.

Most of the plants represented by the macrobotanical collection were previously documented to have been used by Native Americans as food or medicine or for other purposes (Appendix L.14.3). Note, however, that ethnographic and ethnohistoric documentation of their uses does not necessarily establish similar or limited use further in the past.

Plant Taxa (Habitat)

The 63 plant taxa represented in the carbonized-seed collection of the PVAHP were primarily from four habitats (defined in Chapter 1, this volume). The four habitats include the Ballona wetlands (saltwater and freshwater), riparian settings, Los Angeles prairie/plain, and vernal pools. For the macrobotanical study, the four habitats were collapsed into three: Ballona wetlands, riparian (including vernal pools), and Los Angeles prairie/plain (see Appendix L.14.2). In addition to these four habitats, plants from upland areas (including chaparral) located further inland were also recovered. Most of the plants occurred in more than one habitat (n = 45, or 73 percent); in particular, 3 percent (n = 2) of the taxa were found in all four habitats, 8 percent (n = 5) occurred in three habitats, 61 percent (n = 38) occurred in two habitats, and 27 percent (n = 17) occurred in only one habitat. Within the taxa that occurred in two habitats, most were from the Los Angeles prairie/plain and upland/inland habitats (34 of the 38 taxa). Within taxa that occurred in three habitats, the taxa from coastal freshwater/riparian habitats and the Los Angeles prairie/plain were in higher numbers. These patterns in taxa frequencies and habitats indicated that the primary catchment for plant resources was the immediate surroundings, although more-distant habitats were also exploited, through either logistical gathering excursions or exchange with groups in those habitats.

This was even more evident when the carbonized seed frequencies were considered. For example, *Phalaris* sp. and *Hordeum pusillum* (hereafter abbreviated *H. pusillum*), two plants represented by the highest seed frequencies and ubiquity, are plants associated with freshwater, riparian, and Los Angeles prairie and plain habitats, which are in the immediate vicinity of the PVAHP. The *Phalaris* sp. was very similar to *Phalaris caroliniana*, but it is referred to as *Phalaris* sp. in this report. Other taxa that are both ubiquitous and also occurred in relatively higher frequencies that are from these two habitats included *Chenopodium* sp., *Trifolium* sp., and *Stipa* sp. (needlegrass). Five taxa that are associated with the Los Angeles prairie and uplands habitats and occurred in moderate frequencies included *Clarkia* cf. *purpurea* (winecup clarkia), *Hemizonia* sp. (tarweed), *Layia* cf. *platyglossa* (coastal tidytips), *Salvia* cf. *apiana* (white sage), and *Calandrinia* cf. *breweri*. Other noteworthy plants are *Schoenoplectus* [*Scirpus*] cf. *californicus* (California bulrush) and *Cyperus* sp. (flatsedge), which were recovered from LAN-62 in moderate quantities; these plants are associated with the Ballona wetlands and freshwater/riparian habitats. A range of root, tuber, and corm foods was also available in the Ballona wetlands and freshwater/riparian habitats. These foods were not well represented in the PVAHP macrobotanical collection; they are typically difficult to recover and identify archaeologically, because their preservation is often poor. Nonetheless, parenchymatous tissue (most likely root-tuber material) was recovered, representing either monocot rhizome fragments of *Typha* sp. (cattail) found in freshwater-wetland habitats or sedges (*Cyperus* and *Schoenoplectus*) found in brackish-water habitats (like the Ballona wetlands).

Berries (*Rhus* sp. [sumac], *Sambucus* cf. *nigra* ssp. *canadensis* [elderberry], *Arctostaphylos* sp. [manzanita], and *Heteromeles* sp. [toyon]) and nuts (*Quercus* sp. [oak], *Prunus* [chokecherry], *Juglans* sp. [walnut], and *Celtis* sp. [hackberry]) harvested from the foothills of the San Gabriel Mountains, the Palos Verdes Peninsula, and the Santa Monica Mountains were also exploited by the aboriginal populations of the Ballona.

Sources of Seeds

In elucidating the roles of plants in prehistoric subsistence economies, it is very important to be able to delineate which of the plants represented in the macrobotanical collection are associated with the occupation of the site and which are noncultural, intrusive contaminants. The sources of the seeds are critical to define, because that establishes the roles of the plants in the subsistence economy. Similarly, the parts of plants twere used is important, because their representation in the archaeological record can be biased, depending on whether they survive or not. For example, leafy parts of the plant, roots and tubers, and very dry or very oily parts all have a low chance of surviving carbonization. So, there is a bias in the archaeological record toward seed-bearing parts of the plants.

Carbonized seeds enter the archaeological deposits through a variety of pathways that need to be defined. Much has been written and researched in regard to the sources of seeds in archaeological deposits (e.g., Bush 2004; Keepax 1977; Miksicek 1987; Miller and Smart 1984; Minnis 1978; Reddy 2003). A carbonized-seed collection from a single site could represent plants used as food and medicine, as well as for fuel and building. Furthermore, it is possible that a percentage of the collection included noncultural contaminants in the form of seeds from wildfires and natural seed rain during site occupation that became carbonized in hearths. Of importance is that logically, any seeds that were used as food were less likely to be recovered, because much of that produce would have been consumed. What gets recovered are those seeds from accidental spills and intentional discards during food processing, preparation, and consumption in proximity to hearths and other contexts that involved plant foods and fire. Intentional discards were typically undesired seeds (Reddy 2003), which may have been immature, worm infested, or otherwise unpalatable. In addition, fruit pits and nutshell (by-products of processing and consumption) may also have been discarded into hearths as trash disposal. Stored foods have a higher likelihood of survival into the archaeological record because of the potential for catastrophic fires. Seeds from fuel materials have a high likelihood of inclusion in the deposits, but based on whether they are food plants or not, their roles are relatively clear. Use of animal dung (especially of domesticated animals) as fuel complicates matters, because seeds in the dung could have several sources (animal fodder or temper) (Miller and

Smart 1984; Reddy 1999b). Seeds recovered from cooking contexts (such as hearths and roasting features) could have entered the deposits as fuel, processing by-product, accidental food spillage, or intentional food disposal.

In coastal southern California and particularly in the PVAHP, the sources of seeds in the archaeological deposits have included accidental spillage of food and medicinal products, intentional food disposal, processing by-product, ritual and mortuary offerings, and natural seed rain (Figure 256). Seeds from fuel sources have been minimal, because many of the plants exploited in high frequencies would not have made good fuel (for example, grasses and legumes). Storage features with preserved carbonized seeds were not recovered in the project. The primary sources of seeds in cooking contexts (hearths) in the PVAHP included processing by-product, accidental food spillage, and intentional food disposal. The most unique and richest collection was from the ritual contexts at LAN-62 that involved intentional disposal of large quantities of seeds followed by ritual burning and subsequent burial, which allowed for optimal preservation.

The Fit between Pollen and Macrobotanical Data

Pollen analysis was conducted on samples recovered from nonarchaeological and archaeological contexts. Wigand (2015) reconstructed the vegetation and estuarine history using pollen data from geological cores (see Chapters 6 and 7, Volume 1 of this series). Pollen analysis from nonarchaeological contexts was focused on examining the southern California estuarine record to address post-Pleistocene sea-level adjustments and infilling of coastal embayments. The pollen record, revealed in the geological cores, clearly indicated the regional impact of climate upon estuarine, coastal, and chaparral vegetation. These changes were reflected even in shifts in Native American demography and changes in resource utilization (Wigand 2005). Subsequently, Wigand (Chapter 9, this volume) conducted pollen analysis on samples from archaeological contexts. In this chapter, the pollen data from archaeological contexts are discussed briefly and in comparison to the macrobotanical data.

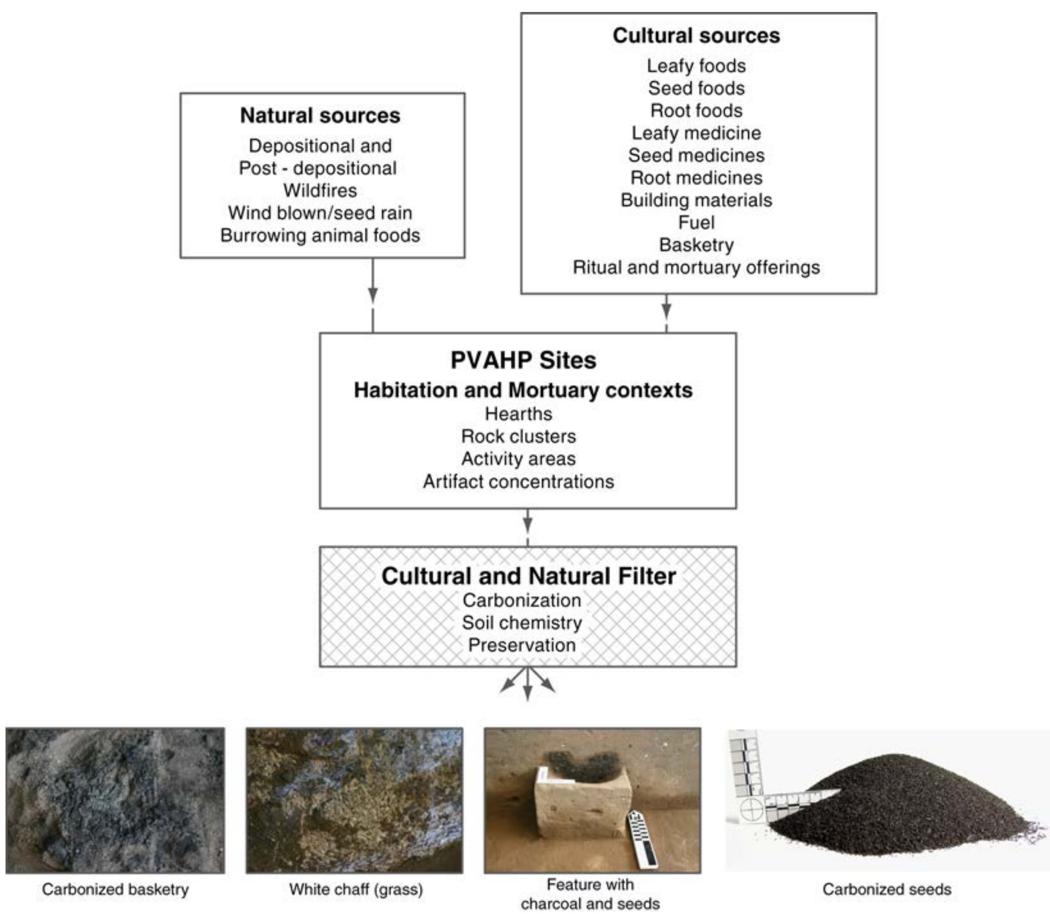

Figure 256. Sources of macrobotanical remains in the PVAHP.

In total, 309 sediment samples from the five PVAHP sites were analyzed for pollen. Although many pollen types (n = 37) were recovered, a handful of pollen types were abundant, including *Aster*-type (sunflower), Malvaceae-type (mallow family), *Typha angustifolia* (narrowleaf cattail), Chenopodiaceae (goosefoot family), *Ambrosia*-type (bursage), and Cyperaceae (sedge family) pollen. Wigand (Chapter 9, this volume) drew three primary conclusions about the archaeological pollen. First, *Aster*-type pollen dominated most of the samples, along with an admixture of *Atriplex*-type (saltbush) pollen. Second, some samples had an abundance of weedy plants that would have occurred in and around Native American habitation or use areas. Finally, some samples, primarily from LAN-62, were dominated by *Typha* pollen and could reflect the presence of high densities of this plant pollen in the general area and/or use of cattail heads for food or as material used to line burials.

When relative frequencies were compared, there was a discrepancy between the pollen and carbonized-seed data. Grasses, which were dominant in the macrobotanical data, were represented in very low quantities in the pollen data. Similarly, *Typha*, which dominated the pollen data, was minimally represented in the macrobotanical data. What is the reason for this discrepancy, and what are the implications? The lack of grass pollen is intriguing; however, the abundance of *Typha* pollen and lack of carbonized seeds suggest that cattail leaves and stems were very likely used for basketry but that the seeds were not used for food. Although there is discrepancy between the data sets, there are also some parallels. For example, *Aster*-type, Malvaceae-type, Chenopodiaceae, *Ambrosia*-type, and Cyperaceae pollen were abundant, and carbonized seeds of these plants were represented in the carbonized-seed collections from the sites.

The fundamental problem with interpreting the pollen record from archaeological sites in general, compared to the use of macrobotanical data, is that human impact and natural disturbance dominate pollen records, compared to macrobotanical data, which are dominated by food resources. Nonetheless, the pollen records are often good indicators of the natural vegetation during site occupation but not what resources were used by the site occupants. The pollen records give a baseline of types of resources available in the region, whereas the macrobotanical data are specific to what was exploited from these resources by the site occupants.

LAN-193

All samples from LAN-193 analyzed for macrobotanical remains were from early Intermediate period deposits, and carbonized seeds were recovered in low densities. In total, 21 samples were analyzed for macrobotanical remains, including 10 samples from a column and 11 samples from two nonburial features. The 21 samples yielded 208 carbonized seeds and very little charcoal; densities measured 3.3 seeds per liter and less than 0.04 g of charcoal per liter, respectively (Table 219). In addition, a large number of the carbonized seeds recovered from the site were indeterminate fragments mostly measuring 0.5–1 mm (n = 86, or 41.3 percent). No disturbance indicators were observed in the samples. The low charcoal densities suggest that exposure of wood to fire was not high at LAN-193, indicating that activities involving fire and wood were limited or that such activity areas were cleaned out, leaving minimal residue in the sampled features. Alternatively, organic preservation in these contexts may have been poor due to the relative age of occupation (compared to the Protohistoric to Mission period contexts at LAN-62 and LAN-211), resulting in low frequencies of carbonized plant remains. However, deposits dating to similar older dates (Intermediate period) in central California yielded higher seed densities (Wohlgemuth 2006).

Table 219. Summary of Macrobotanical Remains Recovered from LAN-193, PVAHP (Early Intermediate Period)

Provenience, by Context	Sediment (liters)	Charcoal		Carbonized Seeds	
		g	g/liter	n	n/liter
Control unit	49	0.04	0.001	161	3.3
CU 1					
Nonburial features	?	—	—	—	—
Feature 1					
Feature 9	?	—	—	23	?
Feature 9[a]	—	—	—	24	—
Total	49+	0.04	0.001	208	3.3[b]

Key: ? = no data.

[a] Not floated.

[b] Based on control-unit data only.

Site Taxonomy

The macrobotanical remains recovered from LAN-193 were represented by 12 taxa (Table 220). There was no clear dominance of any particular taxon, and only 2 taxa occurred in relatively higher frequencies: *Sambucus* cf. *nigra* ssp. *canadensis* (8.7 percent) and *Clarkia* cf. *purpurea* (6.3 percent). Grasses accounted for a little more than one-third of the collection (34.5 percent), and legumes occurred in very low frequencies (1 percent). A single grass-rachis fragment was recovered from a control column. Recovery of carbonized rachis remains is usually indicative of on-site plant processing. No root or nut plants were represented in the collection. Of the 12 taxa, only 1 taxon (*Melilotus* sp. [sweet clover]) was an introduced plant, and only two seeds of this taxon were recovered; it was likely intrusive. Ninety-nine percent of the collection from LAN-193 included native plants, and the macrobotanical collection was highly generalized.

Wetland plants accounted for less than 20 percent of the collection (n = 39, or 18.7 percent), and the majority of the plants were from mixed habitats, including coastal plains and uplands. Given the proximity of the site to rich wetlands during the early Intermediate period, a higher proportion of wetland taxa was expected. It is likely that nonseed parts of the wetland taxa were utilized, such as the green shoots and roots, but that these have not preserved. The high fragmentation in the carbonized-seed collection resulting in indeterminate seed fragments (n = 86, or 41.3 percent) was more likely due to the age of the deposits than to disturbance, because no disturbance indicators were observed in the light fractions.

Control Column

Samples from a control column taken from an excavation area in the western part of the site were analyzed for carbonized macrobotanical remains. The column sample included 10 levels (0–100 cm below surface). Feature 101 (human burial) was located in the vicinity, approximately 110 cm below ground surface.

In total, 49 liters of sediment were processed, and 161 carbonized seeds and 0.04 g of charcoal were recovered (Table 221). Charcoal was recovered in very low quantities and solely from four levels (50–90 cm). With a seed density of

Table 220. Plant Taxa Represented at LAN-193

Genus/Species, by Family	Total Seeds	Percent of Total Seeds	Origin	Part Used	Uses
Unidentified seed fragments	86	41.3			
Asteraceae					
Hemizonia sp.	3	1.4	native	seeds	foods
Layia cf. *platyglossa*	4	1.9	native	seeds	food
Caprifoliaceae					
Sambucus cf. *nigra* ssp. *canadensis*	18	8.7	native	bark, seeds, flowers	food, medicine
Chenopodiaceae					
Chenopodium sp.	5	2.4	native	seeds, leaves	food, medicine
Fabaceae					
Melilotus sp.	2	1.0	introduced	leaves, seeds	medicinal
Onagraceae					
Clarkia cf. *purpurea*	13	6.3	native	bulbs, seeds	food
Poaceae					
Unknown	38	18.3			
Deschampsia cf. *danthonioides*	10	4.8	native	seeds	food
cf. *Eragrostis*	3	1.4	native	seeds	food
Hordeum pusillum	9	4.3	native	seeds	food
Phalaris sp.	4	1.9	native	seeds	food
Stipa sp.	8	3.8	native	seeds, stalks	food, tools, toys
Portulacaceae					
Calandrinia cf. *breweri*	5	2.4	native	seeds, leaves	food
Total	208	100.0			
Amorphous fragments	94				
Poaceae (grass) rachis fragments	1				

Table 221. Macrobotanical Remains Recovered from CU 1 (Early Intermediate Period), LAN-193

Depth (cm)	Sediment (liters)	Charcoal		Carbonized Seeds	
		g	g/liter	n	n/liter
0–10	4	—	—	25	6.3
10–20	5	—	—	31	6.2
20–30	5	—	—	28	5.6
30–40	5	—	—	12	2.4
40–50	5	—	—	17	3.4
50–60	5	0.01	0.002	19	3.8
60–70	5	0.01	0.002	8	1.6
70–80	5	0.01	0.002	12	2.4
80–90	5	0.01	0.002	9	1.8
90–100	5	—	—	—	—
Total	49	0.04	0.001	161	3.3

3.3 seeds per liter, the column sample had higher densities in the top three levels (0–10 cm, 10–20 cm, and 20–30 cm), and the densities decreased with depth.

The 161 seeds recovered from the early Intermediate period deposits were represented by twelve taxa and indeterminate taxa (Table 222). In addition, a single rachis fragment was recovered from the 20–30-cm level. Overall, with the exception of the indeterminate seed fragments, grass seeds occurred in higher relative frequencies (46.6 percent) than any other plant seeds. Although no single taxon dominated the collection, grasses accounted for 46.6 percent of the seeds from the control sample (n = 75). The column sample revealed that exposure of plants to fire at LAN-193 was relatively low and that seed-plants were not utilized extensively by the occupants. This is noteworthy, because relatively higher frequencies of ground stone were recovered from these Intermediate period contexts at the site, especially compared to the Intermediate period contexts at the other PVAHP sites. Given the low seed densities, the ground stone use may have been associated with nonseed-plant processing. Organic preservation may have been poor, resulting in low frequencies of carbonized plant remains. Alternatively, organic preservation may have been poor given the age of the deposits. Preservation is given greater consideration as carbonized deposits and even stains were rarely observed in prehistoric contexts in the Ballona. This is not unexpected, as the Ballona features are all deposited in sands, which are easily leached.

Nonburial Features

Two nonburial features, Features 1 and 9 (both activity areas), were sampled for macrobotanical remains. No carbonized remains were recovered from Feature 1. In total, 47 carbonized seeds were recovered from Feature 9, including 24 seeds that were hand-picked during excavations and 23 seeds from flotation. The collection from Feature 9 was distinct from the control-sample collection in terms of taxa represented. Grasses accounted for less than 5 percent, and *Clarkia* cf. *purpurea* occurred in relatively higher frequencies. Seeds of *Clarkia* were consumed by aboriginal populations, raw, parched, dried, or ground (Moerman 1998). Overall, the feature had low frequencies, and interpretations about plant use could not be made without density data (because of the lack of sediment volumes).

Plant Use at LAN-193

Macrobotanical remains recovered from the early Intermediate period deposits at LAN-193 included plants that have documented ethnohistoric use by Native Americans as food, medicine, toys, and tools (see Table 220). Two taxa (*Sambucus* cf. *nigra* ssp. *canadensis* and *Chenopodium* sp.) had multiple uses as food and medicine. Different parts of the *Stipa* sp. plants could have been used as food and raw materials to make tools (combs) and toys (toy arrows). Although *Melilotus* sp. was the only taxon that could have been used as medicine, it was an introduced plant that was used during the Protohistoric and Mission periods and was not present during the early Intermediate period. *Sambucus* cf. *nigra* ssp. *canadensis* was the most ubiquitous taxon (33.3 percent), followed by *Deschampsia* cf. *danthonioides* (annual hairgrass) (28.6 percent) and *H. pusillum* (19 percent). Overall, grasses were the most ubiquitous plant group (47.6 percent). Based on the ubiquity measures, wetland taxa and grasses had higher degrees of utilization by the occupants than other plants recovered at LAN-193 (see Table 222).

Table 222. Distribution of Taxa by Context at LAN-193 (All Early Intermediate Period)

Genus/Species, by Family	CU 1	Feature 9	Feature 9 (+)	Total
Unidentified seed fragments	54	15	17	86
Asteraceae				
Hemizonia sp.[a]	1	1	1	3
Layia cf. *platyglossa*	4	—	—	4
Caprifoliaceae				
Sambucus cf. *nigra* ssp. *canadensis*	18	—	—	18
Chenopodiaceae				
Chenopodium sp.[a]	3	1	1	5
Fabaceae				
Melilotus sp.a	2	—	—	2
Onagraceae				
Clarkia cf. *purpurea*[a]	4	5	4	13
Poaceae				
Unknown	38	—	—	38
Deschampsia cf. *danthonioides*[a]	10	—	—	10
cf. *Eragrostis*[a]	3	—	—	3
Hordeum pusillum[a]	9	—	—	9
Phalaris sp.[a]	2	1	1	4
Stipa sp.	8	—	—	8
Portulacaceae				
Calandrinia cf. *breweri*[a]	5	—	—	5
Total	161	23	24	208
Amorphous fragments	15	—	—	15
Poaceae (grass) rachis fragments	1	—	—	1
Sediment (liters)	49	?	—	?
Seed density (n/liter)	3.3	?		?

Key: + = not floated; ? = volume unknown.
[a] Wetland taxa.

Although seeds were a common plant part used, leaves and roots may also have been used, which may also be a factor to consider in explaining the low seed density at the site. Any and all of the plants represented at the site could have been used as fuel, although wood from *Sambucus* cf. *nigra* ssp. *canadensis* would have been the better choice for relatively longer-lasting and higher-temperature fires. No other notable pattern of association was present in the macrobotanical data, and the low frequencies of carbonized seeds did not allow for interpretations related to correlations between taxa and specific contexts. The low frequencies could be a function of lower intensities of plant use, particular seed-bearing parts of the plants, and/or poor preservation due to the age of the deposits (early Intermediate period).

LAN-2768

Carbonized seeds were recovered from the prehistoric occupation component at LAN-2768 in low densities. Four loci were defined at the site for management purposes (Loci A, B, C and D), and macrobotanical remains from two loci were analyzed (Loci A and B). Twelve contexts were sampled, including nine features at Locus A and a control unit and two features at Locus B. The following discussion presents macrobotanical recovery and analysis from the two loci together, because the loci are not meaningful for prehistoric behavior but are simply management tools. Furthermore, the loci were adjacent to each other and in similar environmental contexts.

In total, 28 samples were analyzed for macrobotanical remains, including 17 samples from a control unit (CU 529) and 11 samples from nonburial features. The 28 samples yielded 1,464 carbonized seeds and very little charcoal (absent in most samples); density was 1.1 seeds per liter (Table 223). A large number of the carbonized seeds recovered from the site were indeterminate fragments mostly measuring less than 0.5–1 mm (n = 234, or 16 percent). No disturbance indicators were observed in the samples. The low (to absent, in some samples) charcoal densities suggest that exposure of wood to fire was not high at LAN-2768, indicating that activities involving fire and wood were limited or that such activity areas were cleaned out, leaving minimal residue in the sampled features. Alternatively, organic preservation may have been poor given the age of the deposits.

Site Taxonomy

The macrobotanical remains recovered from LAN-2768 were represented by 15 taxa (Table 224). *Calandrinia* cf. *breweri* dominated the collection and accounted for 61.7 percent. Grasses accounted for approximately one-eighth of the collection (13.3 percent), and legumes occurred in very low frequencies (4.2 percent). Of the 15 taxa, only 1 taxon (*Melilotus* sp.) was an introduced plant, and six seeds were recovered (0.4 percent) from a single level in CU 529. Overall, 99.6 percent of the collection from LAN-2768 included native plants.

Wetland plants accounted for a very small portion of the collection (n = 21, or 1.4 percent), and the remaining were from mixed habitats, including coastal plains and uplands. Given the proximity of the site to wetlands, a higher proportion of wetland taxa was expected. It is likely that nonseed parts of the wetland taxa, such as the green shoots and roots, especially for *Cyperus* sp., *Schoenoplectus* cf. *californicus*, and *Rumex* sp. (dock), were utilized. The high fragmentation in the carbonized-seed collection that resulted in indeterminate seed fragments (16 percent) was likely due to the age of the deposits and not to disturbance, because disturbance indicators were not observed in the light fractions.

CU 529

In total, 543 liters of sediment from 17 different levels of CU 529 were floated for paleoethnobotanical study and yielded 1,400 carbonized seeds and a seed density of 2.6 seeds per liter (Table 225). Charcoal was recovered from only two levels (Levels 8 and 10) and in very low to negligible quantities (<0.01 g). The lack of charcoal implies low exposure of plants to fire. The macrobotanical signature of CU 529 was used as a control for the general midden at LAN-2768. CU 529 had Intermediate period deposits, and the highest seed densities were noted in the top five levels (7–11); Level 7 had significantly higher density (Appendix L.14.4). Seed densities dropped dramatically from Level 14 onward. The top two levels (Levels 7 and 8) yielded 53.7 percent of the carbonized seeds, and almost 85 percent of the seeds from the unit were recovered from the top five levels. Most evidence of plant use was in the upper levels of the unit; in other words, within the Intermediate period at LAN-2768, plant use increased over time.

The 1,400 seeds recovered from the Intermediate period deposits in CU 529 represented 11 taxa. *Calandrinia* cf. *breweri* (64.4 percent) dominated the collection. The source of these seeds and their role in prehistoric plant use at the site is discussed later in this section.

Table 223. Summary of Macrobotanical Remains Recovered from LAN-2768, PVAHP (All Early Intermediate Period)

Provenience	Context	Sediment (liters)	Carbonized Seeds	
			n	n/liter
CU 529	control unit	543	1,400	2.6
Feature 12	hearth	170	18	0.1
Feature 18	rock cluster	12	—	—
Feature 19	artifact concentration	15	24	1.6
Feature 20	rock cluster	14	—	—
Feature 24	structure	480	5	0.01
Feature 25	rock cluster	10	—	—
Feature 29	artifact concentration	2	—	—
Feature 30	pit	20	9	0.5
Feature 31	pit	10	1	0.1
Feature 113	artifact concentration	63	5	0.1
Feature 114	rock cluster	46	2	0.04
Total		1,385	1,464	1.1

Table 224. Plant Taxa Represented at LAN-2768

Genus/Species, by Family	Total Seeds	Percent of Total Seeds	Density (n/liter)	Part Used	Uses
Unidentified seed fragments	234	16.0	0.200		
Seed embryos	4	0.3	0.003		
Amaranthaceae					
Amaranthus sp.	21	1.4	0.020	seeds, young shoots	food, medicine
Asteraceae					
Indeterminate fragments	10	0.7	0.010		
Ambrosia sp.	1	0.1	0.001	roots, leaves	primarily medicine, sometimes food
Hemizonia sp.	7	0.5	0.010	seeds	foods
Cyperaceae					
Cyperus sp.	1	0.1	0.001	roots, seeds	food, medicine
Schoenoplectus [*Scirpus*] cf. *californicus*	7	0.5	0.010	seeds, leaves, shoots, roots	food, shelter
Fabaceae					
Indeterminate fragments	51	3.5	0.040		
Melilotus sp.	6	0.4	0.004	leaves, seeds	medicinal
Vicia sp.	4	0.3	0.003	seeds	food
Lamiaceae					
Salvia cf. *apiana*	1	0.1	0.001	seeds, young shoots, leaves	medicinal, water purifier/ taste enhancer, ritual, food
Onagraceae					
Clarkia cf. *purpurea*	18	1.2	0.010	bulbs, seeds	food
Poaceae					
Indeterminate fragments	50	3.4	0.040		
Bromus cf. *carinatus*	132	9.0	0.100	seeds	food
Hordeum pusillum	2	0.1	0.001	seeds	food
Phalaris sp.	10	0.7	0.010	seeds	food
Polygonaceae					
Eriogonum sp.	1	0.1	0.001	young leaves, stems, seeds	food
Rumex sp.	1	0.1	0.001	leaves, seeds, stem	food, medicinal, dye
Portulacaceae					
Calandrinia cf. *breweri*	903	61.7	0.700	seeds, leaves	food
Total seeds	1,464	100.0	1.100		
Amorphous	30		—		
Poaceae					
Rachis fragments	12		—		
Nutshell					
Unidentifiable nut fragments	4 (<0.1 g)				
Juglandaceae					
cf. *Juglans*	3 (<0.1 g)			nuts	food

Table 225. Macrobotanical Remains Recovered from CU 529, LAN-2768 (Intermediate Period)

Genus/Species, by Family	Percent	Total
Indeterminate fragments	15.2	213
Amaranthaceae		
Amaranthus sp.	0.6	8
Asteraceae		
Indeterminate fragments	0.7	10
Hemizonia sp.	0.5	7
Cyperaceae		
Cyperus sp.	0.1	1
Fabaceae		
Indeterminate fragments	3.6	50
Melilotus sp.	0.4	6
Vicia sp.	0.3	4
Onagraceae		
Clarkia cf. *purpurea*	1.0	14
Poaceae		
Indeterminate fragments	3.1	44
Bromus cf. *carinatus*	9.4	132
Phalaris sp.	0.5	7
Polygonaceae		
Eriogonum sp.	0.1	1
Rumex sp.	0.1	1
Portulacaceae		
Calandrinia cf. *breweri*	64.4	902
Total seeds	100.0	1,400
Sediment floated (liters)		543
Seed density (n/liter)		2.6

Nonburial Features

Eleven of the 28 samples from LAN-2768 were from nonburial features, which included a hearth (Feature 12), 3 artifact concentrations (Features 19, 29, and 113), 4 rock clusters (Features 18, 20, 25, 114), 2 pits (Features 30 and 31), and a structure (Feature 24) (Table 226). All the nonburial features dated to the early Intermediate period, with the exception of Feature 113, which is an Intermediate period feature (whether it is early or late Intermediate is unknown). The 11 features yielded 64 carbonized seeds and no charcoal. The lack of charcoal from the light fraction, especially the hearth and the rock clusters, was unusual, given that these types of features are associated with fire. Seed density was low in all the features, especially the rock clusters and the structure. All taxa recovered from these features (not including the indeterminate fragments) have documented use as food and medicine. In general, the low seed densities in all features at the site limited interpretations.

The three artifact-concentration features (Features 19, 29, and 113) yielded 29 carbonized seeds (seed density of 0.4 seeds per liter). Carbonized seeds were absent from Feature 29. Of the remaining two artifact concentrations, Feature 19 had the higher seed recovery (1.6 seeds per liter).

The single hearth feature (Feature 12) yielded 18 carbonized seeds (0.1 seeds per liter) and had considerable postdepositional disturbance. The 18 seeds were represented by three taxa and an indeterminate seed fragment. Three small fragments of *Juglans* sp. (wild walnut) were also recovered (less than 0.1 g).

The two pit features, together, yielded only 10 carbonized seeds, and one of the pits (Feature 30) yielded 9 of those seeds. The four rock clusters had a very low recovery of carbonized seeds, with only 2 seeds (from Feature 114) and 12 grass-rachis fragments from two features. The recovery of grass rachises, although in low numbers, implies grass-seed processing and consumption. Although grass seeds were not recovered from the rock clusters, *H. pusillum, Phalaris* sp., and indeterminate grass-seed fragments were recovered from the site. If the rock clusters were remnants of hearth cleanouts, the grass rachises could have been food cleanings deposited into the hearths prior to food preparation.

A large volume of sediment (480 liters) was processed from Feature 24, a structure, but only five carbonized seeds and 0.01 g of charcoal were recovered. Considerable postdepositional disturbance was observed in the light fraction from this feature. Based on the low seed density, this feature was not a locale at which plant use (entailing seeds), seed processing, or seed disposal occurred. If it was a house floor reused as a roasting pit (as suggested in Chapter 7, Volume 2 of this series), the plant foods roasted would not have included seeds. If the foods roasted were roots or tubers, their remnants had a lower likelihood of survival, and the low charcoal densities suggest that there were few, if any, organic by-products of the roasting preserved.

Plant Use at LAN-2768

The LAN-2768 macrobotanical collection represented plants that have documented ethnohistoric use by Native Americans as food and medicine (see Table 224). Six taxa (*Amaranthus* sp. (pigweed), *Ambrosia* sp., *Cyperus* sp., *Schoenoplectus* cf. *californicus, Salvia* cf. *apiana*, and *Rumex* sp.) have multiple uses as food and medicine and for other purposes. *Schoenoplectus* cf. *californicus* was the only plant used both for food and shelter (depending upon the plant part). *Ambrosia* sp. and *Melilotus* sp. were the only two taxa used primarily as medicine. *Rumex* sp. had uses as food, medicine, and dye. *Salvia* cf. *apiana* could have been used for medicinal purposes, to purify water and enhance the taste, as food, and in ritual activities. Although seeds were a common plant part used, young shoots, stems, leaves, bulbs, and roots were also used, which may also be a factor to consider in explaining the overall lower seed density at the site, particularly among the features. Any and all of the plants represented at the site could have been used as fuel, although wood from *Juglans* sp. would have been the best choice for longer-lasting and higher-temperature fires.

Table 226. Macrobotanical Remains Recovered from Features at LAN-2768 (Early Intermediate and Intermediate Periods)

Genus/Species, by Family	Hearth	Artifact Concentrations				Rock Clusters					Pits			Structure	Total	
	F 12	F 29	F 19	F 113[a]	Total	F 18	F 20	F 25	F 114[a]	Total	F 30	F 31	Total	F 24	n	%
Indeterminate fragments	1	—	14	2	16	—	—	—	—	—	3	—	3	1	21	32.8
Seed embryos	—	—	—	—	—	—	—	—	—	—	4	—	4	—	4	6.3
Amaranthaceae																
Amaranthus sp.	9	—	—	2	2	—	—	—	2	2	—	—	—	—	13	20.3
Asteraceae																
Ambrosia sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1.6
Cyperaceae																
Schoenoplectus [*Scirpus*] cf. *californicus*	7	—	—	—	—	—	—	—	—	—	—	—	—	—	7	10.9
Fabaceae																
Indeterminate fragments	—	—	—	—	—	—	—	—	—	—	1	—	1	—	1	1.6
Lamiaceae																
Salvia cf. *apiana*	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1.6
Onagraceae																
Clarkia cf. *purpurea*	—	—	2	1	3	—	—	—	—	—	1	—	1	—	4	6.3
Poaceae																
Indeterminate fragments	—	—	6	—	6	—	—	—	—	—	—	—	—	—	6	9.4
Hordeum pusillum	—	—	2	—	2	—	—	—	—	—	—	—	—	—	2	3.1
Phalaris sp.	—	—	—	—	—	—	—	—	—	—	—	1	1	2	3	4.7
Portulacaceae																
Calandrinia cf. *breweri*	1	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1.6
Total seeds	18	—	24	5	29	—	—	—	2	2	9	1	10	5	64	100.0
Amorphous	—	—	29	—	29	—	—	—	—	—	—	1	1	—	30	
Poaceae																
Rachis fragments	—	—	—	—	—	11	1	—	—	12	—	—	—	—	12	
Nutshell																
Unidentifiable nut ragments	—	—	—	—	—	—	—	—	—	—	—	—	—	4 (<0.1 g)	4 (<0.1 g)	
Juglandaceae																
cf. *Juglans*	3 (<0.1g)	—	—	—	—	—	—	—	—	—	—	—	—	—	3 (<0.1 g)	
Sediment floated (liters)	170	2	15	63	80	12	14	10	46	82	20	10	30	480	842	
Seed density (n/liter)	0.1	0.0	1.6	0.1	0.4	0.0	0.0	0.0	0.04	0.02	0.5	0.1	0.3	0.01	0.1	

Key: F = Feature.
[a] Intermediate period.

Although LAN-2768 had low carbonized-seed densities, the distribution of taxa in CU 539 and the nonburial features was distinctive. First, *Calandrinia* cf. *breweri* dominated and accounted for 61.7 percent (n = 903) of the collection from the control unit. However, in the 11 nonburial features, a single seed of *Calandrinia* cf. *breweri* was recovered from Feature 12 (hearth). The plant taxa that occurred in higher percentages in the nonburial features included *Amaranthus* sp., *Schoenoplectus* cf. *californicus,* and grasses. The distinct association of plant taxa to context, in this case *Calandrinia* cf. *breweri* recovered in higher frequencies from midden contexts but negligible in to absent from feature contexts, can be explained through two factors. First, the midden contexts (represented by the control unit) represented a range of activities, and the features denoted discrete spatial use. So, the carbonized-seed collection from the control unit represented an amalgam of activities during site occupation, and the collections from the nonburial features characterized discrete activities in which plants played varying roles. Another explanation for the varying taxonomic associations between the control unit and the features is that the collection from the control unit had been subjected to higher disturbance, and the *Calandrinia* cf. *breweri* may have been noncultural. In other words, the seeds may have been seed rain from natural fires. *Calandrinia* cf. *breweri* seeds are small and light and are relatively easy to transport by wind under optimal conditions. The validity of these two scenarios can be resolved through other lines of evidence (fauna and artifacts).

Overall, LAN-2768 yielded relatively low frequencies and densities of carbonized seeds. In general, the control unit yielded higher seed densities than the nonburial features. The higher density in the control unit was primarily due to the *Calandrinia* cf. *breweri* seeds. The low seed density in the nonburial features could not be attributed to sample sizes; therefore, it had to be related to lower plant use or poor preservation due to the age of the deposits (Intermediate period), or perhaps it occurred because plant use did not focus on seeds but rather on green parts of the plant (stem, leaves, and roots) that do not preserve well in the archaeological record. Alternatively, given that charcoal was not recovered from the nonburial features, either there was little exposure to fire in these features (therefore low seed density) or the features were cleaned out during use and prior to abandonment. Because of the low seed densities, no functional interpretations can be offered for the nonburial features. The general low densities at the site could be a function of lower intensities of plant use, particularly seed-bearing parts of the plants, and/or the age of the deposits (Intermediate period).

LAN-54

Carbonized seeds were recovered from the prehistoric occupation component at LAN-54 in low densities. In total, 32 samples were analyzed for macrobotanical remains, including 11 samples from CU 11, 4 samples from two burial features, and 17 samples from eight nonburial features. The 32 samples yielded 106 carbonized seeds (0.14 seeds per liter) and very little charcoal (Table 227). In addition, a large number of the carbonized seeds recovered from the site were indeterminate fragments mostly measuring 0.5–1 mm (n = 42, or 40 percent). No disturbance indicators were observed in the samples. The low charcoal densities suggest that exposure of wood to fire was rare at LAN-54. This indicates that activities involving fire and wood were limited or that such activity areas were cleaned out, leaving minimal residue in the sampled features. Feature 3 (burial) yielded the highest density of carbonized seeds, and Feature 6 (burial) and the control unit had lower but similar densities. The eight nonburial features all had much lower and similar densities. Alternatively, organic preservation may have been poor given the age of the deposits.

Site Taxonomy

Macrobotanical remains recovered from LAN-54 were represented by 15 taxa (Table 228). There was no clear dominance of any particular taxon or family, but 2 taxa occurred in relatively higher frequencies: *Schoenoplectus* cf. *californicus* (12.3 percent) and *Phalaris* sp. (9.4 percent). Grasses accounted for less than a quarter of the collection (21.7 percent), and legumes occurred in very low frequencies (3.8 percent). Of the 15 taxa, only 1 taxon (*Galium* sp. [bedstraw]) was an introduced plant, and only a single seed was recovered. Overall, 99 percent of the collection from LAN-54 included native plants, and the macrobotanical collection was highly generalized.

Table 227. Summary of Macrobotanical Remains Recovered from LAN-54, PVAHP

Context	Sediment (liters)	Carbonized Seeds	
		n	n/liter
Control unit			
CU 11	105.00	38	0.40
Burial features			
Feature 3	20.00	22	1.10
Feature 6	57.00	21	0.40
Nonburial features			
Feature 1	17.00	1	0.10
Feature 7	164.00	9	0.10
Feature 12	41.50	2	0.05
Feature 29	10.25	1	0.10
Feature 23	27.66	3	0.10
Feature 24	240.00	7	0.03
Feature 16	15.00	1	0.10
Feature 36	45.00	1	0.02
Total	742.41	106	0.10

Note: Charcoal was recovered from Feature 16 (0.08 g).

Table 228. Plant Taxa Represented at LAN-54

Genus/Species, by Family	Total Seeds	Percent of Total Seeds	Density (n/liter)	Part Used	Uses
Seed embryo	3	3.0	0.004		
Indeterminate fragments	42	40.0	0.100		
Alismataceae					
cf. *Sagittaria* sp.	2	2.0	0.003	seeds	food, medicine
Asteraceae					
Indeterminate fragments	5	5.0	0.010		
Layia cf. *platyglossa*	2	2.0	0.003	seeds	food
Brassicaceae					
Lepidium sp.	1	1.0	0.001	leaves, seeds	food, medicine
Chenopodiaceae					
Chenopodium sp.	5	5.0	0.010	seeds, leaves	food, medicine
Cyperaceae					
Schoenoplectus [*Scirpus*] cf. *californicus*	13	12.3	0.020	seeds, leaves, shoots, roots	food, shelter
Fabaceae					
Indeterminate fragments	2	2.0	0.003		
cf. *Astragalus* type	1	1.0	0.001	leaves, seeds	varies and depends on species
cf. *Trifolium* sp.	1	1.0	0.001	leaves, seeds	food, medicine
Onagraceae					
Clarkia cf. *purpurea*	2	2.0	0.003	bulbs, seeds	food
Poaceae fragments					
Indeterminate fragments	4	4.0	0.010		
Deschampsia cf. *danthonioides*	5	5.0	0.010	seeds	food
Hordeum pusillum	4	4.0	0.010	seeds	food
Phalaris sp.	10	9.4	0.013	seeds	food
Portulacaceae					
Calandrinia cf. *breweri*	3	3.0	0.004	seeds	food
Rubiaceae					
Galium sp.	1	1.0	0.001	green parts	medicinal
Total	106	100.0	0.100		
Nut fragments					
Marah sp.	4 (<0.01g)		—	seeds, roots	medicine, fish poison, soap, hallucinogenic
Juglans sp.	3 (0.06g)		—	nuts	food

Wetland plants accounted for one-third of the collection (35.8 percent), and the remainder were from mixed habitats, including coastal plains and uplands. Given the proximity of the site to wetlands, a higher proportion of wetland taxa was expected. It is likely that nonseed parts of the wetland taxa were utilized, such as the green shoots and roots. Note, though, that *Schoenoplectus* cf. *californicus* (a wetland plant) accounted for the highest percentage of identified seeds (not including the indeterminate seed fragments). Different parts of *Schoenoplectus* cf. *californicus* were used by aboriginal populations. Young shoots were eaten raw or cooked, and pollen was used in flour, bread, or gruel. Seeds were beaten off into baskets, ground into meal, and used as flour. The large rhizomes were eaten raw or cooked; sometimes they were dried in the sun and then pounded into a kind of flour. The rhizomes were also used to make black dye for baskets. Stalks were used for thatching and insulating for structures, bedding, clothing, etc.

The high fragmentation in the carbonized-seed collection, which resulted in a high proportion of indeterminate seed fragments (n = 42, or 40 percent), was more likely due to the age of the deposits than to disturbance, because no disturbance indicators were observed in the light fractions.

CU 11

Sediment from 11 different levels of CU 11 was floated for the paleoethnobotanical study and yielded 38 carbonized seeds and a seed density of 0.4 seeds per liter (Table 229). The low seed density and the lack of charcoal imply low exposure of plants to fire. The macrobotanical signature of CU 11 was used as a control for the general midden at LAN-54. CU 11 had both early Intermediate and late Millingstone period deposits. Seeds were recovered exclusively from the early Intermediate period deposits (Levels 2–9). In particular, the highest seed densities were noted in Levels 3, 4, 6, and 7.

The 38 seeds recovered from the early Intermediate period deposits were represented by nine taxa and an indeterminate category in CU 11 (Table 230). In addition, meager remains of two nut plants—*Marah* sp. (manroot) and *Juglans* sp.—were also recovered. With the exception of the indeterminate seed fragments, grass seeds occurred in higher relative frequencies (26.3 percent) than any other plant seeds in CU 11. Given the low seed densities for the unit (and the site), these variations between the levels within the unit are not statistically meaningful. The column samples revealed that exposure of plants to fire at LAN-54 was low and that seed plants were not utilized extensively by the occupants. Alternatively, organic preservation may have been poor given the age of the deposits.

Burial Features

Two burial features (Features 3 and 6) were sampled for macrobotanical remains. At the request of the MLD, sediment from burials was not floated; instead, it was treated like a light fraction and sieved and processed through the geological sieves. In total, 43 carbonized seeds were recovered from the two burials, which had distinct seed densities (1.1 seeds per liter in Feature 3 and 0.4 seeds per liter in Feature 6) (Table 231). No charcoal was recovered from the samples.

The 43 seeds were represented by six taxa and an indeterminate category; the range of taxa recovered was largely similar to that represented in CU 11. It was not possible to determine the original source of the seeds recovered from the two burials because of their low frequency and the age of the carbonized-seed collection. For example, it is very likely that the seeds from the burial were originally from the midden deposits and not the burials themselves, because there was no evidence of burning on top of or adjacent to the burials that would have helped to preserve any seeds intentionally included with the burials. However, *Schoenoplectus* cf. *californicus* was recovered in higher relative frequencies (23.3 percent) in both burials, and it is possible that this seed-bearing plant was intentionally included in the burials. Note that *Schoenoplectus* cf. *californicus* was not recovered from CU 11. Placement of plant materials on top of burials or scattering of seeds during burial was a common practice among many Native Americans during the ethnohistoric period (Bean and Blackburn 1976; Kew 1990; LaPena 1978); however, it is not possible to determine whether such practices could have occurred several thousand years ago.

Nonburial Features

Macrobotanical remains from eight nonburial features were analyzed, including four artifact concentrations, three rock clusters, and one pit (see Tables 230 and 231). Only one feature (Feature 16, an artifact concentration) yielded a small quantity of charcoal. Otherwise, no charcoal was recovered from any of the features, which is particularly surprising for the rock clusters if they were, indeed, hearth cleanouts. However, organic preservation may have been poor given the age of the deposits.

Table 229. Macrobotanical Remains Recovered from CU 11, LAN-54

Level	Cultural Stratum	Sediment (liters)	Charcoal		Carbonized Seeds	
			g	g/liter	n	n/liter
2	early Intermediate	9	—	—	2	0.2
3		9	—	—	7	1.0
4		8	—	—	6	1.0
5		11	—	—	2	0.2
6		11	—	—	3	1.0
7		12	—	—	14	1.1
8		9	—	—	2	0.2
9		7	—	—	2	0.3
10	late Millingstone	10	—	—	—	—
11		9	—	—	—	—
12		10	—	—	—	—
Total		105	—	—	38	0.4

Table 230. Distribution of Taxa at LAN-54, by Context and Period

Genus/Species, by Family	Early Intermediate	Early Intermediate	Late Millingstone	Late Millingstone	Early Intermediate	Early Intermediate	Late Millingstone	Total
	Features 12, 16, 29, and 36	Feature 7	Features 1 and 23	Feature 24	Features 3 and 6	Levels 2–9	Levels 10–12	
	Artifact Concentrations	Rock Clusters	Rock Clusters	Pit	Burials	CU 11	CU 11	
Seed embryo	—	—	1	—	2	—	—	3
Indeterminate fragments	1	4	1	2	16	18	—	42
Alismataceae								
cf. *Sagittaria* sp.	—	—	—	—	—	2	—	2
Asteraceae								
Indeterminate fragments	—	—	—	—	5	—	—	5
Layia cf. *platyglossa*	—	—	—	—	—	2	—	2
Chenopodiaceae								
Chenopodium sp.	—	—	2	—	2	1	—	5
Cyperaceae								
Schoenoplectus [*Scirpus*] cf. *californicus*	1	1	—	1	10	—	—	13
Brassicaceae								
Lepidium sp.	1	—	—	—	—	—	—	1
Fabaceae								
Indeterminate fragments	1	—	—	—	—	1	—	2
cf. *Astragalus* type	—	—	—	—	1	—	—	1
cf. *Trifolium* sp.	—	—	—	—	—	1	—	1
Onagraceae								
Clarkia cf. *purpurea*	—	—	—	1		1	—	2
Poaceae fragments								
Indeterminate fragments	1	1	—	—	1	1	—	4
Deschampsia cf. *danthonioides*	—	—	—	3	2	—	—	5
Hordeum pusillum	—	—	—	—	2	2	—	4
Phalaris sp.	—	3		—		7	—	10

Period / Provenience headers span the columns as shown.

continued on next page

Genus/Species, by Family	Period							Total
	Early Intermediate	Early Intermediate	Late Millingstone	Late Millingstone	Early Intermediate	Early Intermediate	Late Millingstone	
	Provenience							
	Features 12, 16, 29, and 36	Feature 7	Features 1 and 23	Feature 24	Features 3 and 6	Levels 2–9	Levels 10–12	
	Artifact Concentrations	Rock Clusters		Pit	Burials	CU 11	CU 11	
Portulacaceae								
Calandrinia cf. *breweri*	—	—	—	—	2	1	—	3
Rubiaceae								
Galium sp.	—	—	—	—	—	1	—	1
Total	5	9	4	7	43	38	—	106
Amorphous						2		2
Nut fragments								
Marah sp.	—	—	—	—	—	4 (<0.01g)	—	4 (<0.01g)
Juglans sp.	—	—	—	—	—	3 (0.06g)	—	3 (0.06g)
Sediment (liters)	111.8	164	44.66	240	77	76	29	742.41
Seed density (n/liter)	0.04	0.1	0.1	0.03	0.6	0.5	0.0	0.1

Table 231. Macrobotanical Remains Recovered from Burial and Nonburial Features at LAN-54, by Feature Type

Feature and Cultural Period	Cultural Period	Level	Sediment (liters)	Charcoal		Carbonized Seeds	
				g	g/liter	n	n/liter
	Burial Features						
Feature 3	early Intermediate	1	10.0	—	—	9	1.0
	early Intermediate	2	10.0	—	—	13	1.3
Subtotal			20.0	—	—	22	1.1
Feature 6	early Intermediate	3	47.0	—	—	8	0.2
	early Intermediate	3	10.0	—	—	13	1.3
Subtotal			57.0	—	—	21	0.4
Subtotal (burial features)			77.0			43	0.6
	Nonburial Features						
Feature 12 (artifact concentration)	early Intermediate	1	41.5	—	—	2	0.05
Feature 16 (artifact concentration)	early Intermediate	1	15.0	0.08	0.005	1	0.1
Feature 29 (artifact concentration)	early Intermediate	1	10.25	—	—	1	0.1
Feature 36 (artifact concentration)	early Intermediate	2	45.0	—	—	1	0.02
Feature 7 (rock cluster)	early Intermediate	1	49.0	—	—	—	—
	early Intermediate	2	34.0	—	—	—	—
	early Intermediate	2A	20.0	—	—	6	0.3
	early Intermediate	3	50.0	—	—	2	0.04
	early Intermediate	3A	11.0	—	—	1	0.1
Subtotal			164.0	—	—	9	0.1
Feature 1 (rock cluster)	late Millingstone	1	6.0	—	—	1	0.2
	late Millingstone	2	11.0	—	—	—	—
Subtotal			17.0	—	—	1	0.1
Feature 23 (rock cluster)	late Millingstone	1	5.46	—	—	3	0.6
	late Millingstone	2	22.2	—	—	—	—
Subtotal			27.66	—	—	3	0.1
Feature 24 (pit)	late Millingstone	1	110.0	—	—	2	0.02
	late Millingstone	1	80.0	—	—	1	0.01
	late Millingstone	1	10.0	—	—	1	0.1
	late Millingstone	1	40.0	—	—	3	0.1
Subtotal			240.0			7	0.03
Subtotal (nonburial features)			560.41	0.08	0.0001	25	0.04
Total			637.41	0.08	0.0001	68	0.1

The eight features had largely similar types of seeds and similarly low seed densities, although there were differences by feature type. Rock clusters, regardless of period, had slightly higher, but not significantly different, seed densities than the artifact concentrations and the pit. Five of the nonburial features were early Intermediate period in age, and three features were dated to the late Millingstone period. The identifiable taxa recovered from the eight features were primarily the wetland plants to be expected, given the location of the site near Ballona Creek. Because of the low densities, interpretations of plant use and disposal at the nonburial features were not possible.

Plant Use at LAN-54

The LAN-54 macrobotanical sample represented plants that have documented ethnohistoric use by Native Americans as food and medicine (see Table 228). Three taxa (cf. *Sagittaria* sp. [arrowhead], *Chenopodium* sp., and *Lepidium* sp. [pepperweed]) have multiple uses as food and medicine. *Schoenoplectus* cf. *californicus* was the only plant used both as food and as shelter (dependent on the plant part). *Galium* sp. and *Marah* sp. were the only two taxa used primarily for medicine. Although seeds were a common plant part used, leaves and roots were also used, which may also be a factor to consider in explaining the low seed density at the site. Any and all of the plants represented at the site could have been used as fuel, although wood from *Juglans* sp. would have been the best choice for longer-lasting and higher-temperature fires. The low frequencies of carbonized seeds did not allow for interpretations related to correlations between taxa and specific contexts. Nonetheless, it is noted that burial features had the highest frequencies of *Schoenoplectus* cf. *californicus*, a wetland plant that can be used for shelter. One possible explanation is that this plant may have been laid in the burial as a bedding or cover. No other notable pattern of association was present in the macrobotanical data.

Overall, LAN-54 yielded low frequencies and densities of carbonized seeds. In general, the control unit and burial features yielded higher densities than the nonburial features. Because of the low densities, no functional interpretations can be offered for the nonburial features. The low densities at the site could be a function of lower intensities of plant use or use of particular seed-bearing parts of the plants, and/or of poor preservation due to the age of the deposits (late Millingstone and early Intermediate period).

Keeping in mind that the overall sample sizes were small, seed densities were significantly higher in the burial features than in the nonburial features ($t = 0.0014$; $p \leq .05$), indicating that they were from different populations. The higher density in the burials was primarily due to the *Schoenoplectus* cf. *californicus* seeds recovered from the burials. Survival of seeds in burials is rare because of the absence of the carbonization processes. These seeds could have been carbonized before they were placed in the burial, or they could have been intrusive. It is also quite likely that the seeds were from the site midden and were incorporated as part of the general fill.

No particular taxon dominated the collection, although *Schoenoplectus* cf. *californicus* occurred in higher relative frequencies. Grasses accounted for 22.4 percent of the seed collection at the site, and more than one-third of the collection were wetland taxa (36.7 percent). Grasses occurred in higher percentages in the nonburial-feature collections than in the burial-feature collections—in particular, *Phalaris* sp. However, further interpretations of this pattern were not made because of the small sample sizes. Wetland taxa (68 percent) and grasses (44 percent) were the most ubiquitous taxa. Given that ubiquity measures the number of food-processing accidents involving particular plants, wetland taxa and grasses had higher degrees of utilization by the occupants than the other plants recovered at LAN-54.

Carbonized seeds were recovered primarily from the late Millingstone period deposits (n = 11, or 0.04 seeds per liter), and early Intermediate period deposits (n = 95, or 0.2 seeds per liter) (Table 232). Diversity in taxa increased over time from the late Millingstone period to the early Intermediate period. Although noted in very low quantities, higher-ranked plant foods, such as nut foods (*Juglans* sp.), were added into the repertoire in the early Intermediate period. Despite the low seed frequency, which is typical at coastal late Millingstone and early Intermediate period sites in southern California, rudimentary plant use could be modeled for the early Intermediate period at LAN-54 and included a preference for wetland taxa, such as *Schoenoplectus* cf. *californicus* and *Phalaris* sp. This is within expectations, given the site's proximity to the Ballona wetlands, which would have been an important food resource for prehistoric populations.

LAN-62

The macrobotanical collection from LAN-62 is an exceedingly rich and unique data set for coastal southern California. In total, 162 samples were analyzed for carbonized macrobotanical remains from eight contexts that yielded 492,803 carbonized seeds (248 seeds per liter) and 22.13 g of nutshell (Table 233). The macrobotanical remains from two loci at LAN-62, Loci A and G, are discussed together.

The eight contexts included seven contexts in Locus A. These included control units (CUs 413 and 627), burials, features in the general burial area, features in the three sampled feature blocks (FBs 3, 4, and 7), features outside the general burial area, and features outside the feature blocks (sitewide). One context in Locus G was also sampled. Samples from Loci C and D were not analyzed. The charcoal density at the site was low: 0.2 g of charcoal per liter of sediment. The overall low charcoal density suggests that exposure of wood to fire was not high and that activities involving fire and wood were limited or that such activity areas were cleaned out, leaving minimal residue in the sampled features. However, charcoal densities were highly variable among the eight contexts. For example, FB 3 had the highest charcoal density (1.4 g per liter), suggesting that exposure of plants to fire was higher there than in other contexts. Of the eight contexts at the site, FB 3 also had the highest seed density: 1,987 seeds per liter of sediment. The age of the deposits is also a contributing factor in the varying seed and charcoal densities. Burial sediments had a relatively moderate seed density (74 seeds per liter), along with FB 7 (49 seeds per liter), and the remaining five contexts had lower densities (see Table 233). Intensity of plant use within LAN-62 was highly variable and dependent on the context and age (as discussed below).

Site Taxonomy

The large macrobotanical collection from LAN-62 was represented by 58 taxa (Table 234). The collection was dominated by seeds belonging to various grass taxa, which accounted for 84.3 percent (n = 343,916) of the carbonized seeds. Of the eight contexts sampled for macrobotanical remains, features from FBs 3 and 7 had an exceptionally high frequency of grass seeds (88.7 percent and 96.2 percent, respectively).

Table 232. Distribution of Taxa at LAN-54, by Period

Genus/Species, by Family	Early Intermediate			Late Millingstone			Total
	n	n/liter	%	n	n/liter	%	n
Seed embryo	2	0.004	2.1	1	0.004	9.1	3
Indeterminate fragments	39	0.1	41.1	3	0.01	27.3	42
Alismataceae							
cf. *Sagittaria* sp.	2	0.004	2.1	—	—	0.0	2
Asteraceae							
Indeterminate fragments	5	0.01	5.3	—	—	0.0	5
Layia cf. *platyglossa*	2	0.004	2.1	—	—	0.0	2
Chenopodiaceae							
Chenopodium sp.	3	0.01	3.2	2	0.01	18.2	5
Cyperaceae							
Schoenoplectus [*Scirpus*] sp.	12	0.03	12.6	1	0.004	9.1	13
Brassicaceae							
Lepidium sp.	1	0.002	1.1	—	—	0.0	1
Fabaceae							
Indeterminate fragments	2	0.004	2.1	—	—	0.0	2
cf. *Astragalus* type	1	0.002	1.1	—	—	0.0	1
cf. *Trifolium* sp.	1	0.002	1.1	—	—	0.0	1
Onagraceae							
Clarkia cf. *purpurea*	1	0.002	1.1	1	0.004	9.1	2
Poaceae fragments							
Indeterminate fragments	4	0.01	4.2	—	—	0.0	4
Deschampsia cf. *danthonioides*	2	0.004	2.1	3	0.01	27.3	5
Hordeum pusillum	4	0.01	4.2	—	—	0.0	4
Phalaris sp.	10	0.02	10.5	—	—	0.0	10
Portulacaceae							
Calandrinia cf. *breweri*	3	0.01	3.2	—	—	0.0	3
Rubiaceae							
Galium sp.	1	0.002	1.1	—	—	0.0	1
Total	95	0.2	100.0	11	0.04	100.0	106
Amorphous	2	0.004	2.1	—	—		2
Nut fragments							
Marah sp.	4 (<0.01g)			—			4 (<0.01g)
Juglans sp.	3 (0.06g)			—			3 (0.06g)

Note: Early Intermediate = 457.75 liters of sediment; late Millingstone = 284.66 liters of sediment.

Table 233. Summary of Macrobotanical Remains Recovered from LAN-62, by Context

Provenience	Sediment (liters)	Charcoal		Carbonized Seeds	
		g	g/liter	n	n/liter
	Control Units, Locus A				
CU 413	440.75	13	0.03	1,266	3
CU 627	286	2.54	0.01	2,760	10
Subtotal (control units)	726.75	15.44	0.02	4,026	6
	Burials, Locus A				
Burial soils	271.42	—	—	20,014	74
Items (no flotation)	—	—	—	89,963	—
	Burial Area, Locus A				
Artifact concentration (Feature 356)	45	—	—	119	3
Items (no flotation)	—	—	—	74	—
	FB 3, Locus A				
Artifact concentrations (Features 384, 456, 458, and 467)	140.82	212.38	1.51	331,645	2,355.1
Rock cluster (Feature 673)	26	0.01	0.0004	201	7.7
Pits (Features 454, 475, 671, and 672)	21.2	48.7	2.3	41,831	1,973.2
Subtotal (FB 3, Locus A)	188.02	261.09	1.4	373,677	1,987
	FB 4, Locus A				
Rock cluster (Feature 419)	84.64	8.16	0.10	567	7
Activity area (Feature 541)	12.5	—	—	23	2
Pit (Feature 612)	5	—	—	4	1
Subtotal (FB 4, Locus A)	102.14	8.16	0.1	594	6
	FB 7, Locus A				
Rock clusters (Features 449, 574, and 623)	32	—	—	1,571	49
	Sitewide, Locus A				
Rock clusters (Features 51, 335, 448, 527, and 659)	196.5	2	0.01	1,632	8.3
Pits (Features 620 and 621)	6	—	—	273	45.5
Subtotal (sitewide features, Locus A)	202.5	2	0.01	1,905	9
	Locus G Features				
Artifact concentrations (Features 683, 685, and 688)	31	0.11	0.004	537	17
Rock clusters (Features 684 and 689)	11.2	—	—	—	—
Activity area (Feature 687)	15	0.2	0.01	323	22
Subtotal (Locus G features)	57.2	0.31	0.01	860	15
Total	1,625.03	287	0.2	492,803	248

Table 234. Plant Taxa Represented at LAN-62, Loci A and G

Genus/Species, by Family	Burials, Locus A	Control Units, Locus A	Burial Area, Locus A	FB 3, Locus A	FB 4, Locus A	FB 7, Locus A	Sitewide, Locus A	Locus G Features	Total	Percent
Indeterminate fragments	546	760	56	8,823	218	30	121	102	10,656	2.2
Unknown seeds	—	—	—	263	—	—	—	—	263	0.05
Seed embryo	6	—	—	1,389	1	—	—	44	1,440	0.3
Aizoaceae										
Unknown	—	—	—	—	—	—	—	2	2	0.0004
Alismataceae										
cf. *Sagittaria* sp.	—	1	—	—	2	—	—	—	3	0.001
Amaranthaceae										
Amaranthus sp.	—	218	—	48	—	—	48	—	314	0.06
Anacardiaceae										
Rhus sp.	5	2	—	31	—	—	—	—	38	0.01
Asteraceae										
Unknown	6	8	—	—	2	2	3	—	21	0.0
Ambrosia sp.	76	10	2	7	6	—	15	6	122	0.02
cf. *Helianthus*	38	—	—	17	—	—	1	—	56	0.01
Hemizonia sp.	1,599	—	—	3,441	3	6	26	—	5,075	1.0
Layia cf. *platyglossa*	1,697	4	—	2,988	1	—	23	1	4,714	1.0
Boraginaceae										
Unknown	—	63	—	—	—	—	—	—	63	0.01
Amsinckia sp.	33	—	—	1	1	—	16	1	52	0.01
Brassicaceae										
Lepidium sp.	44	1	—	28	1	—	—	—	74	0.02
Caprifoliaceae										
Sambucus cf. *nigra* ssp. *canadensis*	9	2	—	11	—	—	4	1	27	0.01
Chenopodiaceae										
Atriplex sp.	6	—	45	100	30	—	174	—	355	0.1
Chenopodium sp.	451	1,465	7	957	91	4	98	208	3,281	1
Cyperaceae										
Cyperus sp.	97	286	—	135	8	1	23	13	563	0.1

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Genus/Species, by Family	Burials, Locus A	Control Units, Locus A	Burial Area, Locus A	FB 3, Locus A	FB 4, Locus A	FB 7, Locus A	Sitewide, Locus A	Locus G Features	Total	Percent
Schoenoplectus [*Scirpus*] cf. *californicus*	66	87	—	562	7	—	138	30	890	0.2
Ericaceae										
Arctostaphylos sp.	6	—	—	12	—	—	—	—	18	0.004
Fabaceae										
Indeterminate fragments	46	137	3	1,227	7	—	22	85	1,527	0.31
cf. *Astragalus* type	—	—	—	27	—	—	—	—	27	0.01
Cicer cf. *arietinum*	—	—	—	1	—	—	—	—	1	0.0002
cf. *Lathyrus* type	13	9	—	8	—	—	—	—	30	0.006
Lupinus sp.	2	—	2	13	5	—	—	—	22	0.004
Melilotus sp.	6	23	—	—	—	—	4	—	33	0.01
Pisum cf. *sativum*	152	49	45	539	7	—	15	8	815	0.2
Trifolium sp.	1,097	—	2	14	—	—	142	—	1,255	0.3
Vicia sp.	43	—	—	1,922	4	—	—	5	1,974	0.4
Hydrophyllaceae										
Phacelia sp.	83	—	—	—	—	—	—	—	83	0.02
Juncaceae										
Juncus sp.	80	—	—	490	22	—	—	—	592	0.1
Lamiaceae										
Salvia cf. *apiana*	992	1	—	1,394	—	—	79	7	2,473	0.5
Malvaceae										
Unknown	—	7	—	8	—	—	—	—	15	0.003
Onagraceae										
Clarkia cf. *purpurea*	824	7	13	6,107	2	3	29	3	6,988	1.4
Papaveraceae										
Papaver sp.	1	1	—	—	—	—	—	—	2	0.0004
Poaceae										
Indeterminate fragments	124	311	3	9,165	29	23	31	12	9,698	2
Agropyron sp.	13	—	—	128	—	—	—	—	141	0.03
Agrostis sp.	77	—	—	150	—	46	29	—	302	0.06
Avena cf. *sativa*	—	—	—	21	—	—	—	—	21	0.004
Bromus cf. *carinatus*	58	—	2	455	—	—	52	—	567	0.1

Genus/Species, by Family	Burials, Locus A	Control Units, Locus A	Burial Area, Locus A	FB 3, Locus A	FB 4, Locus A	FB 7, Locus A	Sitewide, Locus A	Locus G Features	Total	Percent
cf. *Dactyloctenium* sp.	1	—	—	—	—	—	—	—	1	0.0002
Deschampsia cf. *danthonioides*	8	5	—	7,637	31	424	2	6	8,113	2
Hordeum pusillum	6,308	19	7	44,837	30	25	408	19	51,653	10.5
Hordeum vulgare	—	—	—	15	—	—	—	—	15	0.0030
Leptochloa sp.	151	—	—	923	—	—	—	6	1,080	0.22
Lolium cf. *temulentum*	—	31	—	51	—	—	—	—	82	0.02
Phalaris sp.	2,484	148	4	267,605	73	994	275	13	271,596	55.1
Stipa sp.	91	9	—	453	—	—	—	13	566	0.11
Triticum cf. *aestivum*	53	—	—	28	—	—	—	—	81	0.02
Plantaginaceae										
Plantago cf. *erecta*	4	—	—	—	—	—	—	—	4	0.001
Polygonaceae										
Eriogonum sp.	—	—	—	21	—	—	—	—	21	0.004
Polygonum sp.	105	44	—	25	7	—	35	27	243	0.05
Rumex sp.	2	30	—	15	—	—	2	37	86	0.02
Portulacaceae										
Calandrinia cf. *breweri*	92,321	—	2	3,998	4	13	72	202	96,612	19.6
Ranunculaceae										
cf. *Ranunculus* type	—	—	—	—	—	—	—	1	1	0.0002
Rosaceae										
Heteromeles sp.	2	—	—	7,299	2	—	—	—	7303	1.5
Rubiaceae										
Galium sp.	—	—	—	24	—	—	—	—	24	0.005
Solanaceae										
Solanum sp.	1	1	—	—	—	—	—	—	2	0.0004
Datura sp.	10	—	—	—	—	—	—	—	10	0.002
Ulmaceae										
Celtis sp.	—	1	—	—	—	—	—	—	1	0.0002
Violaceae										
Viola sp.	4	286	—	266	—	—	18	8	582	0.12

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Genus/Species, by Family	Burials, Locus A	Control Units, Locus A	Burial Area, Locus A	FB 3, Locus A	FB 4, Locus A	FB 7, Locus A	Sitewide, Locus A	Locus G Features	Total	Percent
Total	109,841	4,026	193	373,679	594	1,571	1,905	860	492,669	100
Grass rachises	70	—	—	309	—	—	—	—	379	
Asphaltum	—	291	—	>784	—	—	—	—	>1000	
Asphaltum with seeds	—	—	—	>70	—	—	—	—	>70	
Carbonized basketry	—	—	—	>1010	—	—	—	—	>1010	
Cucurbitaceae										
Marah sp.	—	0.01g	0.01g	1.3g	—	—	—	0.01g	1.33g	
Fagaceae										
Quercus sp.	5.4g	—	—	4.1g	0.05g	—	0.04g	0.01g	9.6g	
Quercus sp. attachment	0.06g	—	—	5.2g	—	—	—	—	5.26g	
Juglandaceae										
Juglans sp.	3.4g	—	—	1.1g	0.01g	—	—	—	4.51g	
Rosaceae										
Prunus sp.	2.8g	—	—	1.3g	0.07g	—	—	—	4.17g	
Indeterminate nut fragments	0.05g	0.07g	0.01g	0.23 g	0.03g	—	0.01g	0.01g	0.41g	
Nodes	—	0.02g	—	—	—	—	—	—	0.02g	
Parenchymatous soft tissue	—	0.14 g	0.02g	17.93g	2.1g		0.07g	0.01g	20.27g	

The other six contexts had moderate frequencies ranging from 42 to 27 percent (features in sitewide contexts, burials, and features in FB 4) and low frequencies ranging from 13 to 8 percent (control units, features in the general burial area, and Locus G features). This varied distribution suggests that grass-seed use was both spatially and temporally distinct. Grasses were represented by 13 taxa, and 2 particular grasses, *H. pusillum* and *Phalaris* sp., accounted for 65.6 percent of the LAN-62 collection (Figure 257). Other noteworthy grasses recovered included *Hordeum vulgare* (n = 15, or 0.003 percent) and *Triticum* cf. *aestivum (*n = 81, or 0.02 percent).

Of note is that along with grass seeds, 379 grass-rachis remains were recovered from two contexts: burials and features in FB 3. Rachises are the seed-bearing parts of grass plants. Their recovery from archaeological contexts has been used as an indication of plant processing, such as threshing and winnowing (Hillman 1981; Jones 1983; Reddy 2003). The important implications of the recovery of grass-rachis remains from LAN-62 will be discussed later in this chapter.

Legumes, including both native and introduced plants, occurred in very low frequencies (n = 5,684, or 1.2 percent) at LAN-62 (see Table 234). The low frequency is intriguing, given the geographical location and econiche where one would expect a greater availability of and access to legumes. In addition, legumes were an important part of the aboriginal diet during the ethnohistoric period (Ball 1962; Ebeling 1986; Strike 1994). Therefore, their absence from the Protohistoric and Mission period deposits at LAN-62 is surprising. The only explanation for their low frequency is that most of the legume-plant foods were consumed as green plants well before seeding. Therefore, the likelihood of legume seeds being incorporated into the habitation deposits was minimal.

The carbonized-seed collection from LAN-62 had a high percentage of wetland-plant taxa (n = 338,697, or 68.7 percent), which is not surprising, given the proximity to wetlands. The remaining 31.3 percent of the plants were from mixed habitats, including coastal plains and uplands.

A small fraction of the LAN-62 collection was made up of seeds of Old World domesticated-crop plants, including *Cicer* sp., *Pisum* cf. *sativum*, *Hordeum vulgare*, and *Triticum* cf. *aestivum*. They accounted for 0.2 percent of the collection and were recovered in varying frequencies from all of the eight contexts, with the exceptions of the features from FB 3. These seeds were most likely obtained by the aboriginal populations from Mission San Gabriel, the ranchos, or the Pueblo of Los Angeles as payment for labor (Hackel 2005:311).

Of the 63 taxa at LAN-62, 10 were introduced (nonnative to California): *Cicer* sp., *Melilotus* sp., *Pisum* cf. *sativum*, *Brassica* sp., *Agropyron* sp. (wheatgrass)*, Avena* cf. *sativa, Dactyloctenium* sp.*, Hordeum vulgare, Triticum aestivum*, and *Galium* sp. Seeds of introduced taxa accounted for 0.23 percent (n = 1,134) of the total collection from the site. *Pisum* cf. *sativum* occurred in the highest frequencies (n = 815, or 72 percent of the introduced taxa). Of the eight contexts sampled at the site, features in the general burial area in Locus A yielded the highest frequencies of introduced taxa (n = 45, or 5 percent). Less than 1 percent of the seeds recovered from burial sediments were introduced taxa.

A large number of the carbonized seeds recovered from the site were indeterminate fragments mostly measuring 0.5–1 mm (n = 10,656, or 2.2 percent). Disturbance indicators, including rodent droppings, insect parts, land snail, uncarbonized seeds, and fresh rootlets, were observed in the samples and varied greatly among them.

Apart from the seeds, the macrobotanical collection also included nutshell, nut meats, asphaltum, asphaltum with seeds and seed impressions, basketry fragments, parenchyma tissue, and stem nodes. A range of nutshell and nut meats were recovered, including *Marah* sp., *Quercus* sp. (nutshell, nut meat, and attachments), *Juglans* sp., *Prunus* sp., and unidentifiable nutshell fragments. The *Quercus* sp. was probably *Quercus agrifolia* (coast live oak) and/or *Quercus wislizeni* (interior live oak) (Figure 258).

Soft-plant-tissue remains were recovered in varying quantities from all contexts except burials and features in FB 7. Features in FB 3 yielded the highest quantities of soft tissue. These soft-tissue fragments were most likely parenchymatous; such tissues are difficult to identify to taxa without a scanning electronic microscope (SEM). Soft tissues include vegetative storage organs and nonstorage parts, such as nodes, culm bases, inflorescences, etc. The PVAHP soft tissue included vegetative storage organs only because the nonstorage parts were categorized separately and root and stem storage parts. In general, parenchymatous tissue occurred in low frequencies and was outnumbered by seeds. The lower frequency does not necessarily mean lower importance in the prehistoric diet, because the recovery and identification of these macrobotanical data are particularly challenging, as has been discussed by Hather (1994).

Along with carbonized seeds and soft tissue, the macrobotanical collection also included small fragments of asphaltum, asphaltum with impressions of seeds, and asphaltum with seeds firmly imbedded in the melted matrix. These were recovered exclusively from CU 413 and the features in FB 3. In addition, small fragments of carbonized-basketry remains were recovered from the FB 3 samples.

Ubiquity (percentage of samples in which a taxon is present) measurements indicated that specific plants were more ubiquitous (Appendix L.14.5). Ubiquity (presence) is used to evaluate the level of use of a particular taxon. Therefore, a higher ubiquity suggests higher use. Grasses occurred in 55 percent of the samples. In particular, two grasses, *Phalaris* sp. and *H. pusillum,* had the highest ubiquity values (51 and 43 percent, respectively). Acorns of *Quercus* sp. were recovered from 22 percent of the samples and had the highest ubiquity value of all nutshell and nut meats.

Figure 257. Seeds of (*a*) *Phalaris* sp. and (*b*) *Hordeum pusillum*.

Figure 258. Nuts from LAN-62 A: (*a*) *Quercus* sp. and (*b*) *Juglans* sp.

Control Units, Locus A

Samples from two control units were analyzed for macrobotanical remains. CU 413 was located in the southern part of the site. CU 627 was also located in the southern portion of the site but to the north of the main concentration of features. In total, 726.75 liters of sediment were processed from these two control units and yielded 15.44 g of charcoal (0.02 g per liter) and 4,026 carbonized seeds (6 seeds per liter). CU 413 had a lower seed density than did CU 627, although the charcoal densities were similarly low.

CU 413

In total, 440.75 liters of sediment from six levels of CU 413 yielded 1,266 carbonized seeds (3 seeds per liter) and 13 g of charcoal (0.03 g per liter) (see Table 233). Deposits in CU 413 were dated to the Late to Mission period, and seed densities decreased with depth from 9.9 seeds per liter in the 60–70-cm level to 1.4 seeds per liter in the 110–120-cm level. The collection was represented by 24 taxa and was generalized, with no single taxon dominating (Table 235). All the taxa recovered from the control unit were from habitats within the daily catchment of the site, although the majority of the collection consisted of wetland taxa (58.3 percent). The carbonized seeds of berries (*Rhus* sp., *Sambucus* sp., and *Celtis* sp.) probably represented incidental or opportunistic foods collected during foraging outings.

The carbonized-seed collection also included three taxa that were introduced plants. *Pisum* cf. *sativum* (n = 6), *Melilotus* sp. (n = 23), and *Papaver* sp. (n = 1) were recovered from the top three levels of the unit. The *Melilotus* sp. and *Papaver* sp. seeds were recovered from the smaller sieves (1–2 mm and 0.5–1 mm). Asphaltum fragments were also recovered from the control unit (n = 291), along with parenchymatous soft tissue (likely to be parts of root or stem tubers or corms).

CU 627

The macrobotanical collection from CU 627 was composed of 2,760 carbonized seeds (10 seeds per liter) and 2.54 g of charcoal (0.01 g per liter) recovered from 286 liters of

Table 235. Macrobotanical Remains Recovered from CU 413, LAN-62, Locus A (All Late Period)

Genus/Species, by Family	Total	Percent
Indeterminate fragments	198	15.6
Alismataceae		
cf. *Sagittaria* sp.	1	0.1
Amaranthaceae		
Amaranthus sp.	36	2.8
Anacardiaceae		
Rhus sp.	1	0.1
Asteraceae		
Ambrosia sp.	10	0.8
Boraginaceae		
Unknown	8	0.6
Brassicaceae		
Lepidium sp.	1	0.1
Caprifoliaceae		
Sambucus cf. *nigra* ssp. *canadensis*	2	0.2
Chenopodiaceae		
Chenopodium sp.	446	35.2
Cyperaceae		
Cyperus sp.	137	10.8
Schoenoplectus [*Scirpus*] cf. *californicus*	53	4.2
Fabaceae		
Indeterminate fragments	93	7.3
Large unknown	16	1.3
Lupinus sp.	9	0.7
Melilotus sp.	23	1.8
Pisum cf. sativum	6	0.5
Lamiaceae		
Salvia cf. *apiana*	1	0.1
Malvaceae		
Unknown	2	0.2
Onagraceae		
Clarkia cf. *purpurea*	7	0.6
Papaveraceae		
cf. *Papaver* sp.	1	0.1
Poaceae		
Indeterminate fragments	97	7.7
Hordeum pusillum	19	1.5
Lolium cf. *temulentum*	18	1.4
Phalaris sp.	50	3.9
Stipa sp.	9	0.7
Polygonaceae		
Rumex sp.	20	1.6
Solanaceae		
Solanum sp.	1	0.1
Ulmaceae		
Celtis sp.	1	0.1
Total	1,266	100.0
Asphaltum	291	
Parenchymatous soft tissue	89 (0.07g)	
Cucurbitaceae		
Marah sp.	1 (0.01g)	
Indeterminate nut fragment	2 (0.01g)	

sediment. The 2,760 carbonized seeds were represented by 13 taxa, of which grasses (n = 330) accounted for 12 percent and legumes (n = 71) accounted for less than 1 percent (Table 236). Taxa from wetland habitats accounted for 47.4 percent (n = 1,316). The collection was generalized, with no single taxon dominating. All the taxa recovered from this control unit were from habitats within the daily catchment of the site. Of the 13 taxa, *Chenopodium* sp. was recovered in the highest frequencies (n = 1,019, or 37 percent). Three temporal components were identified in the deposits from CU 627. The lowest levels of the unit (Levels 71–74) were Millingstone period, Levels 63–66 were Intermediate period, and Levels 56–62 dated to the Mission period.

The Millingstone period component in CU 627 included 17 carbonized seeds (0.06 percent of the collection). Legumes were absent, grasses occurred in very low frequencies (n = 3, or 17.6 percent), and taxa from wetlands accounted for 47 percent of the collection (n = 7). Seed density in the Millingstone period deposits was very low (0.2 seeds per liter), suggesting low plant use or poor preservation.

The Intermediate period component in the unit yielded 32 carbonized seeds (1.1 percent of the collection from the unit). Legumes were absent, similar to the Millingstone period component, although grass use increased during the Intermediate period (to 19 percent), and wetland taxa accounted for 31.3 percent, which was lower than in the Millingstone period component. Seed density in the Intermediate period deposits was very low (0.5 seeds per liter), suggesting low use of seed-bearing plants. It is also likely that these older deposits had poor preservation of organic remains.

The Mission period deposits in CU 627 yielded 2,711 carbonized seeds (98.2 percent of the collection), parenchymatous soft tissue, nodes, and indeterminate nut fragments. The carbonized-seed collection included grasses (n = 321, or 12 percent) and legumes (n = 71, or 2.6 percent) in relatively low frequencies. Wetland taxa (n = 1,298, or 48 percent) accounted for almost half of the collection, which is surprising, because the wetlands shrank considerably during that period. One taxon, *Chenopodium* sp., occurred in higher frequencies than the others (n = 1,014, or 37.4 percent).

Summary of Control Units

Temporal associations in the macrobotanical collection from the two control units illustrated the following patterns (Table 237):

Table 236. Macrobotanical Remains Recovered from CU 627, LAN-62, Locus A

Genus/Species, by Family	Mission		Intermediate		Millingstone		Total	
	n	%	n	%	n	%	n	%
Indeterminate fragments	542	20.0	12	37.5	8	47	562	20.4
Amaranthaceae								
Amaranthus sp.	178	6.6	4	12.5	—		182	6.6
Anacardiaceae								
Rhus sp.	1	0.04	—		—		1	0.0
Asteraceae								
Unknown	8	0.3	—		—		8	0.3
Layia cf. *platyglossa*	3	0.1	1	3.1	—		4	0.1
Boraginaceae								
Unknown	55	2.0	—		—		55	2.0
Chenopodiaceae								
Chenopodium sp.	1,014	37.4	2	6.3	3	17.6	1,019	37
Cyperaceae								
Cyperus sp.	147	5.4	2	6.3	—		149	5.4
Schoenoplectus [*Scirpus*] cf. *californicus*	28	1.0	4	12.5	2	11.8	34	1.2
Fabaceae								
Indeterminate fragments	44	1.6	—		—		44	1.6
Pisum cf. *sativum*	27	1.0	—		—		27	1.0
Malvaceae								
Unknown	5	0.2	—		—		5	0.2
Poaceae								
Indeterminate fragments	213	7.9	1	3.1	—		214	7.8
Deschampsia cf. *danthonioides*	5	0.2	—		—		5	0.2
Lolium cf. *temulentum*	10	0.4	3	9.4	—		13	0.5
Phalaris sp.	93	3.4	2	6.3	3	17.6	98	3.6
Polygonaceae								
Polygonum sp.	44	1.6	—		—		44	1.6
Rumex sp.	10	0.4	—		—		10	0.4
Violaceae								
Viola sp.	284	10.5	1	3.1	1	6	286	10.4
Total seeds	2,711	100.0	32	100.0	17	100.0	2,760	100.0
Parenchymatous soft tissue	5 (0.05g)		—		—		5 (0.05g)	
Nodes	6 (0.02g)		—		—		6 (0.02g)	
Indeterminate nut fragment	31 (0.06g)		—		—		31 (0.06g)	
Sediment floated (liters)	146		60		80		286	
Seed density (n/liter)	19		0.5		0.2		10	

Table 237. Summary of Macrobotanical Remains Recovered from Control Units at LAN-62, Locus A

Genus/Species, by Family	Mission		Late		Intermediate		Millingstone		Total	
	n	%	n	%	n	%	n	%	n	%
Indeterminate fragments	542	13.5	198	4.9	12	0.3	8	0.2	760	18.9
Alismataceae										
cf. *Sagittaria* sp.	—		1		—		—		1	0.0
Amaranthaceae										
Amaranthus sp.	178	4.4	36	0.9	4	0.1	—		218	5.4
Anacardiaceae										
Rhus sp.	1		1		—		—		2	
Asteraceae										
Unknown	8	0.2	—		—		—		8	0.2
Ambrosia sp.	—		10	0.2	—		—		10	0.2
Layia cf. *platyglossa*	3	0.1	—		1	0.02	—		4	0.1
Boraginaceae										
Unknown	55	1.4	8	0.2	—		—		63	1.6
Brassicaceae										
Lepidium sp.	—		1		—		—		1	
Caprifoliaceae										
Sambucus cf. *nigra* ssp. *canadensis*	—		2		—		—		2	
Chenopodiaceae										
Chenopodium sp.	1,014	25.2	446	11.1	2	0.05	3	0.1	1,465	36.4
Cyperaceae										
Cyperus sp.	147	3.7	137	3.4	2	0.05	—		286	7.1
Schoenoplectus [*Scirpus*] cf. *californicus*	28	0.7	53	1.3	4	0.1	2		87	2.2
Fabaceae										
Indeterminate fragments	44	1.1	93	2.3	—		—		137	3.4
Lupinus sp.	—		9	0.2	—		—		9	0.2
Melilotus sp.	—		23	0.6	—		—		23	0.6
Pisum cf. *sativum*	27	0.7	22	0.5	—		—		49	1.2
Lamiaceae										
Salvia cf. *apiana*	—		1		—		—		1	0.0
Malvaceae										
Unknown	5	0.1	2		—		—		7	0.2

Genus/Species, by Family	Mission		Late		Intermediate		Millingstone		Total	
	n	%	n	%	n	%	n	%	n	%
Onagraceae										
Clarkia cf. *purpurea*	—		7	0.2	—		—		7	0.2
Papaveraceae										
cf. *Papaver* sp.	—		1		—		—		1	
Poaceae										
Indeterminate fragments	213	5.3	97	2.4	1	0.02	—		311	7.7
Deschampsia cf. *danthonioides*	5	0.1	—		—		—		5	0.1
Hordeum pusillum	—		19	0.5	—		—		19	0.5
Lolium cf. *temulentum*	10	0.2	18	0.4	3	0.1	—		31	0.8
Phalaris sp.	93	2.3	50	1.2	2	0.05	3	0.1	148	3.7
Stipa sp.	—		9	0.2	—		—		9	0.2
Polygonaceae										
Polygonum sp.	44	1.1	—		—		—		44	1.1
Rumex sp.	10	0.2	20	0.5	—		—		30	0.7
Solanaceae										
Solanum sp.	—		1		—		—		1	
Ulmaceae										
Celtis sp.	—		1		—		—		1	
Violaceae										
Viola sp.	284	7.1	—		1	0.02	1		286	7.1
Total	2,711	67.3	1,266	31.4	32	0.8	17	0.4	4,026	100.0
Parenchymatous soft tissue	5 (0.05g)		89 (0.07g)		—		—		94 (0.12g)	
Nodes	6 (0.02g)		—		—		—		6 (0.02g)	
Asphaltum	—		291		—		—		291	
Cucurbitaceae										
Marah sp.	—		1 (0.01g)		—		—		1 (0.01g)	
Indeterminate nut fragment	31 (0.06g)		2 (0.01g)		—		—		33 (0.07g)	
Sediment floated (liters)	146		440.75		60		80		726.75	
Seed density (n/liter)	19		3		1		0.2		6	
Charcoal (g)	2.54		12.9		0.01		0.01		15.46	
Charcoal density (g/liter)	0.02		0.03		0.0002		0.0001		0.02	

- First, seed density increased over time, particularly so in the Mission period, indicating a significantly higher plant-use index (and possibly better preservation).
- Second, seeds of *Chenopodium* sp. occurred in higher frequencies (n = 1,465, or 36.4 percent) across time.
- Grasses occurred in lower frequencies (13 percent) than did *Chenopodium* sp. but did increase over time and were significantly higher in the Mission period. Of particular note is that of the two grasses (*Phalaris* sp. and *H. pusillum*) that typically occurred in higher frequencies at LAN-62, *Phalaris* sp. occurred in higher frequencies in the control units (3.7 percent).
- Legumes were recovered only from the Late and Mission period deposits and occurred in slightly higher frequencies in the Late period deposits.
- Parenchyma tissue and nutshell fragments were recovered exclusively from the Late and Mission period deposits.
- The collection from the control units was very different from those recovered from features (as will be evident below). The collection-unit macrobotanical collection was generalized, compared to the specialized collections from the features. This is a very important pattern, because it reveals that there was a direct association between context and activities involving plants. The collection from the control units was reflective of an amalgam of activities (associated with the general habitation midden).

Burials, Locus A

Carbonized macrobotanical remains were recovered from 38 burials and 9 control units with isolated human remains (Table 238). In total, 109,977 carbonized seeds were recovered from burial sediments and also as individual items during excavations (Appendix L.14.6). Flotation of burial sediments could not be implemented (as requested by the MLD); therefore, laboratory dry sieving was conducted using the four geological sieves used in the light-fraction analysis. In addition, sediment was not collected systematically from all burials for macrobotanical analysis (as per directions of the MLD); therefore, only a select few are included in this discussion. Interpretations are not rigorous, because of this selective sampling.

The nine units included contexts with isolated human remains, and it is very likely that the carbonized seeds in these contexts were not associated with the human remains but were, instead, part of the midden. The association of the macrobotanical and human remains was not considered strong in these nine units. Of these nine units, sediment was analyzed from two units (CUs 375 and 675), and individual items were analyzed from the remaining seven units (Table 239). The items included 29 carbonized seeds and 2.01 g of nutshell. The 29 carbonized seeds recovered from the seven units as items included *Arctostaphylos* sp. (n = 1), *Pisum* cf. *sativum* (n = 16), indeterminate grass-seed fragments (n = 2), *H. pusillum* (n = 3), *Phalaris* sp. (n = 4), *Triticum* cf. *aestivum* (n = 2), and *Heteromeles* sp. (n = 1). The nutshell included a whole acorn (2 g) recovered from CU 144 and two nutshell fragments (0.01 g) from CU 161. The acorn was probably that of *Quercus agrifolia* or *Quercus wislizeni*. Today *Quercus agrifolia* stands are located within 5 km of the Ballona to the north, and *Quercus wislizeni* are farther away to the east, but it is unclear whether these distributions were similar in the past.

Sediment from two units (CUs 375 and 675) was processed to recover macrobotanical remains through dry sieving and yielded 1,461 carbonized seeds and 4.34 g of nutshell. CU 375 was located within the main burial ground, and CU 675 was located among the burials in the northeastern part of the burial ground. CU 375 had a higher seed density (19 seeds per liter) than CU 675 (6 seeds per liter) (see Table 238). Grasses (77.2 percent) dominated the collection, and legumes (9.5 percent) occurred in lower frequencies. Among grasses, *H. pusillum* and *Phalaris* sp. accounted for the majority of the collection (71.8 percent). *Pisum* cf. *sativum* (3.7 percent) and *Triticum* cf. *aestivum* (n = 35, or 2.4 percent) were recovered in low frequencies from CU 375. The nutshell from these two units included the recovery of a whole *Prunus* sp. (3 g), acorn nutshell (0.02 g) from CU 375, and 1.3 g of acorn nutshell along with two acorn-nut-attachment fragments (0.02 g). Because of the lack of association between the isolated human remains and the macrobotanical remains in the nine units, they will not be included in the following discussions regarding carbonized remains from burials and associated distributions.

Macrobotanical remains were recovered from 38 burials and included 109,977 seeds (including itemized seeds), 70 grass rachises, and 6.1 g of nutshell (see Table 239; see Appendix L.14.6). The 38 burials have been categorized into five groups based on seed frequency: Group 1 (very high; 7 burials), Group 2 (high; 6 burials), Group 3 (moderate; 7 burials), Group 4 (low; 12 burials), and Group 5 (no seeds, only nuts; 6 burials) (Figure 259; see Table 239). In general, the contextual association of these carbonized seeds with the human remains could not be strongly affirmed, because there was considerable mixing of midden and burial fill during the original interments. For example, later burial pits were dug into the previous ones, and midden was moved around considerably by the aboriginal populations.

Group 1 (>100 Seeds per Burial)

Group 1 burials included seven with very high seed frequencies ranging from 388 to 89,827 seeds. These burials are located along the western part of the burial ground, within 5 m of each other. Group 1 burials, with the exception of burial Feature 232, dated to the Mission period (based on a range of chronological indicators). The temporal placement of burial Feature 232 was uncertain.

Table 238. Macrobotanical Remains Recovered from Burial Soils, LAN-62, Locus A

Context	Seeds (n)	Nuts (Items) (g)	Sediment (liters)	Nuts (g)	Seeds (n)	Seed Density (n/liter)	Total
Feature 10	—	—	2.43	0.01	413	170	413
Feature 14	—	—	0.32	—	92	288	92
Feature 50	—	—	0.2	—	32	160	32
Feature 68	—	—	51	1.53	14,664	288	14,664
Feature 70	—	—	16.5	0.02	1,961	119	1,961
Feature 76	—	—	0.02	—	14	700	14
Feature 82	—	—	0.16	—	10	63	10
Feature 85	—	—	1.87	—	76	41	76
Feature 96	—	—	0.02	—	1	50	1
Feature 101	—	—	0.08	—	25	313	25
Feature 112	—	—	0.96	—	105	109	105
Feature 128	1	—	—	—	—	—	1
Feature 141	—	—	0.32	—	91	284	91
Feature 149	—	—	0.2	—	4	20	4
Feature 164	1	—	—	—	—	—	1
Feature 172	—	—	0.45	—	19	42	19
Feature 196	—	0.2	—	—	—	—	—
Feature 232	—	—	31	0.01	388	13	388
Feature 237	29	—	—	—	—	—	29
Feature 271	89,827	—	—	—	—	—	89,827
Feature 273	—	—	1.75	0.01	410	234	410
Feature 285	—	0.9	—	—	—	—	—
Feature 286	—	—	0.05	—	3	60	3
Feature 289	—	—	0.33	—	9	27	9
Feature 300	—	0.04	—	—	—	—	—
Feature 313	2	—	0.35	—	89	254	91
Feature 334	—	0.2	—	—	—	—	—
Feature 341	—	—	0.3	—	7	23	7
Feature 376	42	—	1.89	0.22	35	19	77
Feature 423	—	0.3	—	—	—	—	—
Feature 430	—	—	0.6	—	85	142	85
Feature 438	—	—	0.06	—	9	150	9
Feature 453	—	—	0.34	—	2	6	2
Feature 502	15	—	—	—	—	—	15
Feature 512	—	0.5	—	—	—	—	—
Feature 565	—	—	0.01	2	5	500	5
Feature 587	—	—	1.21	0.15	4	3	4
Feature 601	17	—	—	—	—	—	17
Subtotal (burials)	89,934	2.1	112	4.0	18,553	165	108,487

continued on next page

Context	Seeds (n)	Nuts (Items) (g)	Sediment (liters)	Nuts (g)	Seeds (n)	Seed Density (n/liter)	Total
Isolated CU 142	3	—	—	—	—	—	3
Isolated CU 144	—	2	—	—	—	—	—
Isolated CU 151	19	—	—	—	—	—	19
Isolated CU 154	1	—	—	—	—	—	1
Isolated CU 156	1	—	—	—	—	—	1
Isolated CU 161	2	0.01	—	—	—	—	2
Isolated CU 164	1	—	—	—	—	—	1
Isolated CU 374	2	—	—	—	—	—	2
Isolated CU 375	—	—	40	3.02	774	19	774
Isolated CU 675	—	—	119	1.32	687	6	687
Subtotal (isolated control units)	29	2	159	4	1,461	9	1,490
Total	89,963	4.2	271.4	8.3	20,014	74	109,977

Table 239. Burial Groups, LAN-62, Locus A, by Frequency of Macrobotanical Remains

Group	Frequency (n)	Burials	Feature Numbers (in order of frequency, lowest to highest)
1	>100 seeds	7	112, 232, 273, 10, 70, 68, and 271
2	51–100 seeds	6	85, 376, 430, 141, 313, and 14
3	11–50 seeds	7	76, 502, 601, 172, 101, 237, and 50
4	<10 seeds	12	96, 128, 164, 453, 286, 149, 587, 565, 341, 289, 438, and 82
5	no seeds, only nuts	6	196, 285, 300, 334, 423, and 512

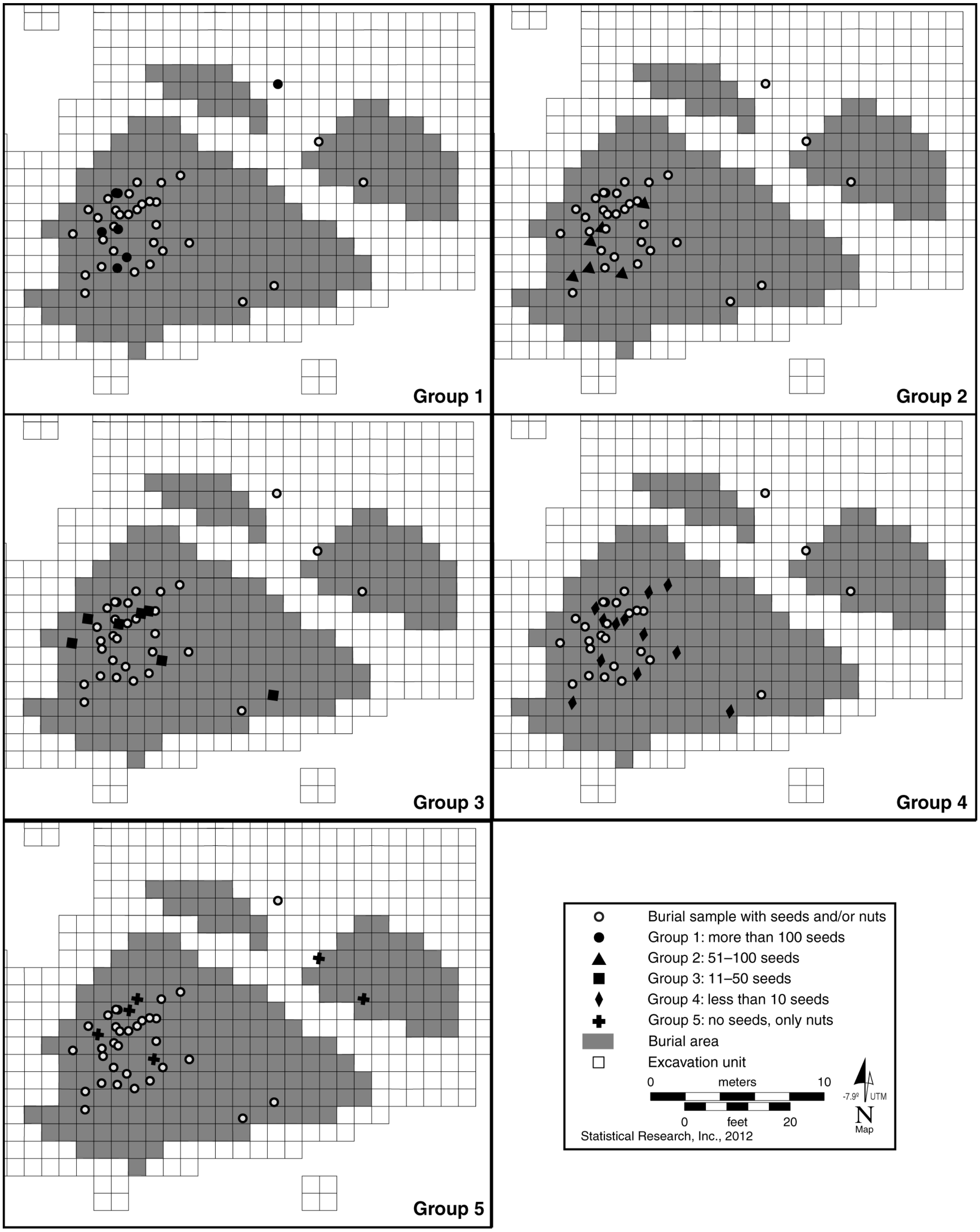

Figure 259. Distribution of macrobotanical remains in sampled burials at LAN-62.

Figure 260. *Calandrinia* seeds with a shaft straightener, burial Feature 271.

Burial Feature 271, with an exceedingly high seed frequency of 89,827 carbonized seeds, is the northernmost burial and is adjacent to burial Feature 273 (see below). Burial Feature 271 consisted of a single primary inhumation and scattered human skeletal remains associated with at least four additional individuals. The primary inhumation was a 20–24-year-old adult of indeterminate sex. Burial Feature 271 is of particular interest because of the cache of 89,827 carbonized *Calandrinia* sp. seeds (probably *C. ciliata*). According to ethnohistoric records, *Calandrinia* sp. was used by aboriginal populations for its medicinal qualities (Timbrook 2007). This cache of *Calandrinia* sp. seeds was placed approximately 7.5 cm east of the anterior side of the cranium of the primary individual. A steatite shaft straightener was placed in the midst of these seeds (Figure 260). Shell beads and steatite fragments were also found scattered around the individual. The placement of the seeds in a spatially discrete area of the burial was most likely an offering. Because flotation of sediments associated with the burial was not conducted, the possibility of other seed offerings in this burial cannot be addressed.

Burial Feature 68, immediately south of burial Feature 271, along the western periphery of the burial ground, also had a very high seed frequency, with 14,664 carbonized seeds recovered from 51 liters of sediment (287.5 seeds per liter). In addition, 69 grass rachises and acorn nutshell (0.03 g) were also recovered. The presence of grass rachises indicated that the grass seeds were not cleaned completely before they were included in the burial context. Rachises are separated from the grass grain during the threshing and winnowing stages while preparing the grain for use (Hillman 1981; Reddy 2003). A whole *Juglans* sp. nut (1.5 g) was recovered as an individual item from the feature. With the exception of the nut, the macrobotanical remains were recovered from the burial fill; they could be associated with either the burial or the midden fill. Of the 29 taxa represented in the collection from this burial, grasses, particularly *H. pusillum* (31 percent) and *Phalaris* sp. (10 percent), occurred in higher frequencies. *Calandrinia* sp. accounted for 14.3 percent of the collection. A single seed of *Datura* sp. (jimsonweed) was recovered from the burial fill. *Datura* sp. is typically associated with mourning and other rituals in Native American cultures in California. The original sources of these seeds probably included both the activities associated with the burial event and subsequent infilling of the burial with midden. Particular seeds, such as *H. pusillum*, *Phalaris* sp., *Calandrinia* sp., *Hemizonia* sp., and *Layia* cf. *platyglossa*, were broadcast during the burial event as offerings to the dead. The seeds represented in low frequencies were associated with the midden burial fill and not directly linked to the burial.

Burial Feature 70, south of burial Feature 68, yielded 1,961 carbonized seeds and 0.02 g of small fragments of acorn nutshell from 16.5 liters of sediment (119 seeds per liter). Of the 22 taxa recovered from the burial sediment, 4 were identified as associated with the burial event (seed broadcasting as part of interment ritual) based on their high frequencies: *H. pusillum, Phalaris* sp., *Calandrinia* cf. *breweri,* and *Salvia* cf. *apiana*. Both *Calandrinia* cf. *breweri* and *Salvia* cf. *apiana* probably had ritual roles in the interment, whereas the grasses were probably offered as food.

The last three burials included in Group 1 (burial Features 10, 273, and 232) had seed frequencies ranging between 413 and 388. Burial Feature 232 is located to the northeast, outside the main part of the burial area. Similar to the other burials in this group, *H. pusillum* (21 percent), *Phalaris* sp. (14 percent), and *Calandrinia* cf. *breweri* (13 percent) were the primary seeds related to the burial; all the other seeds were most likely associated with the midden fill. Note that burial Feature 232 had 154 *Chenopodium* sp. seeds (13 percent), and these were more likely associated with the midden fill than with the burial (given the higher incidence of *Chenopodium* sp. seeds in the control units [37.4 percent in contemporary Mission period contexts]).

Group 1 burials were characterized by higher frequencies of grasses (particularly *H. pusillum* and *Phalaris* sp.) and *Calandrinia* cf. *breweri* as the primary seed offerings/broadcast during the burial activity (Table 240). Nuts were infrequent, in terms of overall recovery, and were represented by acorn and wild walnut.

Group 2 (51–100 Seeds per Burial)

This group of six burials had a high seed frequency (76–92 seeds) and is located primarily on the southwestern periphery of the main burial area. Very little nutshell was recovered from these burials (see Tables 238 and 240; Appendix L.14.6). Four of the six burials were dated to the Mission period (burial Features 14, 141, 313, and 376), and two (burial Features 85 and 430) did not have good temporal indicators. Grasses, particularly the two main grasses (*H. pusillum* and *Phalaris* sp.), constituted the majority of the collection from these burials (62.3 percent), whereas *Calandrinia* cf. *breweri* occurred in much lower frequencies than in Group 1 (11 percent) (see Table 240). Old World domesticated-crop seeds accounted for a higher percentage in Group 2 (6 percent) than in Group 1 (0.2 percent). Three main taxonomic differences delineated Group 2 from Group 1: a greater taxonomic diversity in Group 1, more nutshell in Group 1, and, lastly, a higher frequency of domesticated crops in Group 2.

Group 3 (11–50 Seeds per Burial)

The seven burials in Group 3 had moderate seed frequencies (14–32 seeds), and there was no apparent pattern in their spatial distribution. Of the seven burials, four of them were dated to the Mission period (burial Features 50, 76, 101, and 601), and three did not have any good temporal indicators (burial Features 172, 237, and 502). None of the Group 3 burials had nutshell or nuts associated with them. The macrobotanical collection from this group was dominated by grasses (58 percent) and legumes (24 percent), which together accounted for 82 percent of all the seeds from these seven burials (see Table 240). Note that legumes were low in both Groups 1 and 2. Domesticated-crop seeds accounted for almost a quarter of the collection from Group 3 (24 percent). *Calandrinia* cf. *breweri* (which was in relatively higher frequencies in Groups 1 and 2) was absent.

Group 4 (<10 Seeds per Burial)

The 12 burials in Group 4 had low seed frequencies (less than 10 seeds) and were distributed randomly in the burial area. Four of these burials (burial Features 96, 128, 438, and 587) were dated to the Mission period, 1 burial (burial Feature 565) was dated to the Late to Mission period, and 7 burials (burial Features 82, 149, 164, 286, 289, 341, and 453) did not have good temporal indicators. The macrobotanical remains consisted primarily of grasses (64 percent) and legumes (11 percent), which accounted for the majority of the collection (see Table 240). Domesticated-crop seeds were low (4 percent), and *Calandrinia* cf. *breweri* (recovered in high frequencies in Groups 1 and 2) accounted for only 9 percent of this collection. Nutshell, including wild walnut, acorns, and unidentifiable nutshell fragments, was recovered from only 2 burials in this group (burial Features 587 and 565) (see Table 238). Burial Feature 565 had a whole acorn, an extremely rare recovery for coastal southern California.

Group 5 (No Seeds, Only Nutshell)

The final burial group, Group 5, includes six burials with nuts (4.14 g) and no seeds. Two burials were dated to the Mission period (burial Features 196 and 334), burial Feature 512 was dated to the Late to Mission period, and the remaining three burials did not have any temporal indicators. Of note are burial Feature 512, which had three halves of acorn nutshell with meat, and burial Feature 196, with half an acorn nutshell with meat. The other four burials had fragments of acorn nutshell. The six burials with nuts and no seeds are primarily located along the western periphery of the main burial ground, with the exception of burial Feature 300, which is outside and to the northeast of the main burial ground.

Taxonomic Discussion

In total, 52 taxa were recovered from the 38 burials. The majority of these taxa were from three main families: grasses (44 percent), Asteraceae (sunflower family) (18 percent), and legumes (6.5 percent). Among grasses, two particular grasses (*H. pusillum* and *Phalaris* sp.) dominated the collection, in terms of both frequencies and ubiquity. Domesticated-crop seeds, particularly *Pisum* cf. *sativum* (29 percent) and *Triticum* cf. *aestivum* (13 percent), were moderately ubiquitous. They were recovered in higher frequencies from burial-feature Group 3. The 13 burials with domesticated-crop seeds are in a tight cluster along the northwestern part of the burial ground. The association of Old World domesticated crops suggests that the Ballona occupants had regular access to these crop seeds and that these seeds were accepted as part of the

Table 240. Burial Groups Showing Frequency of Selected Macrobotanical Remains, LAN-62, Locus A

Genus/Species, by Family	Group 1		Group 2		Group 3		Group 4		Group 5	
	n	%	n	%	n	%	n	%	n	%
Asteraceae	3,342	19	11	2.1	3	2.0	1	2	—	
cf. *Helianthus* (Asteraceae)	38	0.2	—	0.0	—	0.0	—	0.0	—	
Hemizonia sp. (Asteraceae)	1,584	9	3	1	2	1.3	1	2	—	
Layia cf. *platyglossa* (Asteraceae)	1,696	9	1	0.2	—	0.0	—	0.0	—	
Chenopodium sp. (Chenopodiaceae)	377	2.1	18	4	9	6.0	3	5.4	—	
Fabaceae (legumes)	1,138	6.3	24	5	36	24	6	11	—	
Salvia cf. *apiana* (Lamiaceae)	955	5.3	9	2	2	1.3	—	0.0	—	
Poaceae (grasses)	7,788	43.4	319	62.3	87	58	36	64.3	—	
Hordeum pusillum (Poaceae)	5,573	31.1	179	35.0	36	24	18	32.1	—	
Phalaris sp. (Poaceae)	1,797	10.0	102	20	29	19.2	3	5.4	—	
Calandrinia cf. *breweri* (Portulacaceae)	2,549	14.2	55	11	—	0.0	5	9	—	
Datura sp. (Solanaceae)	5	0.03	5	1.0	—	0.0	—	0.0	—	
Domesticated crop seeds	29	0.2	31	6.1	36	24	2	4	—	
Total[a]	17,941	100.0	512	100.0	151	100.0	56	100.0	—	
Grass rachises	69		—		—		—		—	
Quercus sp. (Fagaceae)	0.08		0.22		—		—	2	4.1	
Quercus sp. attachment (Fagaceae)	—		—		—		—		0.04	
Juglans sp. (Juglandaceae)	1.5		—		—		0.1		—	
Prunus sp. (Rosaceae)	—		—		—		—		—	
Unidentifiable nut fragments	—		—		—		0.05		—	

[a] Includes data from burials only (not the units) and Burial 271.

daily diet. Incorporation of nontraditional foods into burials (as seed castings during burial ritual or offerings) is strong evidence of cultural acceptance of these foods. Again, these interpretations should be used with caution because of the potential of mixing of deposits during depositional processes (during the burial process).

The recovery of *Calandrinia* cf. *breweri* and *Datura* sp. from particular burial groups is noteworthy. Both these plants had important roles in Native American ritual practices (Timbrook 2007). The burials with these plants are in a relatively tight cluster along the western periphery of the burial ground and are primarily in Groups 1 and 2.

The 13 burials with nuts and nutshell (with and without seeds) are on the western periphery of the burial ground, except for burial Features 232 and 300, which are outside and to the northeast of the main burial ground.

In general, the recovery of macrobotanical remains from burial contexts is rare, especially in coastal southern California, for several reasons. First, sampling for macrobotanical remains is not widespread, particularly from burial contexts. For example, very few of the Chumash sites with burials have been sampled for macrobotanical remains (see, for example, Gamble [2008]). This lack of sampling reflects a general lack of paleoethnobotanical studies by archaeologists. Second, macrobotanical remains (seed and plant offerings during a burial event or annual ceremonies) in general have a very low likelihood of survival in burial contexts, because these contexts have low exposure to fire. Survival increases when offerings are ritually burned on top of a burial, as noted in several ethnohistoric studies, such as Bean and Blackburn (1976:566), Bean and Saubel (1972), and Kew (1990), among others. In the PVAHP, sampling of burial sediments (whenever allowed by the MLD) and macrobotanical items collected from the burials has resulted in a rare insight into the role of plants in burial ritual, an insight based on direct data rather than oral history and conjecture.

Most of the burials sampled for macrobotanical remains dated to the Mission period. Three of the main patterns that can be reiterated include the following:

- Grasses, particularly *H. pusillum* and *Phalaris* sp., were the most ubiquitous plant seeds used as ritual offerings. There seems to have been a preference for *H. pusillum* over *Phalaris* sp.

- A third of the 38 burials had seeds of Old World domesticated crops. The association of Old World domesticated crops with only some burials could suggest access to these crop seeds by individuals who brought these foods into the aboriginal village. Second, these foods, although nontraditional, were adopted into the traditional practices, such as mortuary rituals, by select individuals.

- Select burials located in a relatively tight cluster along the western periphery of the burial ground had seeds of unique plants, such as *Calandrinia* cf. *breweri* and *Datura* sp. These individuals may have had special roles in the society, because these plants have been typically associated with medicinal and shamanic practices.

Other Macrobotanical Remains from Burial Contexts

In addition to carbonized seeds, three groups of macrobotanical remains were recovered from burial contexts: basketry, plant fiber, and seed chaff. Basketry remains were recovered from several contexts at LAN-62, and their study is presented in Chapter 5 of this volume. The plant fiber included uncarbonized, matted-down plant material recovered from three burials (burial Features 278, 423, and 470) adjacent to each other in the northwest corner of the main burial ground. Analysis of these materials revealed that they were desiccated and matted rootlets of grasses and/or sedges. These materials were most likely used as bedding upon which the human body was placed during the burial event. It is very unlikely that the rootlets were intrusive, because they were compact both vertically and horizontally and were not diffused as would be typical if they had intruded into the burial.

The third group of nonseed macrobotanical remains recovered included white grass chaff, mostly likely of *Phalaris* sp., recovered from 27 burials and nonburial contexts at LAN-62 (Figure 261). This unique material has been very rarely recovered from archaeological contexts because of its fragility and survival during carbonization. The chaff was white, appearing leached of its original color, which would have been light brown, and was recovered from a pit (Feature 607), an excavation unit (EU 146), 18 burials, and 1 unit with isolated human remains (EU 373) (Appendix L.14.7). The 18 burials with this chaff were concentrated in the central part of the main burial ground. The chaff was observed on the sediment surrounding the burial and was most likely included during the interment event. It could have functioned as bedding material, offerings, and/or decoration. Of note is that the chaff was collected in large quantities during plant processing of the particular grass seeds and likely stored for such uses. Chaff is the outer seed coat of grasses and includes the glumes. The removal of chaff from the grass seed, particularly of wild (nondomesticated) grasses, involves pounding and subsequent winnowing—the chaff is the by-product of pounding and winnowing seeds (see Hillman 1981; Jones 1983; Reddy 2003). Because of the fragility of the glumes, chaff is rarely preserved in the archaeological record. Furthermore, storage of chaff lends risks of fungal infestation due to moisture associated with unburned and/or fresh plant parts. Therefore, in most parts of the world (in prehistoric and modern times), chaff was used immediately as animal fodder or as temper in building plastering rather than stored for long periods. The recovery of chaff from LAN-62 contexts has important implications for the socioeconomic system at play during the Late, Protohistoric, and Mission periods in the Ballona, in terms of labor and planning. These implications will be discussed later in this chapter.

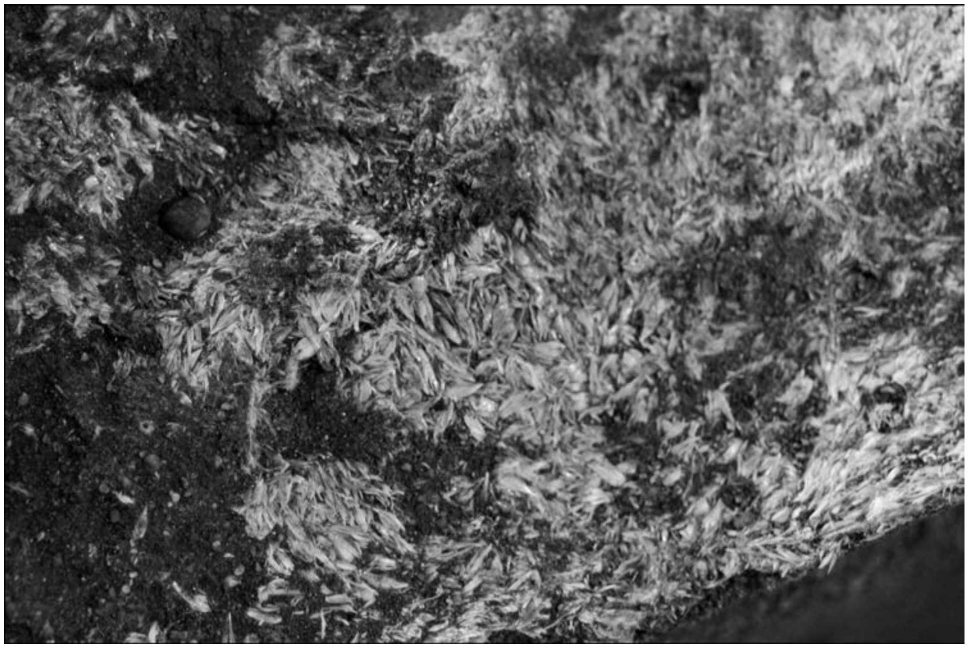

Figure 261. Chaff from LAN-62.

Features in the General Burial Area, Locus A

Macrobotanical remains from a single feature from the general burial area were analyzed. This feature, Feature 356, was an artifact concentration immediately to the north of the burial ground.

Artifact Concentration

Feature 356 was an artifact concentration of ground stone (complete basin metate and mano) that was not fire-affected. A rich and varied collection of material culture was recovered from the fill surrounding the feature, including invertebrates, vertebrates, debitage, ground stone, and FAR. The faunal material was diverse and included mammals, birds, and fishes. The abundant invertebrates recovered included scallop, clam, and oyster. The feature fill was composed of dark, silty sand consistent with the surrounding sediment and a noted absence of oxidized sediment and charcoal.

Flotation of 45 liters of feature-fill sediment yielded 119 carbonized seeds (3 seeds per liter sediment). In addition, 74 carbonized seeds were collected directly from the individual feature as items (Table 241). The light fractions did not yield any charcoal greater than 2 mm in size. The 193 seeds (including the 74 items) were represented by 11 taxa; with the exception of *Lupinus* sp. (lupine) and the indeterminate seed fragments, all taxa recovered from the feature have documented use by aboriginal populations as food and/or medicine. The recovery of parenchymatous soft tissue and *Marah* sp. is important, because the use of roots, tubers, and nonseed parts of plant foods is very rarely preserved in the archaeological record.

Overall, plant disposal and use associated with Feature 356 was dominated by two plants—*Atriplex* sp. (n = 45, or 23.3 percent) and *Pisum* cf. *sativum* (n = 45, or 23.3 percent)—that accounted for 46.6 percent of the seeds. Grasses accounted for only 8.3 percent. Most importantly, *Pisum* cf. *sativum* was an introduced plant (from the Old World), and its recovery from Feature 356 suggests that the feature was in use during the Mission period. As mentioned earlier, these crop seeds were most likely obtained by the aboriginal populations from Mission San Gabriel and/or the ranchos. Whether these plants were cultivated by the Native Americans cannot be determined with the given data.

Based on the macrobotanical collection, it is likely that the remnants of Feature 356 represented an amalgam of activities related to food processing and preparation. The absence of charcoal and oxidized sediment did not lend support to its having been a hearth, but it could have been a hearth cleanout (particularly of the food-preparation residue and accidental loss of foods/seeds during food processing). If it is a hearth cleanout, then the original food-preparation locale involved the preparation of various plant foods, including seeds, tubers, soft-tissue foods, and nuts.

FB 3, Locus A

Nine features from FB 3 were sampled for macrobotanical remains. As discussed in Chapter 1 (this volume), FB 3

Table 241. Macrobotanical Remains from Burial-Area Feature 356 (Artifact Concentration), LAN-62, Locus A

Genus/Species, by Family	Seed Count (n)	Item Count (n)	Total Seeds (n)	Percent of Total
Indeterminate fragments	39	17	56	29.0
Asteraceae				
Ambrosia sp.	2	—	2	1.0
Chenopodiaceae				
Atriplex sp.	45	—	45	23.3
Chenopodium sp.	7	—	7	3.6
Fabaceae				
Indeterminate fragments	3	—	3	1.6
Lupinus sp.	—	2	2	1.0
Pisum cf. *sativum*	—	45	45	23.3
Trifolium	—	2	2	1.0
Onagraceae				
Clarkia cf. *purpurea*	11	2	13	6.7
Poaceae				
Indeterminate fragments	3	—	3	1.6
Bromus cf. *carinatus*	2	—	2	1.0
Hordeum pusillum	5	2	7	3.6
Phalaris sp.	—	4	4	2.1
Portulacaceae				
Calandrinia cf. *breweri*	2	—	2	1.0
Total	119	74	193	100.0
Parenchymatous soft tissue	4		4	
Cucurbitaceae				
Marah sp.		1 (0.01g)	1 (0.01g)	
Fagaceae				
Quercus sp.	4 (0.01g)		4 (0.01g)	
Sediment floated (liters)	45			
Seed density (n/liter)	3			
Charcoal (g)				
Charcoal density (g/liter)				

was a complex of features that dated to the Mission period. Functionally, this feature complex has been interpreted as a locus of mourning-related activities (see Volume 2 of this series), including ritualistic offerings, based on its proximity to the burial ground.

The nine features that were analyzed included four artifact concentrations (Features 384, 456, 458, and 467), one rock cluster (Feature 673), and four pits (Features 454, 475, 671, and 672). The nine features yielded 373,677 carbonized seeds and a seed density of 1,987 seeds per liter (Table 242).

As a group, the artifact concentrations had the highest taxonomic diversity, with 46 taxa, followed by pits (34 taxa) and then rock clusters (6 taxa) (see Table 242). Seed densities were different, with significantly higher densities in the artifact-concentration group (2,355 seeds per liter), followed by pits (1,973 seeds per liter), and rock clusters (8 seeds per liter). Grasses occurred in higher frequencies in all feature types in FB 3 and accounted for the majority of the collection—in particular, *Phalaris* sp. Legumes were recovered from artifact concentrations and, in very low frequencies, from pits, but they were absent from rock clusters.

Artifact Concentrations

Sediment from four artifact concentrations within FB 3 (Features 384, 456, 458, and 467) was processed and analyzed for macrobotanical remains (see Table 242; Appendix L.14.8). Of the four artifact concentrations, Feature 384 was the largest and most complex. It was an approximately 4-by-6-m area characterized by large quantities of charcoal, basketry fragments, burned-seed concentrations, invertebrate and

Table 242. Macrobotanical Remains Recovered from FB 3, LAN-62, Locus A

Genus/Species, by Family	Artifact Concentrations[a]	Percent	Rock Cluster[b]	Percent	Pits[c]	Percent	Total	Percent
Indeterminate fragments	8,377	2.5	18	9.0	426	1.0	8,821	2.36
Unknown seeds/embryos	1,555	0.5	—		97	0.2	1,652	0.44
Amaranthaceae								
Amaranthus sp.	48	0.01	—		—		48	0.01
Anacardiaceae								
Rhus sp.	28	0.01	—		3	0.01	31	0.01
Asteraceae								
Ambrosia sp.	6	0.002	1	0.5	—		7	0.002
cf. *Helianthus*	10	0.003	—		7	0.02	17	0.005
Hemizonia sp.	3,300	1.0	1	0.5	140	0.3	3,441	0.92
Layia cf. *platyglossa*	2,882	0.9	—		106	0.3	2,988	0.80
Boraginaceae								
Amsinckia sp.	—	0.0	—		1	0.002	1	0.0003
Brassicaceae								
Lepidium sp.	28	0.01	—		—		28	0.01
Caprifoliaceae								
Sambucus cf. *nigra* ssp. *canadensis*	11	0.003	—		—		11	0.003
Chenopodiaceae								
Atriplex sp.	74	0.02	—		26	0.1	100	0.03
Chenopodium sp.	808	0.2	2	1.0	147	0.4	957	0.26
Cyperaceae								
Cyperus sp.	108	0.03	2	1.0	25	0.1	135	0.04
Schoenoplectus [*Scirpus*] cf. *californicus*	420	0.1	3	1.5	139	0.3	562	0.15
Ericaceae								
Arctostaphylos sp.	12	0.004	—		—		12	0.003
Fabaceae								
Indeterminate fragments	1,106	0.3	—		121	0.3	1,227	0.33
cf. *Astralagus* type	—	0.0	—		27	0.1	27	0.01
Cicer cf. *arietinum*	1	0.0003	—		—		1	0.0003
cf. *Lathyrus* sp.	7	0.002	—		1	0.002	8	0.002
Lupinus sp.	13	0.004	—		—		13	0.003

Genus/Species, by Family	Artifact Concentrations[a]	Percent	Rock Cluster[b]	Percent	Pits[c]	Percent	Total	Percent
Pisum cf. *sativum*	523	0.2	—		16	0.04	539	0.14
Trifolium sp.	14	0.004	—		—		14	0.004
Vicia sp.	1,803	0.5	—		119	0.3	1,922	0.51
Juncaceae								
Juncus sp.	451	0.1	—		39	0.1	490	0.13
Lamiaceae								
Salvia cf. *apiana*	1,068	0.3	—		326	0.8	1,394	0.37
Malvaceae								
Unknown	8	0.002	—		—		8	0.002
Onagraceae								
Clarkia cf. *purpurea*	5,645	1.7	—		462	1.1	6,107	1.63
Poaceae								
Indeterminate fragments	6,652	2.0	1	0.5	2,512	6.0	9,165	2.45
cf. *Agropyron* sp.	128	0.04	—		—		128	0.03
Agrostis sp.	146	0.04	—		4	0.01	150	0.04
Avena cf. *sativa*	18	0.01	—		3	0.01	21	0.01
Bromus cf. *carinatus*	436	0.1	1	0.5	18	0.04	455	0.12
Deschampsia cf. *danthonioides*	7,568	2.3	3	1.5	66	0.2	7,637	2.04
Hordeum pusillum	32,128	9.7	51	25.4	12,658	30.3	44,837	12.00
Hordeum vulgare	11	0.003	—		4	0.01	15	0.004
Leptochloa sp.	923	0.3	—		—		923	0.25
Lolium cf. *temulentum*	43	0.01	—		8	0.02	51	0.01
Phalaris sp.	245,878	74.1	111	55.2	21,616	51.7	267,605	71.61
Stipa sp.	448	0.1	—		5	0.01	453	0.12
Triticum cf. *aestivum*	20	0.01	—		8	0.02	28	0.01
Polygonaceae								
Eriogonum sp.	21	0.01	—		—		21	0.01
Polygonum sp.	15	0.005	—		10	0.02	25	0.01
Rumex sp.	15	0.005	—		—		15	0.004
Portulacaceae								
Calandrinia cf. *breweri*	1,382	0.4	7	3.5	2,609	6.2	3,998	1.07

continued on next page

Genus/Species, by Family	Artifact Concentrations[a]	Percent	Rock Cluster[b]	Percent	Pits[c]	Percent	Total	Percent
Rosaceae								
Heteromeles sp.	7,298	2.2	—		1	0.002	7,299	1.95
Rubiaceae								
Galium sp.	18	0.01	—		6	0.01	24	0.01
Violaceae								
Viola sp.	191	0.1	—		75	0.2	266	0.07
Total	331,645	100.0	201	100.0	41,831	100.0	373,677	100.0
Parenchymatous soft tissue	1,262		—		81		1,343	
Poaceae (grass) rachises	96		—		213		309	
Asphaltum	>770		—		8		>784	
Asphaltum with seeds	>36		—		34		>70	
Cucurbitaceae								
Marah sp.	79 (1.28 g)		—		2 (0.01g)		81 (1.3g)	
Fagaceae								
Quercus attachment	39 (0.2g)		—		15 (5g)		54 (5.2g)	
Quercus sp. nutshell	111 (3.75g)		1 (0.02g)		18 (1.02g)		130 (4g)	
Juglandaceae								
Juglans sp.	42 (0.83g)		—		1 (0.04g)		43 (0.87g)	
Rosaceae								
Prunus sp.	71 (1.29g)		—				71 (1.3g)	
Indeterminate nut fragments	96 (0.2g)		—		6 (0.02g)		102 (0.23g)	
Carbonized basketry	>1,000		2		10		>1010	
Sediment analyzed (liters)	140.82		26		21.2		188.02	
Seed density (n/liter)	2,355		8		1,973		1,987	
Charcoal (g)	212.38		0.01		48.7		261.09	
Charcoal density (g/liter)	1.5		0.0004		2.3		1.4	

[a] Features 384, 456, 458, and 467.
[b] Feature 673.
[c] Features 454, 475, 671, and 672.

Figure 262. Feature 384 with carbonized baskets and seeds, LAN-62.

vertebrate remains, lithic artifacts, glass and shell beads, and worked bone (Figure 262). In addition, white grass chaff, mostly likely of *Phalaris* sp., was also observed within the feature. This white chaff was very likely part of an offering or perhaps the lining of baskets that contained the offerings.

The carbonized macrobotanical remains included 331,645 seeds in the feature block. Wild grasses occurred in the highest frequencies (88.8 percent) among the families, and in particular, *Phalaris* sp. accounted for 74 percent of the collection. A second grass, *H. pusillum*, accounted for 9.7 percent of the collection. In total, 573 Old World domesticates representing five different crop seeds (*Avena* cf. *sativa*, *Cicer* cf. *arietinum*, *Hordeum vulgare*, *Pisum* cf. *sativum*, and *Triticum* cf. *aestivum*) were recovered from the artifact concentrations (see Table 242). *Pisum* cf. *sativum* seeds were recovered in high frequencies from all artifact concentrations, but the other four crops were not as ubiquitous. The recovery of Old World domesticated-crop seeds from these features indicated usage in the Protohistoric or Mission period. Given their general low densities and frequencies, these plants were not major contributors to the diets.

Seed density varied greatly among the four artifact concentrations. For example, Feature 458 had a very high seed density of 6,719 seeds per liter, and Feature 467 had the lowest seed density, with 511 seeds per liter. Overall, the taxonomic diversity was high (46 taxa) for the group, but individually, it varied; the highest was in Feature 384 (42 taxa), followed by Feature 458 (37 taxa), and Features 456 and 467 (21 taxa each). Although the range of taxa recovered varied among the four features, the focus of plant use and disposal was on grasses—in particular, *Phalaris* sp. This consistent pattern among the four features suggests that this particular grass was the focus of plant use in this locale. The variation in seed densities between the four features reflected varying levels of use. In addition to macrobotanical remains, these four features also yielded high frequencies of other artifacts and faunal remains. The ultimate interpretation of these features has to incorporate all these data.

Pits

Sediment from four pit features (Features 454, 475, 671, and 672) was processed and analyzed for carbonized macrobotanical remains (see Appendix L.14.8). The pits were characterized by anthropogenic sediment, moderate to large charcoal quantities, vertebrate and invertebrate remains, worked shell and bone, glass beads, and lithic artifacts. Of the four pits, two were shallower (Features 454 and 475) than the other two.

The seed densities of the four pits varied widely, with higher densities in Features 671 and 672 than in shallower pit Features 454 and 475 (see Appendix L.14.8). Basketry fragments were present in Features 671 and 672 but were very small and fragile. Charcoal densities were also distinct but did not reflect the seed-density pattern; Features 475 and 672 had higher charcoal densities than did Features 454 and 671. The variation in charcoal densities in this context suggests that Features 475 and 672 had more in situ oxidation than did Features 454 and 671 and contained a higher percentage of woody-plant materials (which produce charcoal when burned).

In addition to carbonized seeds and other plant matter, the macrobotanical remains also included carbonized-basketry remains, asphaltum fragments, and asphaltum with seeds (see Table 242). The asphaltum fragments and asphaltum with seeds were from the basket remains in the pits—often baskets were covered with pitch or asphaltum to make them waterproof (Anderson 1993; Gamble 1983). Asphaltum was used not only for water-container baskets but also for coiled baskets used for food preparation, burden baskets, and storage baskets. The carbonized seeds were dominated by wild grasses (n = 36,887, or 88.2 percent), in particular *H. pusillum* (30.3 percent) and *Phalaris* sp. (51.7 percent) (see Table 242). Of note is the recovery of four Old World domesticates (*Pisum* cf. *sativum*, *Avena* cf. *sativa*, *Hordeum vulgare*, and *Triticum* cf. *aestivum*) from these pits, suggesting that these features were used during the Mission period.

Macrobotanical analysis of the feature fill of these pits revealed that the seeds placed in these baskets and burned were primarily grasses, in particular *H. pusillum* and *Phalaris* sp. Whether the baskets were intentionally burned as offerings or accidentally burned while being stored was not easy to distinguish. Also, the seeds in the baskets would not be considered a cleaned collection/product; in other words, although 82 percent belonged to two particular grasses, the remaining 18 percent included other plants. It is possible that such an amalgam of seeds dominated by a couple of taxa could have been a concoction for pinole. Pinole was a gruel-like preparation made by aboriginal populations that included flour of wild seeds and partially ground seeds, cooked together (Timbrook 2007).

Rock Cluster

Macrobotanical remains from a single rock cluster (Feature 673) were also analyzed. Feature 673 was a tightly clustered concentration of a small number of ground stone fragments and fire-affected cobbles. A small quantity of flaked stone debitage, glass beads, and faunal bone was also recovered from the feature fill. Charcoal was observed within and around the perimeter of the feature. The macrobotanical collection from Feature 673 was dominated by wild grasses (83 percent), primarily *Phalaris* sp. (55.2 percent) and *H. pusillum* (25.4 percent). The extremely low charcoal density (0.004 g per liter) and relatively lower seed diversity (11 taxa) than other features in FB 3 suggest that the macrobotanical remains in this feature were probably the non-ashy remnants of hearth residue. The absence of ash from the feature suggested that the original hearth contents did not have much ash or that the ash did not survive into the cleanout remnants. Therefore, Feature 673 could be either the discards of a hearth or a deflated hearth where grasses, particularly *Phalaris* sp. and *H. pusillum,* were processed.

Summary and Discussion of FB 3

Features from FB 3 yielded an extremely rich macrobotanical collection with distinctive signatures that included high frequencies of two particular wild grasses, wild-grass-rachis remains, Old World domesticates, and seeds embedded in asphaltum. Based on stratigraphy and chronological studies (see Volume 2 of this series) as well as cultural materials (see Chapters 2, 3, and 5, this volume), FB 3 has been dated to the Mission period (A.D. 1771–1834). The data from this unique feature complex have provided a rare glimpse into the ritual lifestyles of aboriginal populations during the Mission period.

If, indeed, this feature complex was the remains of activities related to annual mourning practices (Strong 1929), the macrobotanical collection indicated that the plant foods offered included locally available foods along with some rarer foods. There was a concerted effort to offer particular plant foods, such as wild grasses—specifically, *Phalaris* sp. and *H. pusillum*, with a preference for the former. In addition to these two grasses, seven other grasses were also included in the offerings but in notably lower frequencies. Three types of nuts, *Quercus* sp., *Juglans* sp., and *Prunus* sp., were included in these offerings. Based on the recovery of parenchymatous tissue, root and tuber foods were also part of the ritual giving. It is not possible to comment on whether these root and tuber foods were cooked (roasted or boiled) or uncooked before offering. (Such distinctions can be made only through analysis using an SEM; that procedure was not conducted for this project).

Fragments of asphaltum with embedded seeds were recovered from some features and indicated that seeds were thrown into asphaltum-lined baskets and then burned together, as opposed to seeds' being burned elsewhere and transported to the feature-block location in the asphaltum-lined baskets. The embedded seeds were trapped in the bubbled asphaltum that formed a web around the seeds as it cooled.

Given the high ratios of wild-grass seeds to nongrass seeds (8:1) in the feature complex and the focus on *Phalaris* sp. and *H. pusillum*, it is quite likely that these seed offerings in baskets may have been collections of seeds that would have been used to make a particular type of pinole. Aboriginal pinole was made using a range of seeds ground and mixed together, but typically one or two plants dominated the concoction. For example, chia pinole could have included oats, corn, or native grasses, depending on individual preferences (Timbrook 2007:189–190). It is therefore quite likely that the seeds in asphaltum-lined baskets were different types of pinole offered to the deceased. The distribution of seeds as devotional items or offerings during the Mission period has been noted in the ethnohistoric literature for the Gabrielino and surrounding Native American groups (Timbrook 2007).

In addition to these wild-plant foods, several Old World domesticated-crop seeds were also included in the offerings. When compared to other contexts at the site (such as burials, control units, other feature blocks [FBs 4 and 7], sitewide contexts, and Locus G), FB 3 yielded the majority of these domesticates (n = 604, or 65 percent). Note, though, that FBs 4 and 7 dated to the Intermediate and Millingstone periods; these domesticates would not have been available when those areas were in use. What is of importance is that of the five domesticates recovered from LAN-62, only two (*Pisum* cf. *sativum* and *Triticum* cf. *aestivum*) were recovered from burial contexts (see Table 234). Unfortunately, only limited macrobotanical data was available for burials, as the MLD guidelines for burial excavation and sediment processing disallowed the flotation of burial fill. These Old World domesticates were most likely not cultivated by the aboriginal populations but, instead, obtained from surrounding missions and ranchos and the Pueblo of Los Angeles as payment for services or in exchange for other goods. Despite these plants' not being part of the corpus of traditional plant foods, the newly introduced foods were included by the aboriginal populations in the ceremonial offerings to the deceased. There did appear to have been a more concerted effort to limit them as part of direct offerings into burials. The choice and acceptance of these particular two domesticates (peas and wheat) for burial offerings are unclear. In other words, when seeds were broadcast or offered directly onto the deceased during interment, there was more discretion in terms of whether the foods were traditional or introduced. When the offerings were made as part of annual mourning ceremonies and rituals, less discretion was practiced. This distinction could have been an intentional choice based on tradition and acceptable foods in particular cultural contexts. Then again, it is also likely that annual mourning ceremonies included populations from a wider catchment than did interment events. Foods brought into the settlement for mourning offerings would be more diverse than those brought to interment events, which may have included only individuals from a single village. Regardless, the fact that the aboriginal populations included new foods into their ritual practices soon after these plant foods were incorporated into their diet shows that they regarded these new foods as having comparable prestige.

Alternatively, these patterns of association may reflect a temporal change in the socioeconomic system during the course of the Mission period. For example, earlier in the Mission period, fewer Native Americans would have had access to Old World domesticates, and therefore, there would be fewer chances of such plants being incorporated into interments and features. Later in the Mission period, when there was more interaction between Native groups and the missions, the ranchos, and the Pueblo of Los Angeles, there would have been greater access to introduced crops; one would expect a higher frequency of domesticates incorporated into Native American practices. The incorporation of Old World domesticates into aboriginal diets and lifeways is discussed further later in this chapter.

FB 4, Locus A

Three features from FB 4 were sampled for macrobotanical remains. As discussed in Chapter 1 (this volume), FB 4 was a complex of features dated to the Intermediate period, including two rock clusters (Features 419 and 612) and an activity area (Feature 541) that, together, they yielded 594 carbonized seeds (Table 243). Of the three, Feature 419 had the highest taxonomic diversity and seed densities, followed by Feature 541 and Feature 612. Grasses were recovered in the highest frequencies from Feature 419; Feature 612 yielded only two grass seeds, and none was recovered from the activity area (Feature 541).

Activity Area

In total, 23 carbonized seeds were recovered from Feature 541. No charcoal was recovered, and the seed density was relatively low (compared to other contexts at the locus). Feature 514 was a shallow feature filled with invertebrates spread over a 0.83-by-0.93-m area. Artifacts recovered from the fill included marine shell, small quantities of flaked stone debitage and artifacts, and faunal bone. No ash or sediment change was observed in the feature.

The 23 carbonized seeds were highly fragmented, and the fragmentation could be an indicator of postdepositional disturbance and/or depositional processes. Given the lack of postdepositional indicators in the light fractions (such as rodent fecal remains, snails, uncarbonized seeds, and others), it is more likely that the seed fragmentation was related to some aspect of the depositional processes. The lack of charcoal, the low seed diversity (two taxa), and the low seed density, relative to the rock clusters in FB 4, all suggest that plant processing, preparation, or consumption were not the primary activities centered on Feature 541. Instead, the feature may have been the focus of invertebrate processing.

Rock Clusters

Sediment from two rock clusters, Features 419 and 612, was processed for macrobotanical remains. The two features, although both rock clusters, were different in character. Feature 612 was a relatively tightly clustered group of cobbles, some of which showed signs of thermal alteration. Small quantities of marine shell and faunal bone were recovered from the feature; charcoal, ash, and other burned materials were absent. In contrast, Feature 419 spanned an area of three 1-by-1-m test pits and included a moderate number of unshaped pieces of FAR, ground stone, and unshaped/unmodified cobbles. In addition, small quantities of flaked stone artifacts, a ground stone disk bead, and a large faunal collection were recovered, including mammal (42 percent of total collection) and bony-fish (39 percent) remains. Invertebrate remains were also recovered, and worked shell, although infrequent, included one cupped olivella-shell bead (generally spanning a period of 800–40 B.P.) and one asphaltum-covered abalone shell. Disturbance indicators in the light fractions were minimal for both features.

Based on the low recovery of carbonized seeds from Feature 612 (4 seeds), plant use was not a predominant activity. The second rock cluster, Feature 419, had a higher seed density, and grasses accounted for 28.4 percent of the collection, represented primarily by *Phalaris* sp. and *H. pusillum* (see Table 243). Of all the taxa in the collection, *Chenopodium* sp. accounted for the highest frequencies, with 88 seeds

Table 243. Macrobotanical Remains Recovered from FB 4, LAN-62, Locus A

Genus/Species, by Family	Activity Area	Rock Cluster	Rock Cluster	Total
	Feature 541	Feature 419	Feature 612	
Indeterminate fragments	19	198	1	218
Seed embryo	—	1	—	1
Alismataceae				
cf. *Sagittaria* sp.	—	2	—	2
Asteraceae				
Unknown	—	2	—	2
Ambrosia sp.	—	5	1	6
Hemizonia sp.	—	3	—	3
Layia cf. *platyglossa*	—	1	—	1
Boraginaceae				
Amsinckia sp.	—	1	—	1
Brassicaceae				
Lepidium sp.	—	1	—	1
Chenopodiaceae				
Chenopodium sp.	3	88	—	91
Cyperaceae				
Cyperus sp.	—	8	—	8
Schoenoplectus [*Scirpus*] cf. *californicus*	—	37	—	37
Fabaceae				
Indeterminate fragments	—	7	—	7
Lupinus sp.	—	5	—	5
Pisum cf. *sativum*	—	7	—	7
Vicia sp.	—	4	—	4
Juncaceae				
Juncus sp.	—	22	—	22
Onagraceae				
Clarkia cf. *purpurea*	—	2	—	2
Poaceae				
Indeterminate fragments	—	29	—	29
Deschampsia cf. *danthonioides*	—	31	—	31
Hordeum pusillum	—	28	2	30
Phalaris sp.	—	73	—	73
Polygonaceae				
Polygonum sp.	1	6	—	7
Portulacaceae				
Calandrinia cf. *breweri*	—	4	—	4
Rosaceae				
Heteromeles sp.	—	2	—	2
Total	23	567	4	594
Parenchymatous soft tissue		24		24
Fagaceae				
Quercus sp.		12 (0.05g)		12 (0.05g)
Juglandaceae				
Juglans sp.	1 (0.01g)			1 (0.01g)
Rosaceae				

Genus/Species, by Family	Activity Area	Rock Cluster	Rock Cluster	Total
	Feature 541	Feature 419	Feature 612	
Prunus sp.		2 (0.07g)		2 (0.07g)
Indeterminate nut fragments	2 (<0.01g)	15 (0.02g)		17 (0.03g)
Sediment analyzed (liters)	12.5	84.64	5	102.14
Charcoal (g)		8.16		8.16
Charcoal density (g/liter)		0.10		0.1
Seed density (n/liter)	2	7	1	6

(15.5 percent). *Pisum* cf. *sativum* (domesticated pea) was also recovered from Feature 419. However, these seeds were most likely intrusive, because the feature has been dated to the Intermediate period, and these plants were brought into the area by the Spanish during the Protohistoric and Mission periods. Several human burials were located above this feature, and it was very likely subjected to postdepositional disturbance. For example, burial Features 284 and 287 are less than 30 cm above Feature 419, and burial Feature 406 is 40 cm above it.

Given that no single plant dominated the collection, the functional roles of the plants in Feature 419 were difficult to ascertain. If, indeed, the feature was a hearth cleanout, a number of plants were processed in the original locale as food and likely as fuel to cook the shellfish and vertebrate resources.

Summary and Discussion of FB 4

The three features sampled from FB 4 yielded macrobotanical remains distinctive to each. Unfortunately, no unique plant-use signatures distinctive of Intermediate period nonburial features were evident. No functional relationship between the macrobotanical collection and feature type was evident, either.

Nonetheless, four main patterns in plant use during the Intermediate were observed. First, grasses did not dominate the collection (as was evident in FB 3, dating to the Mission period), but a select few grasses were exploited, including *Deschampsia* cf. *danthonioides*, *H. pusillum*, and *Phalaris* sp. Second, *Chenopodium* sp. occurred in the highest frequencies of all taxa (n = 91, or 15.3 percent). It was used as both food and medicine (depending on the species) by aboriginal populations in coastal southern California. Seeds, young plants, and leaves of *C. berlandieri* (pigseed goosefoot) were eaten; roots of *C. californicum* (California goosefoot) were used as soap, and its bark was used as medicinal tea for stomach ailments (Timbrook 2007:55). The third pattern is that legumes occurred in higher frequencies in the Intermediate period features than in Mission period features. Finally, specific wetland taxa were recovered in higher frequencies from the Intermediate period features than from the Mission period features—in particular, *Cyperus* sp. (n = 8, or 1.3 percent), *Juncus* sp. (rush) (n = 22, or 3.7 percent), *Polygonum* sp. (knotweed) (n = 7, or 1.2 percent), and *Schoenoplectus* cf. *californicus* (n = 37, or 6.2 percent). This is not surprising, given that based on paleoenvironmental reconstructions, the marsh and wetland settings were richer during the Intermediate period in the Ballona (see Altschul et al. 2003; Altschul et al. 2007).

FB 7, Locus A

Three features from FB 7 were sampled for macrobotanical remains. As discussed in Chapter 1 (this volume), FB 7 was a complex of features that dated to the Millingstone period. Rock-cluster Features 449, 574, and 623 yielded 1,571 carbonized seeds (Table 244). Of the three, Feature 449 had the significantly higher seed densities.

Rock Clusters

The three features were similar in that they were composed of tightly clustered groups of FAR and ground stone fragments. No ash or evidence of in situ burning was observed. Fill from Feature 449 also yielded small quantities of flaked stone artifacts and charcoal, considerable amounts of vertebrate remains, and some invertebrate remains. No faunal remains (vertebrate or invertebrate) were recovered from Feature 574. The fill of Feature 623 had small quantities of faunal remains (both vertebrate and invertebrate) but no flaked stone.

Feature 623 did not yield any macrobotanical remains, and Feature 574 only had 5 indeterminate carbonized-seed fragments. Feature 449 yielded 1,567 carbonized seeds, including seeds from nine taxa (see Table 244). Grasses accounted for 96 percent of the carbonized seeds. Notably, *H. pusillum*, which occurred in higher frequencies in later periods, accounted for only 1.6 percent. Two radiocarbon dates obtained on shell (venus clam) and carbonized seeds (*Phalaris* sp.) from Feature 449 yielded very different dates. The venus clam dated to the late Millingstone period (2890–2450 cal B.C.), and the *Phalaris* sp. dated to the Late to Historical period (cal A.D. 1490–1960). The carbonized-seed collection from Feature 449 was more akin to a Late period to Mission period collection rather than to a Millingstone period collection, based on the higher seed density and the dominance of grass taxa.

Based on the macrobotanical remains recovered from the three features in FB 7, the Millingstone period exploitation of plant resources was primarily focused on grasses, particularly *Phalaris* sp. and *Deschampsia* cf. *danthonioides*. This stands in contrast to the Intermediate period plant use noted

Table 244. Macrobotanical Remains from FB 7, LAN-62, Locus A

Genus/Species, by Family	Rock Clusters			Total
	Feature 449	Feature 574	Feature 623	
Indeterminate fragments	26	4	—	30
Asteraceae				
Unknown	2	—	—	2
Hemizonia sp.	6	—	—	6
Chenopodiaceae				
Chenopodium sp.	4	—	—	4
Cyperaceae				
Cyperus sp.	1	—	—	1
Onagraceae				
Clarkia cf. *purpurea*	3	—	—	3
Poaceae				
Indeterminate fragments	23	—	—	23
Agrostis cf. *exarata*	46	—	—	46
Deschampsia cf. *danthonioides*	424	—	—	424
Hordeum pusillum	25	—	—	25
Phalaris sp.	994	—	—	994
Portulacaceae				
Calandrinia cf. *breweri*	13	—	—	13
Total	1,567	4	—	1,571
Sediment analyzed (liters)	25	3	4	32
Seed density (n/liter)	63	1.3	—	49.1
Charcoal (g)				
Charcoal density (g/liter)				

in FB 4. Although grasses were the primary plants used in the Mission period, the two grasses that were targeted were *Phalaris* sp. and *H. pusillum*; *Deschampsia* cf. *danthonioides* was exploited minimally in the Mission period. This change in exploitation could indicate a change in food preference, or perhaps *H. pusillum* was not as readily available during the Millingstone period. However, the latter is unlikely, because *H. pusillum* and *Phalaris* sp. occur in similar habitats, and *Phalaris* was available in these early periods.

Features from Sitewide Contexts, Locus A

Macrobotanical remains from seven features outside the feature blocks were analyzed. These features included two pits (Features 620 and 621) and five rock clusters (Features 51, 335, 448, 527, and 659). Spatially, the two pits were east of the feature blocks, and the rock clusters were north and west of the feature blocks. Unlike the feature blocks, which were temporally discrete, these features in non-feature-block contexts have diverse temporal designations. Instead, two features (Features 51 and 527) dated to the Mission period, one feature (Feature 335) dated to the Protohistoric to Mission period, one feature (Feature 621) was Intermediate period in age, and three features (Features 448, 620, and 659) could not be dated.

The seven features yielded 1,905 carbonized seeds (Table 245). As a group, the rock clusters had the highest taxonomic diversity (24 taxa), relative to the pits, with 7 taxa (see Table 245). Seed densities were distinctive, with significantly higher densities in the pits (46 seeds per liter); the rock clusters had a much lower seed density (8 seeds per liter).

Pits

The two pits, Features 620 and 621, were at least 10 m to the west of FB 3. Feature 620, a circular feature measuring 0.75 m across and at least 0.2 m deep, was discovered during mechanical stripping. The fill yielded a few small lithic flakes and a piece of steatite. The vertical extent of the feature could not be delineated because of limitations of encountering ground water. Feature 621, another roughly circular pit that measured 0.4 m in diameter and was at least 0.5 m deep,

Table 245. Macrobotanical Remains from Features in Sitewide Contexts, LAN-62, Locus A

Genus/Species, by Family	Rock Clusters						Pits			Total
	Feature 51	Feature 335	Feature 448	Feature 527	Feature 659	Total	Feature 620	Feature 621	Total	
Indeterminate fragments	39	25	1	30	3	98	—	23	23	121
Amaranthaceae										
Amaranthus sp.	48	—	—	—	—	48	—	—	—	48
Asteraceae										
Unknown	—	3	—	—	—	3	—	—	—	3
Ambrosia sp.	—	—	—	—	—	—	—	15	15	15
Helianthus annuus	—	—	—	—	—	—	—	1	1	1
Hemizonia sp.	22	—	—	1	—	23	—	3	3	26
Layia cf. *platyglossa*	9	—	—	14	—	23	—	—	—	23
Boraginaceae										
Amsinckia sp.	13	3	—	—	—	16	—	—	—	16
Caprifoliaceae										
Sambucus cf. *nigra* ssp. *canadensis*	4	—	—	—	—	4	—	—	—	4
Chenopodiaceae										
Atriplex sp.	3	4	—	—	—	7	—	167	167	174
Chenopodium sp.	74	14	—	10	—	98	—	—	—	98
Cyperaceae										
Cyperus sp.	21	2	—	—	—	23	—	—	—	23
Schoenoplectus [*Scirpus*] cf. *californicus*	131	1	—	3	3	138	—	—	—	138
Fabaceae										
Indeterminate fragments	17	5	—	—	—	22	—	—	—	22
Melilotus sp.	4	—	—	—	—	4	—	—	—	4
Pisum cf. *sativum*	15	—	—	—	—	15	—	—	—	15
Trifolium sp.	142	—	—	—	—	142	—	—	—	142
Lamiaceae										
Salvia cf. *apiana*	68	6	—	5	—	79	—	—	—	79
Onagraceae										
Clarkia cf. *purpurea*	27	2	—	—	—	29	—	—	—	29

continued on next page

Genus/Species, by Family	Rock Clusters						Pits			Total
	Feature 51	Feature 335	Feature 448	Feature 527	Feature 659	Total	Feature 620	Feature 621	Total	
Poaceae										
Indeterminate fragments	18	12	1	—	—	31	—	—	—	31
Agrostis sp.	29	—	—	—	—	29	—	—	—	29
Bromus cf. *carinatus*	52	—	—	—	—	52	—	—	—	52
Deschampsia cf. *danthonioides*	—	—	—	—	—	—	2	—	2	2
Hordeum pusillum	388	—	—	13	—	401	7	—	7	408
Phalaris sp.	257	5	3	10	—	275	—	—	—	275
Polygonaceae										
Polygonum sp.	30	5	—	—	—	35	—	—	—	35
Rumex sp.	2	—	—	—	—	2	—	—	—	2
Portulacaceae										
Calandrinia cf. *breweri*	12	—	—	5	—	17	55	—	55	72
Violaceae										
Viola sp.	18	—	—	—	—	18	—	—	—	18
Total	1,443	87	5	91	6	1,632	64	209	273	1,905
Parenchymatous soft tissue		7		4		11		3	3	14
Fagaceae										
Quercus sp.	13 (0.04g)					13 (0.04g)				13 (0.04g)
Indeterminate nut fragments				1 (<0.01g)		1 (<0.01g)				1 (<0.01g)
Sediment analyzed (liters)	12	46	8.5	127	3	196.5	3	3	6	202.5
Charcoal (g)	2									
Charcoal density (g/liter)	0.17									
Carbonized seeds (n)	1,443	87	5	91	6	1,632	64	209	273	1,905
Seed density (n/liter)	120	1.9	0.6	0.7	2.0	8	21	70	46	9

was also discovered during mechanical-stripping activities. Ash, charcoal, and other evidence of burning was noted during excavation of these two features. The functions of these pit features are unclear, although storage could be plausible. Feature 621 yielded a date that placed its use during the Intermediate period; Feature 620 was not dated and did not yield any artifacts that were temporal markers.

The two features yielded 273 carbonized seeds and parenchymatous soft tissue (n = 3) (see Table 245). *Atriplex* sp. and *Calandrinia* cf. *breweri* accounted for the majority of the seeds. Grasses were recovered in very low frequencies (n = 9, or 4 percent). *Calandrinia* cf. *breweri* (n = 55) contributed to the majority of the collection from Feature 620. There has been documented use of *Calandrinia* cf. *breweri* seeds as food during the ethnohistoric period. Furthermore, *Calandrinia* was an esteemed food among some coastal groups (Timbrook 2007:46). *Atriplex* sp. accounted for 80 percent of the collection from Feature 621 (Intermediate period). The roots of *Atriplex* sp. were used by coastal populations to make soap, and the seeds were consumed by some groups as food (Timbrook 2007:42). The relatively specialized macrobotanical collections from the two pits suggest that these two plants, *Atriplex* sp. in Feature 620 and *Calandrinia* cf. *breweri* in Feature 621, were disposed of in these features. Given the absence of ash and charcoal, it is unlikely that the plants and/or seeds were processed at these features. Instead, they were deposited, as either by-product or trash, or stored there (in perishable containers).

Rock Clusters

Five rock clusters located to the north and east of FB 7 were sampled for macrobotanical remains. Features 51, 527, and 659 were similar in that they were composed of a very tightly clustered group of FAR and cobbles. The feature fills yielded ground-stone-vessel fragments, moderate quantities of unworked faunal bone, marine shell, and flaked stone artifacts. Ash, charcoal, and any evidence of in situ thermal activity were absent from these three features. Feature 448 was different from these three in that the small numbers of FAR and ground stone fragments were not tightly grouped. Otherwise, the feature fill was similar to that of Features 51, 527, and 659. Feature 335 was different from the other rock clusters, because it included a small number of unshaped, fire-affected cobbles with an underlying pit. However, the corpus of material culture recovered from the feature was similar to that of the other rock clusters.

The five features, together, yielded 1,632 carbonized seeds, parenchymatous soft tissue (n = 11), fragments of *Quercus* sp. nutshell (n = 13; 0.04 g), and fragments of unidentifiable nutshell (n = 1; <0.01 g). Feature 51 had the highest seed density and also the highest taxonomic diversity of the rock clusters (see Table 245). Features 51, 335, and 527 all dated to the Protohistoric and Mission periods and also had the three highest seed densities and taxonomic diversities (n = 23, 9, and 8 taxa, respectively). Features 448 and 659 were not dated. None of the rock clusters had a single taxon that dominated the collection. In other words, the collections were generalized and perhaps the results of an amalgam of activities. Features 448 and 659 were distinct from the other features, not only in their low seed densities, but also in the low presence or the absence of grasses. The low densities reveal that plant disposal and/or use did not occur at these two features; instead, the seeds recovered (a total of 11 from both features) were not indicative of specific behavioral activities. It is also likely that these Features 448 and 659 could be old, from the Intermediate or Millingstone period, when preservation was typically poor.

Summary and Discussion of Sitewide Contexts

The seven features sampled from areas outside the feature blocks yielded macrobotanical remains that were distinctive. Four main patterns were discerned from the data. First, the collections were distinctive to the feature types. Unfortunately, there did not appear to be a functional relationship between the macrobotanical collection and feature types. For example, the more specialized macrobotanical collections from the two pits suggest that two plants, *Atriplex* sp. in Feature 620 and *Calandrinia* cf. *breweri* in Feature 621, were disposed of, either as by-product or trash, or stored (in perishable containers). The generalized collections of the rock clusters suggest that an amalgam of activities occurred; either plants were not part of the activities at Features 448 and 659, or these features were old and had poor preservation.

Second, the collections from the two Mission period features (Features 51 and 527) were not similar to each other, nor were they similar to collections from features in FB 3, which also dated to the Mission period. For example, grasses accounted for 52 percent of the collection in Features 51 and 527, which was much lower than grasses in Mission period rock clusters in FB 3 (82.5 percent). Because FB 3 features were specialized features (likely mourning related), they were not representative of plant taxa from nonritual-context features. In other words, although they were only two features, as compared to nine in FB 3, Features 51 and 527 may have been more representative of Mission period rock clusters than those in FB 3.

The macrobotanical collection from Feature 621, dated to the Intermediate period, was different from the FB 4 collection (also Intermediate period). Feature 621 did not have any grasses or legumes and was primarily composed of *Atriplex* sp. seeds. The Intermediate period collection from FB 4 included grasses and legumes among other taxa, such as *Atriplex* sp. (5 percent). Finally, the collections from Features 448, 659 ,and 620, which were not dated, were most akin to macrobotanical remains from Intermediate or Millingstone period features, based on the low seed densities, the lower grass-seed frequencies, and the lack of nutshell.

In summary, macrobotanical data from features in sitewide contexts (i.e., outside the feature blocks) have helped resolve that collections from FB 3 (Mission period) features cannot be used to identify Mission period collections, because they are special-function collections. However, taxonomic markers in collections from FB 4 (Intermediate period) features can be used to interpret Intermediate period collections.

Features from LAN-62, Locus G

Six features in Locus G of LAN-62 were sampled for macrobotanical remains. Locus G was to the northeast of Locus A, and it was separated initially for management purposes. Note that all the features in Locus G were discovered and excavated after mechanical stripping of the overburden. The archaeology at the two loci, however, showed distinct signatures of prehistoric behavior (Vargas and Douglass 2009). For example, Locus A was characterized by burial and ritual features primarily dating to the Protohistoric and Mission periods. Such features were absent from Locus G, and chronometric data and stratigraphic analysis indicated an occupation span of more than 6,000 years, including the Late and early Historical periods.

The six features included one activity area (Feature 687) and five rock clusters (Features 683, 684, 685, 688, and 689). Only three of the six features were dated through chronometric data. Feature 687 (activity area) dated from the Late period to the Mission period, Feature 684 (rock cluster) was likely used during the Late period, and use of Feature 688 (rock cluster) was sometime between the Intermediate period and the Late period.

In total, 860 carbonized seeds were recovered from four of the six features (Table 246). Two features (Features 684 and 689) did not yield any macrobotanical remains. Two taxa accounted for almost half the collection: *Chenopodium* sp. (24 percent) and *Calandrinia* cf. *breweri* (23.5 percent). Grasses (8 percent) and legumes (11.4 percent) were in low frequencies. Seed densities varied widely; there were no seeds in two rock clusters (Features 684 and 689), low densities in two rock clusters (Features 683 and 685), and high densities in one rock cluster (Feature 688) and the activity area (Feature 687). Note, however, that Features 687 and 688 overlapped each other. Furthermore, disturbance indicators in the light fraction from both features were high and included uncarbonized seeds, land-snail shell, and insect parts. In other words, there is a high likelihood that the carbonized-seed collections from these features experienced contamination, both from each other and from other contexts.

Activity Area

Feature 687 consisted of a large, ovate artifact scatter including worked and unworked shell, flaked stone artifacts, a Cottonwood Triangular projectile point, ground stone, and vertebrate remains. The shell included abalone, the majority of which was concentrated in the southeast portion of the feature. Three worked-shell artifacts included two scoops made from white clam and one cupped olivella bead. Small quantities of charcoal were recovered from throughout the feature. A large concentration of ocher was also recovered. The feature was used sometime between the Late and Mission periods.

The collection from the feature included grasses (21 percent) and legumes (30 percent) (see Table 246). Based on the recovery of *Pisum* cf. *sativum* (2.5 percent), it is more likely that this feature was used during the Mission period than the Late period. No single grass occurred in high frequencies, and no taxon dominated the collection; plant use was generalized at this locale and did not focus on a particular plant or a group of plants. The collection was more akin to the signature of a midden context in which an amalgam of plant taxa is represented as residue from a range of plant use activities.

Rock Clusters

Five rock clusters were sampled, and three yielded macrobotanical remains (see Table 246). Features 683 and 685 were similar, not only in the low seed densities, but in their contents. Feature 683 consisted of a small cache of ground stone artifacts, including manos and metates, in addition to FAR, tarring pebbles, and debitage. Of note was a patch of dark, black clay underneath the largest piece of FAR. Moderate quantities of faunal bone were also recovered. Feature 685 was a small concentration of flaked lithic artifacts including burned ground stone fragments. The feature may have been either a cache of broken ground stone or redeposited hearth remnants. Although no ash or sediment oxidation was evident, charcoal was present intermittently in the fill. The macrobotanical collections from these two features were generalized and did not have the signatures of by-products of any specific behavior associated with plant use. Instead, they may have been just remnants of generalized midden from the locus.

Feature 688 was a long and narrow concentration of artifacts composed of flaked stone artifacts and small quantities of vertebrate and invertebrate remains. One worked-shell artifact, a Pismo-clam tool, was also recovered. No charcoal or ashy sediment was present in the feature. Feature 688 had the highest seed density of the six features sampled from Locus G. Two taxa accounted for 74 percent of the collection: *Chenopodium* sp. (35 percent) and *Calandrinia* cf. *breweri* (39 percent). Grasses and legumes were absent. Wetland taxa (*Cyperus* sp., *Polygonum* sp., and *Rumex* sp.) were also recovered and accounted for 14.3 percent of the collection (see Table 246). This was expected, because Feature 688 was dated between the Intermediate and Late periods, and rich wetlands were present in the Intermediate period in the vicinity of the locus. Both *Chenopodium* sp. and *Calandrinia* cf. *breweri* could have been processed as food by the occupants, or alternatively, the contents of Feature 688 could have been the dumped remains of food-processing activities.

Table 246. Macrobotanical Remains from LAN-62, Locus G

Genus/Species, by Family	Rock Clusters						Activity Area	Total
	Feature 683	Feature 685	Feature 688	Feature 684	Feature 689	Total	Feature 687	
Indeterminate fragments	6	—	37	—	—	43	59	102
Seed embryo	2	—	21	—	—	23	21	44
Aizoaceae								
Unknown	2	—	—	—	—	2	—	2
Asteraceae								
Ambrosia sp.	—	—	3	—	—	3	3	6
Layia cf. *platyglossa*	—	—	—	—	—	—	1	1
Boraginaceae								
Amsinckia sp.	—	—	—	—	—	—	1	1
Caprifoliaceae								
Sambucus cf. *nigra* ssp. *canadensis*	—	—	—	—	—	—	1	1
Chenopodiaceae								
Chenopodium sp.	—	—	179	—	—	179	29	208
Cyperaceae								
Cyperus sp.	—	—	11	—	—	11	2	13
Schoenoplectus [*Scirpus*] cf. *californicus*	1	2	—	—	—	3	27	30
Fabaceae								
Indeterminate fragments	—	—	—	—	—	—	85	85
Pisum cf. *sativum*	—	—	—	—	—	—	8	8
Vicia sp.	—	—	—	—	—	—	5	5
Lamiaceae								
Salvia cf. *apiana*	7	—	—	—	—	7	—	7
Onagraceae								
Clarkia cf. *purpurea*	—	—	—	—	—	—	3	3
Poaceae								
Indeterminate fragments	—	—	—	—	—	—	12	12
Deschampsia cf. *danthonioides*	—	—	—	—	—	—	6	6
Hordeum pusillum	—	—	—	—	—	—	19	19
Leptochloa sp.	—	—	—	—	—	—	6	6
Phalaris sp.	—	—	—	—	—	—	13	13
Stipa sp.	—	—	2	—	—	2	11	13

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Genus/Species, by Family	Rock Clusters						Activity Area	Total
	Feature 683	Feature 685	Feature 688	Feature 684	Feature 689	Total	Feature 687	
Polygonaceae								
Polygonum sp.	—	—	27	—	—	27	—	27
Rumex sp.	—	—	36	—	—	36	1	37
Portulacaceae								
Calandrinia cf. *breweri*	—	—	201	—	—	201	1	202
Ranunculaceae								
cf. *Ranunculus* type	—	—	—	—	—	—	1	1
Violaceae								
Viola sp.	—	—	—	—	—	—	8	8
Total	18	2	517	—	—	537	323	860
Parenchymatous soft tissue	2 (<0.01g)					2 (<0.01g)		2 (<0.01g)
Cucurbitaceae								
Marah sp.		2 (<0.01g)				2 (<0.01g)		2 (<0.01g)
Fagaceae								
Quercus sp.	1 (<0.01g)					1 (<0.01g)		1 (<0.01g)
Indeterminate nut fragments			1 (<0.01g)		1 (<0.01g)	1 (<0.01g)		2 (<0.01g)
Sediment analyzed (liters)	10	8	13	2	9	42	15	57
Charcoal (g)	0.1					0.1	0.2	0.3
Charcoal density (g/liter)	0.01					0.002	0.01	0.005
Carbonized seeds (n)	18	2	517	—	—	537	323	860
Seed density (n/liter)	2	0.3	40	—	—	13	22	15.09

Summary and Discussion of Locus G Features

There were general similarities between the macrobotanical collections from Locus G features and the collections from features in Locus A. First, they were similar to collections from features in sitewide contexts, in that some features had high densities of seeds and others had very low densities. This was different from FB 3 features, most, if not all, of which had relatively high densities. Second, Feature 688, used sometime between the Intermediate period and the Late period, shared signatures with FB 4 (an Intermediate period complex). Unfortunately, because of a significant amount of postdepositional disturbance noted in the light fractions of the Locus G features, their data did not have the same integrity as the data from features in the feature-block complexes (FBs 3, 4, and 7) in Locus A.

Plant Use at LAN-62

The rich macrobotanical collection from LAN-62 was unique, not only for the high seed densities and associations of seeds with mourning and ritual contexts, but also in terms of the taxa recovered. Grasses were the most ubiquitous, in particular *Phalaris* sp. (52 percent) and *H. pusillum* (43 percent) (see Appendix L.14.5). *Phalaris* sp. was also the most ubiquitous of all taxa recovered from LAN-62. (Ubiquity is a good measure of the rate and intensity of plant use.) Other plants that had a relatively high ubiquity included *Chenopodium* sp. (44 percent), *Schoenoplectus* cf. *californicus* (40 percent), *Calandrinia* cf. *breweri* (35 percent), *Pisum* cf. *sativum* (35 percent), and *Hemizonia* sp. (32 percent). As a collection, the LAN-62 data were relatively homogeneous; seven taxa were recovered from at least a third of the samples, and there was a low ubiquity index (less than 25 percent) for the majority of the samples.

A significant majority of the plants represented in the macrobotanical collection were locally available and were within the daily catchment of the population, including the Ballona and the surrounding Los Angeles plains/prairie. Only eight taxa were from nonlocal settings (not within the daily catchment), including *Sambucus* cf. *nigra* ssp. *canadensis*, *Arctostaphylos* sp., *Leptochloa* sp. (sprangletop), *Celtis* sp., *Quercus* sp., *Juglans* sp., and *Prunus* sp. The seeds and berries of these plants were likely either obtained through trade with other groups or collected during seasonal gathering excursions into the more-distant inland uplands.

There was a distinct spatial variation in macrobotanical recovery. For example, when data from the control units and the feature-block complexes were compared, there was very little similarity in seed densities and taxonomic diversity. The collection-unit macrobotanical collection was more generalized than the specialized collections from the features and provided a direct association between context and activities involving plants. For example, *Chenopodium* sp. seeds occurred in higher frequencies across time in the control units and grasses occurred in lower frequencies (13 percent), but that was not the case in all the feature blocks. Also, the collection from the control units was reflective of an amalgam of activities associated with the general habitation midden, and the feature blocks provided strong contexts of plant use and disposal. These dissimilarities should be considered when data from the various contexts with strong temporal data are compiled to discern patterns across time.

Several important trends in the macrobotanical data were identified, and implications for plant use and disposal are discussed.

- High seed density. First, the extremely high seed density of 248 seeds per liter (see Table 234) was primarily due to the rich deposits from the mourning contexts in FB 3 (1,987 seeds per liter), LAN-62, Locus A. The midden deposits and nonmourning features (such as the control units, FBs 4 and 7, the sitewide contexts, and the Locus G features) had much lower seed densities (between 6 and 49 seeds per liter). It is indeed very rare to recover mourning features, in general, in coastal southern California, particularly those that have excellent preservation of macrobotanical remains. High densities from such contexts are atypical.

- Distinct combinations of seeds in ritual contexts. The macrobotanical collections from the mourning features (FB 3) shed light on aboriginal ritual practices associated with the dead. Plant foods offered ritually during annual mourning ceremonies included locally available foods along with some rarer foods. Several ethnohistoric accounts have described Native American mourning rituals to honor the deceased. For example, Bean and Saubel (1972) described Nukil (among the Cahuilla) as an annual or biennial ritual that is a week-long ceremony to honor all members of a lineage who died during the previous year. Typically, these were initiated when there was adequate food and other valuables that could be used to gift and feed guests, and all participants were required to contribute to the ceremony. The Kitanemuk practiced an annual mourning ceremony in horseshoe-shaped ramadas near the villages (Bean and Blackburn 1976:566). Food was brought in, and a cloth effigy of the deceased was made. On the final day, an effigy-burning ceremony was held during which food, nuts, baskets, and seeds were thrown into the fire by women. Afterward, the pit was filled, and a special dancer danced on top to compact it. Similar practices were observed by Strong (1929) for the Cahuilla, the Serrano by Benedict (1924), and Kumeyaay by Waterman (1910). At LAN-62, FB 3, similar ritual offerings of plant-food seeds were made. Although there was a concerted effort to offer particular plant foods, such as wild grasses, specifically *Phalaris* sp. and *H. pusillum*, several Old World domesticated-crop seeds were also included in the offerings (see further discussion of this below). Analysis of macrobotanical remains from several features has revealed that offerings of wild-plant seeds in various combinations were made in asphaltum-lined baskets. It is possible that the various combinations of the wild seeds could have been for different types of pinole.

- Another noteworthy pattern in the LAN-62 macrobotanical collection was that specific plants were associated with particular contexts. For example, *Calandrinia* cf. *breweri* and *Datura* sp. were recovered in higher frequencies from the burials and FB 3 (see Table 234). Both these plants had important roles in Native American ritual practices (Timbrook 2007). Furthermore, they were associated with particular burial groups in a relatively tight cluster along the western periphery of the burial ground (Groups 1 and 2). When present in ritual contexts, these plants are associated with medicinal and shamanic practices (Timbrook 2007); therefore, it is possible that these seeds were deposited either by a shaman or into the grave of a shaman.

Plant use at LAN-62 changed considerably over time from the Millingstone period through the Mission period. Macrobotanical data by temporal period are presented in Table 247. Plant use increased dramatically in the Mission period (regardless of whether FB 3 is included or not) and fluctuated in the prior periods. The seed densities in the Millingstone, Intermediate, and Late period contexts were statistically different. In other words, there is very high confidence that the samples were from different sample populations ($\chi^2 = 1978$; $df = 2$; $p < .001$). Factors potentially causing these lower seed densities in these earlier periods include sampling, preservation, and, most importantly, the plant-processing and -consumption methods. Sampling is not a determining issue, because it was adequate, and in the case of the Late period, the sample was the largest of all periods (see Table 247). Preservation could very well be a determining factor, primarily considering the age of the older deposits, especially those from the Millingstone and Intermediate periods. Also, it has been observed that early (Millingstone and Intermediate period) deposits in coastal southern California have low seed densities despite adequate sampling (Reddy 2004a; Wigand 2005). The low seed densities could also be because plant use was focused on the nonseed parts of the plants, such as leaves, stems, and roots, and seeds were supplemental. Prehistoric use of leaves and leafy parts of plants is obviously hard to define in the archaeological record, and all references are based on ethnohistorical accounts; therefore, the interpretations remain conjectural. Use of roots as food is considerably less elusive, because if they have been cooked, especially by charring, they often survive as parenchymatous soft tissue. Parenchymatous soft tissue was recovered from all except the Millingstone period contexts; its absence does not necessarily mean it was not used. In summary, the fluctuations in plant use (higher in the Intermediate period and lower in the Millingstone and Late periods) could have resulted from changing populations (reflecting the intensity of plant use), changing reliance on leaves and leafy parts of the plants, and differential use of roots and tubers.

Changes in plant use were noted over time also in terms of plant groups exploited. Exploitation of taxa associated with wetlands increased over time (Figure 263). This did not correlate well with the model of wetland and settlement evolution for the Ballona. Starting around 1000 B.P., the Ballona Lagoon became a sediment-choked estuary; most areas were abandoned, except those near the lagoon edge and the mouth of Centinela creek (see Volume 1 of this series). There was a dramatic change in settlement location, most likely in response to changing environment. By 1000 B.P., the entire population in the Ballona had congregated along the lagoon edge, with most people located at the base of the bluff near LAN-62 and LAN-211 (Altschul et al. 2005). The marshy wetlands in the Ballona, though, remained relatively productive (Wigand 2005). Although the size of the wetlands decreased over time, exploitation of taxa associated with wetlands increased over time. Some of these taxa included *Atriplex* sp. and *Cyperus* sp., which can tolerate fluctuations in salinity. These trends demonstrate that social factors were more important than temporal changes in environmental conditions in determining which plants were the focus of gathering activities. Alternatively, larger or more-permanent aboriginal populations during the Protohistoric period may have practiced more-intensive targeting of wetland taxa.

Legume exploitation also changed over time, with a significant increase in the Late period, compared to the preceding Intermediate period and the subsequent Mission period (see Figure 263). Legumes were absent from the Millingstone period collections. Similarly, use of grasses fluctuated over time, decreasing abruptly in the Intermediate and Late periods and then increasing dramatically in the Mission period. Particularly, the decrease in grass use during the Late period was inversely correlated with an increase in legumes.

Despite these fluctuations, grasses were utilized throughout the cultural sequence, although over time, certain grasses were selectively used (see Figure 263). There was a striking preference for *Phalaris* sp. through time, as well as for *H. pusillum*, although to a lesser extent. Both grasses produce seeds in the spring and grow in relatively dense stands, without cultivation. Based on these data, it is evident that these two grasses became increasingly important over time in the prehistoric diets and were staples in the Mission period Native American diet. They were also the predominant offerings in ritual ceremonial contexts (Figure 264). A trend toward heavier exploitation of *Phalaris* sp. began in the Millingstone period and continued through the sequence in the Ballona. The implication of this focused exploitation will be addressed in detail later in the chapter.

Given the importance of *Phalaris* sp. and *H. pusillum*, seeds from the various temporal contexts at LAN-62 were measured to address possible morphological changes in seed size over time. The analysis revealed that the mean size of both seeds increased over time. These changes were most evident from

Table 247. Distribution of Particular Plant Taxa (Seeds) at LAN-62, by Temporal Period

Plant Group	Mission (without FB 3)[a]		Mission (with FB 3)		Late		Intermediate		Millingstone	
	n	%	n	%	n	%	n	%	n	%
Sediment analyzed (liters)	391		447.02		529.95		221.14		116	
Carbonized seeds (n)	4,848		377,721		1,728		1,229		431	
Seed density (n/liter)	12		845		3		6		4	
Grasses (n)	1,853	38.2	332,389	88.0	270	15.6	188	15.3	170	39.4
Legumes (n)	685	14.1	4,000	1.1	248	14.4	28	2.3	—	0.0
Wetland taxa (n)	2,607	54	325,271	86.1	862	49.9	564	45.9	180	42

Genus/Species, by Family	Mission (without FB 3)		Mission (with FB 3)		Late		Intermediate		Millingstone	
	n	%	n	%	n	%	n	%	n	%
Asteraceae										
cf. *Helianthus*	—	0.0	42	0.01	—		—		1	0.2
Hemizonia sp.	23	0.5	3,443	0.9	—		3	0.2	4	1
Layia cf. *platyglossa*	27	0.6	3,009	0.8	1	0.1	2	0.2	—	0.0
Caprifoliaceae										
Sambucus cf. *nigra* ssp. *canadensis*	5	0.1	15	0.004	3	0.2	—		—	0.0
Chenopodiaceae										
Atriplex sp.	52	1.1	103	0.03	45	2.6	34	2.8	167	39
Chenopodium sp.	1,148	24	2,032	0.5	482	27.9	286	23.3	5	1.2
Cyperaceae										
Cyperus sp.	172	3.5	322	0.1	139	8.0	23	1.9	2	0.5
Schoenoplectus [*Scirpus*] cf. *californicus*	190	4	721	0.2	83	4.8	12	1.0	5	1.2
Ericaceae										
Arctostaphylos sp.	—	0.0	12	0.003	—		—		—	
Fabaceae										
Cicer cf. *arietinum*	—	0.0	1	0.0003	—		—		—	
cf. *Lathyrus* type	—	0.0	8	0.002	—		—		—	
Pisum cf. sativum	95	2.0	581	0.2	—		—		—	
Trifolium sp.	144	3.0	156	0.04	—		—		—	
Vicia sp.	5	0.1	1,922	0.5	5	0.3	4	0.3	—	0.0

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Genus/Species, by Family	Mission (without FB 3)		Mission (with FB 3)		Late		Intermediate		Millingstone	
	n	%	n	%	n	%	n	%	n	%
Juncaceae										
Juncus sp.	—	0.0	490	0.1	—	0.0	22	1.8	—	0.0
Lamiaceae										
Salvia cf. *apiana*	—	0.0	1,467	0.4	8	0.5	6	0.5	—	0.0
Onagraceae										
Clarkia cf. *purpurea*	45	1	6,134	1.6	21	1.2	4	0.3	—	0.0
Poaceae										
Avena cf. *sativa*	—	0.0	21	0.01	—	0.0	—	0.0	—	0.0
Bromus cf. *carinatus*	54	1.1	506	0.1	2	0.1	—	0.0	1	0.2
Deschampsia cf. *danthonioides*	11	0.2	7,639	2.0	6	0.3	31	2.5	3	0.7
Hordeum pusillum	427	9	45,300	12.0	43	2.5	30	2.4	51	12
Hordeum vulgare	—	0.0	15	0.0	—	0.0	—		—	0.0
Phalaris sp.	382	8	267,741	70.9	63	3.6	80	6.5	114	26.5
Stipa sp.	11	0.2	453	0.1	20	1.2	2	0.2	—	0.0
Triticum cf. *aestivum*	—	0.0	28	0.01	—	0.0	—	0.0	—	0.0
Portulacaceae										
Calandrinia cf. *breweri*	20	0.4	11,265	3.0	3	0.2	205	16.7	7	1.6
Parenchymatous soft tissue (n)	20		1,353		10		63		—	
Grass rachises (n)	—		309		—		—		—	
Asphaltum	—		>1,000		291		—		—	
Asphaltum with seeds	—		>80		—		—		—	
Total nutshell (n)	50		526		83		66		1	
Total nutshell (g)	0.05		14.67		0.32		0.31		0.02	
Fagaceae										
Quercus sp. (n)	17		196		11		12		1	
Quercus sp. (g)	0.05		9.15		0.05		0.05		0.02	
Juglandaceae										
Juglans sp. (n)	—		43		—		7		—	
Juglans sp. (g)	—		0.84		—		0.8		—	

Note: Only contexts with strong chronometric and stratigraphic data were included in this table. Percentages are within each period.

[a] Does not include the ritual contexts of FB 3.

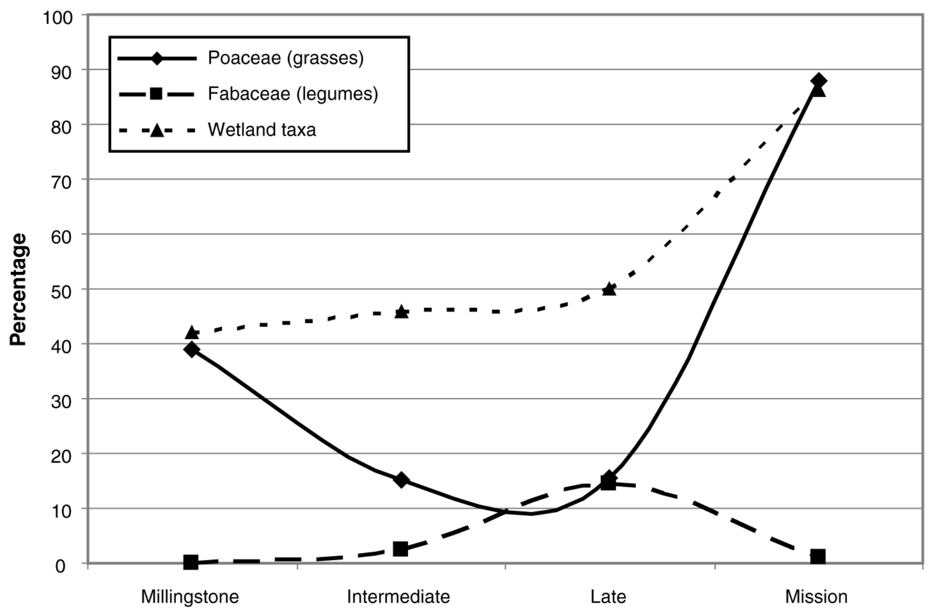

Figure 263. Changes in the exploitation of grasses, legumes, and wetland taxa over time at LAN-62.

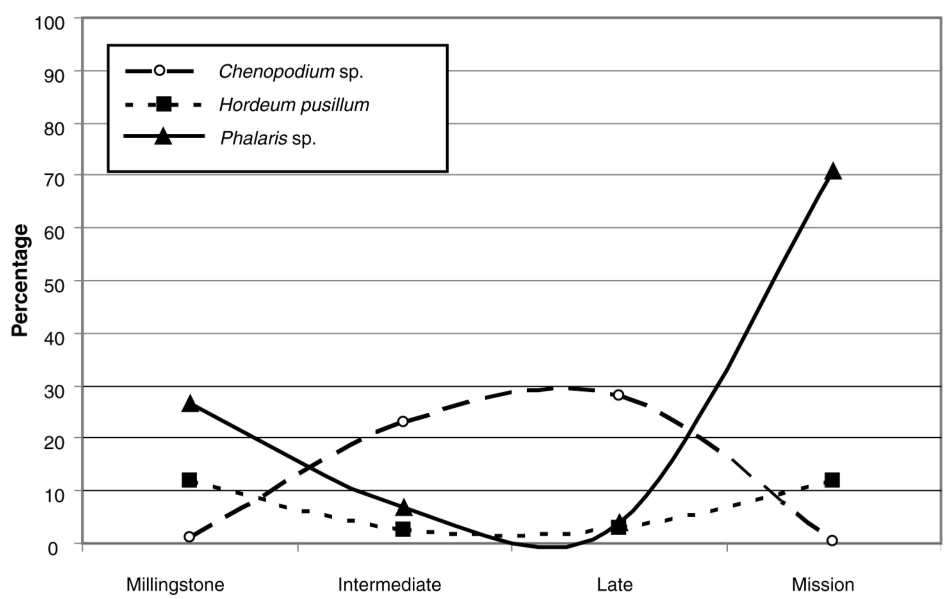

Figure 264. Distribution of the three most-ubiquitous taxa over time at LAN-62.

the late Intermediate period through the Protohistoric period; statistical tests demonstrated that the samples were from different populations. Initial cultivation of morphologically wild plants is very difficult to discern in the archaeological record. However, an increase in seed size is widely recognized by paleoethnobotanists as one of the early indicators that the selective pressures on a wild-plant species changed. This is particularly true for grasses and legumes. In short, these changes in seed size in the Ballona samples were consistent with general expectations for initial grass cultivation. This will be elaborated further later in the chapter, incorporating the results from Mission period contexts from LAN-211, as well.

Although carbonized seeds were recovered in low to very high densities, nutshell was recovered in very low quantities from LAN-62. Overall, when nutshell frequencies were compared over time, nuts were recovered in very low densities; the Millingstone period deposits had the lowest nut use, and there were only slightly higher values in the Intermediate and Late periods (Figure 265). Only in the Mission period was there a significant increase in acorn use. Mission period Ballona occupants mostly exploited *Quercus agrifolia* and *Quercus wislizeni*. Based on these results, acorn use was a very late adaptation, and this is consistent with results documented further south along the coast (Reddy 2004b). These patterns did contradict many accepted models of California acorn exploitation that have argued for intensive use during the Millingstone and Intermediate periods (Basgall 1987; Glassow 1996; Hildebrandt and Mikkelsen 1993:34; Wohlgemuth 1996). This issue also will be discussed further later in this chapter.

Finally, the last important trend noted in the macrobotanical sample from LAN-62 was that Old World domesticated-crop seeds were recovered from specific contexts. These were represented by two legumes, *Cicer* cf. *arietinum* and *Pisum* cf. *sativum*, and three grasses (also known as cereals), *Avena* cf. *sativa*, *Hordeum vulgare*, and *Triticum aestivum* (Table 248). The majority of the seeds were from FB 3 contexts (n = 604, or 65 percent). *Pisum* cf. *sativum* was the most ubiquitous domesticated seed at the site. However, it was intrusive in FB 4 (Feature 419), because the feature had several human burials located above it and very likely had been subjected to postdepositional disturbance as a result of the interment of these burials. Old World domesticated legumes, also known as pulses, dominated the collection (n = 815, or 87.4 percent of domesticated crops). These were primarily *Pisum* cf. *sativum*; only one *Cicer* cf. *arietinum* seed was recovered.

Pisum cf. *sativum* was probably the first domesticated legume of the Old World and was domesticated during the early Neolithic (7500–6000 B.C.) in the Near East, most likely in Iraq or Turkey (Zohary and Hopf 1988:96). It has always been a good companion crop to wheat and barley, because it enriches the soils when used as a rotation crop (Helbaek 1964; Zohary and Hopf 1988). In addition, there has been much debate on whether pulses preceded cereals in domestication. Archaeological data on *Cicer* cf. *arietinum* are limited, but it is generally believed to have been domesticated during the Neolithic period in Turkey or northern Syria (Zohary and Hopf 1988:101).

Cereals (annual domesticated grasses cultivated for their grains) accounted for only 12.5 percent of the Old World domesticated-seed collection at LAN-62. Of the three crops, *Triticum aestivum* was recovered in the highest frequencies (n = 81), followed by *Avena* cf. *sativa* (n = 21) and *Hordeum vulgare* (n = 15). *Triticum aestivum* is the wheat that evolved under cultivation from *Triticum turgidum (*domesticated wheat, or emmer/durum wheat) in the southwestern corner of the Caspian belt (Zohary and Hopf 1988:5) between 6000 and 5000 B.C. *Avena* cf. *sativa* is a secondary crop that evolved into a domesticated plant, not as a crop, but as a weed that was accidentally propagated with wheat and barley (Zohary and Hopf 1988:75). As a plant, it is hardy and tolerant of colder and unpredictable temperatures. *Hordeum vulgare* is one of the founder crops of the Old World Neolithic food production, and it is often referred to as a universal companion to wheat, despite its being better adapted to drier conditions, poor soils, and salinity. The earliest evidence of domesticated barley was from the Jordan Valley during the early Neolithic (Hillman 1975).

These Old World domesticates were consumed by the Mission period aboriginal populations in the Ballona, as evidenced by their recovery from both midden and ritual contexts at LAN-62. As stated earlier, these Old World domesticates probably were not cultivated by the aboriginal populations; instead, they were probably obtained from surrounding missions and ranchos and the Pueblo of Los Angeles as payment for services rendered or in exchange for other products. Rancho los Quintos (1801–1809 approximately) was the most likely source in the Ballona for these domesticated products. Alternatively, some of these domesticates could have been imported from Mexico by the missions (Hackel 1998:114), especially before the missions and pueblos were successfully growing their own food. After the missions and pueblos started producing in surplus, exports of foodstuffs from Mexico decreased (Hackel 1998:117).

There was considerable variation in the recovery of domesticates at LAN-62, depending on the context. For example, although peas were ubiquitous, oats and barley had lower ubiquity values and were recovered only from FB 3. Wheat was recovered from burials and also from FB 3. The recovery of domesticate seeds from burial contexts and mourning features (FB 3) indicated that these plants were incorporated into the corpus of traditional plant foods relatively quickly (within a couple of decades) by the aboriginal population. In other words, aboriginal populations included new foods into their ritual practices soon after they were incorporated into their diet and regarded these new foods as having comparable prestige to traditional wild-plant foods.

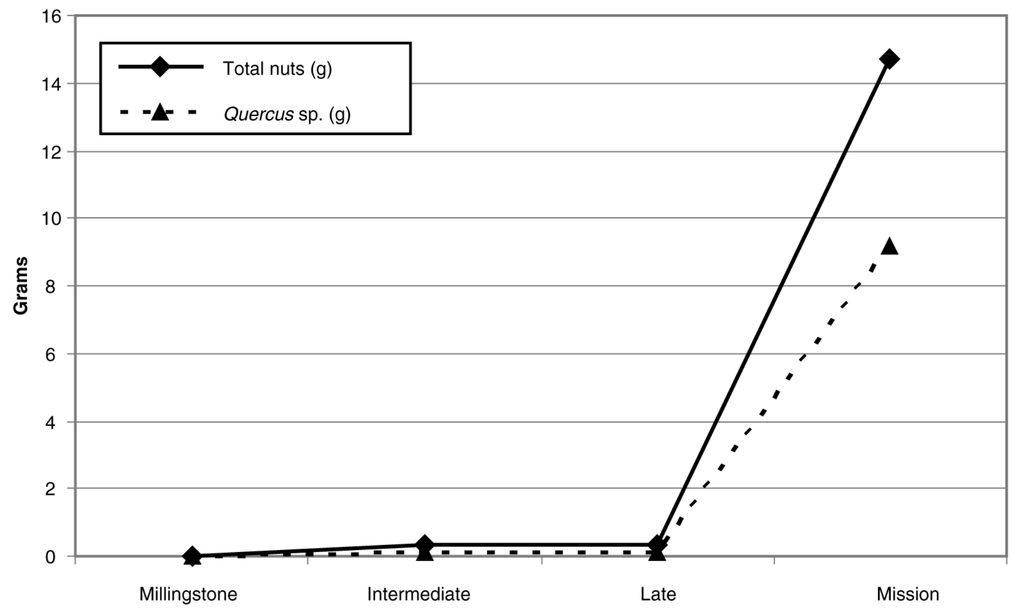

Figure 265. Distribution of nutshell over time at LAN-62.

Table 248. Old World Domesticated-Crop Seeds Recovered from LAN-62, Loci A and G

Genus/Species, by Family	Common Name	Locus A							Locus G Features	Total
		Burials	Control Units	Burial Area	FB 3	FB 4	FB 7	Sitewide		
Fabaceae										
Cicer cf. *arietinum*	chick pea	—	—	—	1	—	—	—	—	1
Pisum cf. *sativum*	garden pea	152	49	45	539	7	—	15	8	815
Poaceae										
Avena cf. *sativa*	oats	—	—	—	21	—	—	—	—	21
Hordeum vulgare	cereal barley	—	—	—	15	—	—	—	—	15
Triticum cf. *aestivum*	wheat	53	—	—	28	—	—	—	—	81
Total		205	49	45	604	7	—	15	8	933

Table 249. Charcoal Wood Identified from Select Human Burials, LAN-62, Locus A

Taxon	Common Name	Burial Feature(s)	No. of Burials
Unknown dicot		150	1
cf. Asteraceae		426	1
Conifer	unidentifiable conifer	91, 181, and 223	3
Salix sp.	willow	24, 108, 181, 185, 223, 273, 285, 312, and 426	9
Platanus racemosa	California sycamore	108, 223, 285, 364, and 426	5
cf. *Pseudotsuga*	Douglas fir	91, 108, 223, 273, 285, 312, 363, and 426	8
Pseudotsuga cf. *macrocarpa*	bigcone Douglas fir	108, 223, 273, and 426	4

Analysis of Wood Charcoal from LAN-62, by John M. Marston

Fifty-five samples of carbonized wood from 13 human burials at LAN-62, Locus A were analyzed. The 55 specific samples from the 13 burials were chosen for wood-charcoal analysis based on their size and condition (Table 249). This discussion describes the identification methods, the criteria for identification of specific taxa found in the samples, and the tentative conclusions based on the analysis.

Identification Methods

The visible transverse section of each charcoal fragment was examined with a 7.5×–75×-zoom stereomicroscope. If no clean section was available, the wood was broken by hand to reveal a new section. If the sample was evidently a single piece of charcoal originally, only a few pieces were examined, but if there was no such evidence, at least 10 fragments were examined, up to the total number of fragments in the sample. Additional diagnostic characters in the radial and tangential sections were examined at 100×–400× with an incident-light compound microscope. Wood identifications were based on comparisons with a comparative collection of experimentally carbonized California wood and with published wood atlases (Panshin and de Zeeuw 1970; Schoch et al. 2004; Schweingruber 1990). Wood anatomy generally only permits identification to the genus level, but it is possible to distinguish between the woods of different species within a genus on phytogeographic grounds (Schweingruber 1990). All specific identifications are based on phytogeography.

Identified Taxa

Analysis of the 55 samples submitted resulted in the identification of four taxa, one family, and two plant groups. They included *Pseudotsuga* cf. *macrocarpa* (bigcone Douglas fir), cf. *Pseudotsuga* (Douglas fir), *Platanus racemosa* (California sycamore), *Salix* sp. (willow), cf. Asteraceae, unknown dicot, and unknown conifers (see Table 249).

cf. Asteraceae

Only two small pieces of this wood were present in the samples from burial Feature 426, and each contained less than one complete growth ring. The distinct heartwood, tall rays, and radial pore bands of this wood resemble several shrubs within the family Asteraceae, including *Artemisia* (sagebrush), several species of which are native to coastal southern California (Hickman 1993). The small size of the preserved twigs, though, made such a specific identification impossible.

Platanus racemosa

Only one species of sycamore is native to California, *Platanus racemosa* (Hickman 1993). Fragments of wood charcoal from five burials (burial Features 108, 223, 285, 364, and 426) matched published descriptions of the genus and a comparative piece of *P. racemosa*.

Salix sp.

Wood charcoal from nine burials (burial Features 24, 108, 181, 185, 223, 273, 285, 312, and 426) were identified as *Salix* sp. Most likely species are *S. lucida* (shining willow), *S.lasiolepis* (arroyo willow), *S. laevigata* (red willow), and *S. exigua* (narrowleaf willow), which are ubiquitous in California and native to the south coast region. Also possible are *S. gooddingii* (Goodding's black willow) and *S. sitchensis* (Sitka willow), which are rarer but have been found in the south coast and the western transverse ranges of the Los Angeles basin, respectively (Hickman 1993). Individual species of willow are indistinguishable on the basis of wood anatomy (Panshin and de Zeeuw 1970; Schoch et al. 2004; Schweingruber 1990).

Pseudotsuga cf. *macrocarpa*

Wood charcoal from eight burials was identified as cf. *Pseudotsuga*, and fragments from four burials were identified as *Pseudotsuga* cf. *macrocarpa*.

The identification of this wood type had to remain relatively tentative, because comparative material of *Pseudotsuga* was not available for this investigation; so, the identification of the species cannot be confirmed. An additional complication was presented by the large number of fragments that showed clear evidence of compression wood in the latewood (the part of an annual ring of wood characterized by compact, thick-walled cells formed during the later part of the growing season), which can comprise up to 80–90 percent of the growth ring in these instances and presents an appearance similar to spiral thickenings. Although the latewood was highly compressed, delicate spiral thickenings were visible in the earlywood cells (the part of the wood in a growth ring of a tree that is produced earlier in the growing season, with larger and thinner walls than those produced later in the growing season), although some earlywood tracheids (elongated cells in vascular plants) lacked any helical thickenings or cavities entirely. This pattern has been noted in microscopic examination of *Pseudotsuga* and *Taxus* (yew) compression wood (Patel 1963; Pillow and Luxford 1937; Timell 1978). Small resin canals appearing infrequently and primarily in the latewood are also typical for *Pseudotsuga*, although the archaeological wood examined here often lacked resin canals entirely, which is unusual for the genus (Panshin and de Zeeuw 1970:474).

Fragments of charcoal with visible resin canals and thin spiral thickenings in all tracheids were recorded as *Pseudotsuga* cf. *macrocarpa*, and those without evident resin canals and with helical cavities (likely the result of compression wood) interfering with the standard pattern of spiral thickenings were recorded as cf. *Pseudotsuga*. Of the two California species of Douglas fir, *P. macrocarpa* is more likely than *Pseudotsuga menziesii* (Douglas fir), which does not grow in the Transverse Ranges of southern California and would have been less accessible than *P. macrocarpa* (Hickman 1993).

Unknown Conifer

Several pieces of coniferous wood differed substantially from the *Pseudotsuga* type at high magnification, specifically in the shape and patterning of cross-field pits visible in the radial section. These may be within the range of *Pseudotsuga* but appeared more like those of *Juniperus* (juniper). The presence of possible resin canals and relatively tall rays and a lack of intercellular spaces in the transverse section were inconsistent with published descriptions and comparative pieces of juniper. This wood also lacked spiral thickenings, making *Pseudotsuga* a less compelling option, although still perhaps the most likely candidate. This taxon was recorded as Conifer 2 and was recovered from burial Features 91, 181, and 223.

Indeterminate Dicotyledonous (Flowering Plants with Two Embryonic Leaves or Cotyledons in the Seeds) Wood

This type of wood was found only in one sample (burial Feature 150). Although a wood grain was visible on the various sides of the fragments, making it clearly an angiosperm (flowering plant), the grain was very fine and twisted, prohibiting further examination. The original piece of wood may have been knotted.

Criteria for Identification

Table 250 lists the wood-anatomy characters used to identify each taxon. The descriptions will permit reevaluation of the identifications, if necessary in the future. Distinctive characters are noted with an asterisk, and rare occurrences are in parentheses.

Interpretations and Conclusions

The wood species identified from LAN-62, Locus A, included typical coastal types (*Salix*, *Platanus*, and possible *Artemisia*) but also a surprising quantity of conifer wood, which must have come from local mountain ranges and may have been scavenged along Ballona Creek. At least some of this wood was certainly *Pseudotsuga*, presumably *P. macrocarpa*, which grows in the Transverse Ranges, close to the site of deposition. The bulk of the conifer pieces, however, belonged to an uncertain type that appeared to be the compression wood of *Pseudotsuga*.

Compression wood forms when a gymnosperm stem is subjected to a weight imbalance, resulting in lateral stress and the production of additional cells on the loaded (lower) side of the branch (Panshin and de Zeeuw 1970:288; Schweingruber et al. 2006:52–54), which cause asymmetrical growth rings with a high proportion of latewood, a less-distinct early-latewood transition, and oftentimes fewer resin canals, as noted in the samples analyzed for this project (Panshin and de Zeeuw 1970:289–291). Compression wood can appear in trunk or branch wood and is harder than normal gymnosperm wood.

Because compression-wood and normal-wood structure usually occur on opposite sides of the same lateral branch (lower and upper, respectively), their co-occurrence in many of the samples examined here may indicate the burning of whole branches in each context. It is also possible that this wood was trunk wood from a tree subjected to light or gravity stress such that it grew at an angle for a prolonged period (Schweingruber et al. 2006:54, 124).

Very few pieces of conifer charcoal examined in this study were weathered, and there was no evidence of insect burrowing present, suggesting that the wood was burned shortly after branch death. Although this might include both deliberate cutting of fuelwood and collection of dead branches, it is unlikely that this wood reached the site as driftwood. It appeared that the wood was brought to the Playa Vista area from nearby mountains by human action. The large size of many conifer pieces suggested the use of trunk and primary-branch wood, most easily harvested through the cutting of whole trees, whether living, standing deadwood, or fallen. It is likely that the activities resulting in the deposition of these charcoal remains were fuel intensive and necessitated the import of large pieces of wood from local mountain ranges.

Table 250. Criteria for Charcoal Identification

Taxon	Cross Section	Radial Section	Transverse Section
cf. Asteraceae	*Pores in radial files and groups; tangential bands of apotracheal parenchyma; *heartwood distinct.	*Rays >50 cells.	Not observed.
Platanus racemosa	*Diffuse porous, *pores small, solitary or in short radial files and groups; *rays wide, regularly spaced.	No spiral thickenings.	*Rays 5+ seriate, up to 100 cells high.
Salix sp.	*Diffuse porous, *small, solitary pores, *uniseriate rays.	*Rays with 1–2(-3) rows of (square to) upright marginal cells, no spiral thickenings.	*Rays uniseriate, 5–12 cells high, no spiral thickenings.
Pseudotsuga cf. *macrocarpa*	*Conifer, *abrupt early-latewood transition, growth ring >80 percent earlywood; *resin ducts visible, though small and infrequent; no intercellular spaces.	*Usually 3 uniseriate pits per cross-field cell, sometimes 2 pits or 4 in biseriate rows, *pits taxodioid to piceoid; tracheid pits with simple tori, mostly uniseriate; *fine spiral thickenings in all tracheids; no marginal ray tracheids, ray tracheids not nodular.	Rays uniseriate, 3–11 cells high, though most often 6–10 cells high.
cf. *Pseudotsuga* (probably compression wood)	*Conifer, gradual to abrupt early-latewood transition, *growth ring mostly latewood (50–90 percent); resin ducts small and infrequent to absent; no intercellular spaces.	*Usually 3 uniseriate pits per cross-field cell, sometimes 2 pits or 4 in biseriate rows, *pits taxodioid to piceoid; tracheid pits with simple tori, mostly uniseriate; *fine spiral thickenings in some earlywood tracheids, but often entirely absent in the earliest cells, *latewood cells highly twisted with helical cavities at a 45 degree angle or steeper; no marginal ray tracheids, ray tracheids not nodular.	Rays uniseriate, 3–11 cells high, though most often 6–10 cells high.
Conifer 2	*Conifer, gradual to abrupt early-latewood transition, mostly earlywood; a few possible small resin ducts present; no intercellular spaces.	*1–2 cupressoid-taxodiod pits per cross-field cell, often biseriate; tracheid pits with simple tori, uni- to biseriate; *no spiral thickenings.	Rays uni- (bi-)seriate, 5–15 cells high.

Note: Parentheses indicate rare occurrences. Asterisks indicate distinctive characters.

Table 251. Summary of Macrobotanical Remains Recovered from LAN-211

Context	Sediment (liters)	Charcoal		Carbonized Seeds	
		g	g/liter	n	n/liter
CU 426	429	216	0.50	17,507	41
Features outside FB1	347	0.3	0.001	586	2
Features inside FB1	179	89	0.50	26,044	145
Total	954.9	305.32	0.32	44,137	46

LAN-211

The macrobotanical collection from LAN-211 is another rich data set composed of 44,137 carbonized seeds (46 seeds per liter), parenchymatous soft tissue (n = 188), asphaltum (n = 1), grass rachises (n = 9), and several types of nutshell (Table 251).

The 51 samples were from three main contexts: one control unit (CU 426), features outside FB 1, and features inside FB 1. The overall low charcoal density (0.32 g of charcoal per liter of sediment) suggested that exposure of wood to fire was not high and that activities involving fire and wood were limited or, more likely, that such activity areas were cleaned out, leaving minimal residue in the sampled features. However, charcoal densities were variable among the three contexts. For example, the control unit and the features inside FB 1 had similar charcoal densities (0.5 g per liter), suggesting that exposure of plants to fire was higher there than in the features outside FB 1 (0.001 g per liter). Of the three contexts at the site, features inside FB 1 had the highest seed density, with 145 seeds per liter of sediment. The features outside FB 1 had a significantly lower seed density (2 seeds per liter). Intensity of plant use within LAN-211 was variable and was dependent on the context and period (as discussed below).

Site Taxonomy

The macrobotanical collection from LAN-211 was represented by 52 taxa (Table 252). The collection was dominated by seeds belonging to grass taxa, which accounted for 69.4 percent (n = 30,648) of the carbonized seeds. The carbonized-seed collection from LAN-211 had a high percentage of wetland-plant taxa (n = 32,157, or 73 percent), which is not surprising, given the nearby wetlands. The remaining 27 percent of the plants were from mixed habitats, including coastal plains and uplands. Of the three main contexts sampled for macrobotanical remains, features from inside FB 1 had an exceptionally higher frequency of grass seeds (62 percent) than the control unit (36.8 percent) and features outside FB 1 (1.2 percent).

The grasses were represented by 14 taxa, and 2 grasses, *H. pusillum* (26 percent) and *Phalaris* sp. (36 percent), accounted for 62 percent of the LAN-211 collection. Similar to that of LAN-62, the LAN-211 macrobotanical collection was akin to a specialized collection with a focus on a few plants (in this case 2 grasses). Of note is that along with grass seeds, 9 grass-rachis remains were recovered from two contexts: CU 426 and features inside FB 1. As mentioned previously, rachises are the seed-bearing parts of the grass plants. Their recovery from archaeological contexts has been used as an indication of plant processing, such as threshing and winnowing (Hillman 1981; Jones 1983; Reddy 2003). The important implications of the recovery of grass-rachis remains from both LAN-211 and LAN-62 will be discussed later in this chapter.

Legumes occurred in low frequencies (n = 3,986, or 9 percent) at LAN-211, which is surprising, given the geographical location and econiche and that legumes were an important part of aboriginal diet during the ethnohistoric period (see Table 252). Therefore, their absence from the Protohistoric and Mission period deposits at LAN-211 is surprising. The only explanation for their low frequency is that most of the legume-plant foods were consumed as green plants, well before seeding. Therefore, the likelihood of legume seeds being incorporated into the habitation deposits was minimal. The legumes recovered from LAN-211 included four native plants and two introduced plants. The native plants were *Astragalus* sp. (milkvetch), *Lupinus* sp., *Trifolium* sp., and *Vicia* sp. (wild vetch), and the three introduced plants were *Cicer* cf. *arietinum*, *Melilotus* sp., and *Pisum* cf. *sativum*.

A small fraction of the LAN-211 collection was made up of seeds of Old World domesticated crop plants, including *Cicer* sp., *Pisum* cf. *sativum*, *Hordeum vulgare*, and *Triticum* cf. *aestivum*, as well as the New World domesticate, *Zea mays*. They accounted for 1.35 percent of the collection and were recovered in varying frequencies from all three contexts. These seeds were most likely obtained by the aboriginal populations from the Spanish padres, ranchers, or residents of the pueblo.

Of the 52 taxa at LAN-211, 12 were introduced (nonnative to California): *Trianthema* cf. *portulacastrum* (desert horsepurslane), *Cicer* sp., *Melilotus* sp., *Pisum* cf. *sativum*, *Brassica* sp., *Agropyron* sp., *Avena* cf. *sativa, Dactyloctenium* sp., *Hordeum vulgare, Triticum aestivum*, *Zea mays*, and *Galium* sp. Seeds of introduced taxa accounted for 6.82 percent (n = 2,935) of the total collection from the site. *Melilotus* sp. occurred in the highest frequencies (n = 1,973, or 4.5 percent of the introduced taxa). Of the three contexts sampled at the site, CU 426 yielded the highest frequencies of introduced taxa (n = 2,303, or 78.5 percent of introduced taxa).

A large number of the carbonized seeds recovered from the site were indeterminate fragments mostly measuring 0.5–1 mm (n = 3,119, or 7 percent). Disturbance indicators, including

Table 252. Plant Taxa Represented at LAN-211

Genus/Species, by Family	CU 426	All Features	Total	Percent
Unidentified seed fragments	1,357	1,758	3,115	7
Unknown seeds	28	18	46	0.1
Aizoaceae				
Trianthema cf. *portulacastrum*	2	18	20	0.05
Alismataceae				
cf. *Sagittaria* sp.	—	17	17	0.04
Amaranthaceae				
Amaranthus sp.	245	49	294	1
Anacardiaceae				
Rhus sp.	—	24	24	0.1
Asteraceae				
Unknown fragments	2	2	4	0.01
Ambrosia sp.	8	3	11	0.02
Hemizonia sp.	23	29	52	0.1
Layia cf. *platyglossa*	43	51	94	0.2
cf. *Taraxacum* type	—	3	3	0.01
Brassicaceae				
Lepidium sp.	41	17	58	0.1
Boraginaceae				
Amsinckia sp.	104	206	310	1
Caprifoliaceae				
Sambucus cf. *nigra* ssp. *canadensis*	10	24	34	0.1
Chenopodiaceae				
Chenopodium sp.	244	270	514	1.2
Cyperaceae				
Cyperus sp.	10	38	48	0.1
Schoenoplectus [*Scirpus*] cf. *californicus*	591	404	995	2.3
Ericaceae				
Arctostaphylos sp.	39	3	42	0.1
Fabaceae				
Unknown	37	181	218	0.5
Cicer cf. *arietinum*	21	11	32	0.1
cf. *Astragalus* sp.	22	1	23	0.1
Lupinus sp.	109	10	119	0.3
Melilotus sp.	1,514	459	1,973	4.5
Pisum cf. *sativum*	99	64	163	0.4
Trifolium sp.	18	1,141	1,159	2.6
Vicia sp.	277	22	299	1
Juncaceae				
Juncus sp.	—	25	25	0.1
Lamiaceae				
Salvia cf. *apiana*	1,091	1,716	2,807	6.4
Malvaceae				
Unknown	2	—	2	0.005
Menispermaceae				
cf. *Menispermum* type	1	—	1	0.002

Genus/Species, by Family	CU 426	All Features	Total	Percent
Onagraceae				
Clarkia cf. *purpurea*	166	195	361	1
Papaveraceae				
Papaver sp.	—	1	1	0.002
Poaceae				
Unknown fragments	124	372	496	1.1
cf. *Agropyron* sp.	272	34	306	0.7
Agrostis cf. *exarata*	—	135	135	0.3
Avena cf. *sativa*	5	5	10	0.02
Bromus cf. *carinatus*	1	54	55	0.1
cf. *Dactyloctenium* sp.	3	21	24	0.1
Deschampsia cf. *danthonioides*	126	782	908	2.1
Hordeum pusillum	4,490	6,924	11,414	25.9
Hordeum vulgare	114	3	117	0.3
Leptochloa sp.	—	114	114	0.3
Lolium cf. *temulentum*	—	151	151	0.3
Phalaris sp.	5,569	10,255	15,824	35.9
Stipa sp.	289	531	820	1.9
Triticum cf. *aestivum*	263	1	264	0.6
Zea mays	10	—	10	0.02
Plantaginaceae				
Plantago cf. *erecta*	3	20	23	0.1
Polygonaceae				
Polygonum sp.	34	52	86	0.2
Rumex sp.	6	10	16	0.04
Portulacaceae				
Calandrinia cf. *breweri*	87	38	125	0.3
Rosaceae				
Heteromeles sp.	7	3	10	0.02
Rubiaceae				
Galium sp.	—	15	15	0.03
Violaceae				
Viola sp.	—	350	350	0.8
Total	17,507	26,630	44,137	100.0
Parenchymatous soft tissue	119	69	188	
Asphaltum	1		1	
Poaceae rachises	8	1	9	
Cucurbitaceae				
Marah sp.	132	47 (0.14g)	255 (0.14g)	
Fagaceae				
Quercus sp.	4	76 (0.63g)	80 (0.63g)	
Quercus attachments	7	2 (0.06g)	9 (0.06g)	
Juglandaceae				
Juglans sp.	13	12 (0.1g)	25 (0.1g)	
Rosaceae				
Prunus cf. *virginiana*	69 (0.14g)		69 (0.14g)	
Unidentifiable nut fragments	19	63 (0.11g)	82 (0.11g)	

rodent droppings, insect plants, land snail, uncarbonized seeds, and fresh rootlets, were observed in the samples and varied greatly among them.

Apart from seeds, the macrobotanical collection also included nutshell, nut meats, a single asphaltum fragment, and parenchyma tissue. A range of nutshell and nut meats was recovered, including *Marah* sp., *Quercus* sp. (nutshell and attachments), *Juglans* sp., *Prunus* sp., and unidentifiable nutshell fragments. The *Quercus* sp. was probably *Quercus agrifolia* and/or *Quercus wislizeni*.

Soft-plant-tissue remains recovered in varying quantities from the three contexts were most likely parenchymatous, including vegetative storage organs, such as root and stem storage parts. Soft-tissue fragments occurred in low frequency and were outnumbered by seeds.

Ubiquity (percentage of samples in which a taxon is present) measurements indicated that specific plants had higher ubiquity values. Ubiquity (presence) is used to evaluate the level of use of a particular taxon. Therefore, a higher ubiquity suggests higher use. Grasses occurred in 84 percent of the samples; legumes had a lower ubiquity of 68 percent (Appendix L.14.9). In particular, two grasses, *Phalaris* sp. and *H. pusillum*, had the highest ubiquity values (80 and 72 percent, respectively). Other taxa with moderate ubiquity values included *Amsinckia* sp. (fiddleneck) (60 percent), *Chenopodium* sp. (64 percent), *Clarkia* cf. *purpurea* (46 percent), *Hemizonia* sp. (28 percent), *Layia* cf. *platyglossa* (26 percent), *Salvia* cf. *apiana* (62 percent), *Schoenoplectus* cf. *californicus* (76 percent), and *Stipa* sp. (66 percent). *Quercus* sp. (acorns) was recovered from 18 percent of the samples and had the highest ubiquity of all nutshell and nut meats. Seeds belonging to domesticated crops were recovered from 28 percent of the samples, which suggests that although they were not a dominant plant resource, they were not sparse, either.

Control Unit

Samples from one control unit were analyzed for macrobotanical remains. CU 426 was located within the main feature block at the site and was used as the control for macrobotanical remains in the midden at the site. The control unit included Mission, Late, and Intermediate period deposits: Levels 60–63 were Mission period; Levels 64–69 were Late period; and Levels 70–75 were Intermediate period.

CU 426

CU 426 yielded 17,507 carbonized seeds (41 seeds per liter) and 216.3 g of charcoal (0.5 g per liter) (Table 253). The collection was represented by 43 taxa, and seeds of 2 taxa accounted for more than half the collection: *Phalaris* sp. (31.8 percent) and *H. pusillum* (25.6 percent). All the taxa recovered from the control unit were from habitats within the daily catchment of the site. Overall, grasses dominated the collection and accounted for 64.4 percent of the seeds with legumes (12 percent) in lower frequencies.

The majority of the collection included wetland taxa (66.2 percent). The carbonized seeds included berries of *Arctostaphylos* sp. and *Sambucus* sp. in very low frequencies. These were most likely incidental or opportunistic foods collected during foraging outings.

The carbonized-seed collection also included nine taxa of introduced plants, of which four were wild plants and six were domesticated plants. The four introduced wild plants included *Trianthema* cf. *portulacastrum* (a common weedy plant associated with crop fields in the Old World), *Melilotus* sp., cf. *Agropyron* sp., and cf. *Dactyloctenium* sp. These seeds were recovered from the smaller sieves (1–2 mm and 0.5–1 mm) in Mission and Late period deposits. The six introduced domesticated plants included *Cicer* cf. *arietinum*, *Pisum* cf. *sativum*, *Avena* cf. *sativa*, *Hordeum vulgare*, *Triticum* cf. *aestivum*, and *Zea mays* (see Table 253). Note that 8 (of the 21) seeds of *Cicer* cf. *arietinum* and 2 (of the 5) seeds of *Avena* cf. *sativa* were intrusive into the Late period deposits of CU 426 (in Level 64, the first level of the Late period). In other words, the recovery of the 10 domesticated-plant seeds from the uppermost level of the Late period was indicative of vertical disturbance in the unit.

In addition to the carbonized seeds, the collection also included outer-shell fragments of *Marah* sp. (132, 0.44 g), nutshell and attachment fragments of *Quercus* sp., nutshell fragments of *Juglans* sp. and *Prunus* cf. *virginiana* (common chokecherry), and indeterminate nutshell fragments (42, 0.15 g). Parenchymatous soft tissue (likely to be root or stem tubers/corms) was recovered, along with grass rachises (n = 8).

Temporal Patterns in CU 426

The collections from the three chronologically distinct deposits in the unit indicated that there was change in plant use over time. The Intermediate period component in CU 426 comprised nine carbonized seeds (0.05 percent of seeds in the collection). The meager remains and the very low seed density (0.05 seeds per liter) suggested low use of seed-bearing plants or poor organic preservation.

The Late period component in the unit yielded 4,162 carbonized seeds (24 percent of the collection from the unit) and had a seed density of 21 seeds per liter. The collection was dominated primarily by grasses (75 percent) and legumes (18.5 percent) (see Table 253). Parenchymatous soft tissue and a range of nutshell were also recovered. Plant use increased considerably in the Late period from the previous Intermediate period. But note that some of the material in the Late period contexts could have been intrusive from the Mission period deposits.

The Mission period deposits in CU 426 yielded 13,336 carbonized seeds (76 percent of the collection), parenchymatous soft tissue, grass rachises, and nutshell. The carbonized-seed collection included grasses (61 percent) and legumes (10 percent). The grasses were represented by 11 taxa, of which 2 occurred in higher frequencies: *Phalaris* sp. (28 percent) and *H. pusillum* (25 percent). The 11 grass taxa also included 3 Old World domesticates and 1 New World domesticate.

Table 253. Macrobotanical Remains Recovered from CU 426, LAN-211, by Temporal Period

Genus/Species, by Family	Mission		Late		Intermediate		Total	
	n	%	n	%	n	%	n	%
Unidentified seed fragments	1,261	9.5	94	2.3	2	22.2	1,357	7.8
Unknown seeds	26	0.2	2	0.05	—	0.0	28	0.2
Aizoaceae								
Trianthema cf. *portulacastrum*	2	0.01	—	0.0	—	0.0	2	0.01
Amaranthaceae								
Amaranthus sp.	242	1.8	3	0.1	—	0.0	245	1.4
Asteraceae								
Unknown fragments	2	0.01	—	0.0	—	0.0	2	0.01
Ambrosia sp.	7	0.1	1	0.02	—	0.0	8	0.05
Hemizonia sp.	23	0.2	—	0.0	—	0.0	23	0.1
Layia cf. *platyglossa*	23	0.2	20	0.5	—	0.0	43	0.2
Brassicaceae								
Lepidium sp.	41	0.3	—	0.0	—	0.0	41	0.2
Boraginaceae								
Amsinckia sp.	76	0.6	27	0.6	1	11.1	104	0.6
Caprifoliaceae								
Sambucus cf. *nigra* ssp. *canadensis*	8	0.1	2	0.05	—	0.0	10	0.1
Chenopodiaceae								
Chenopodium sp.	238	1.8	6	0.1	—	0.0	244	1.4
Cyperaceae								
Cyperus sp.	10	0.1	—	0.0	—	0.0	10	0.1
Schoenoplectus [*Scirpus*] cf. *californicus*	537	4.0	52	1.2	2	22.2	591	3.4
Ericaceae								
Arctostaphylos sp.	30	0.2	9	0.2	—	0.0	39	0.2
Fabaceae								
Unknown	28	0.2	9	0.2	—	0.0	37	0.2
Cicer cf. *arietinum*	13	0.1	8	0.2	—	0.0	21	0.1
cf. *Astragalus* sp.	—	0.0	21	0.5	1	11.1	22	0.1
Lupinus sp.	109	0.8	—	0.0	—	0.0	109	0.6
Melilotus sp.	826	6.2	688	16.5	—	0.0	1,514	8.6
Pisum cf. *sativum*	99	0.7	—	0.0	—	0.0	99	0.6
Trifolium sp.	—	0.0	18	0.4	—	0.0	18	0.1
Vicia sp.	251	1.9	26	0.6	—	0.0	277	1.6
Lamiaceae								
Salvia cf. *apiana*	1,049	7.9	42	1.0	—	0.0	1,091	6.2
Malvaceae								
Unknown	2	0.01	—	0.0	—	0.0	2	0.01
Menispermaceae								
cf. *Menispermum* type	1	0.01	—	0.0	—	0.0	1	0.01
Onagraceae								
Clarkia cf. *purpurea*	162	1.2	4	0.1	—	0.0	166	0.9

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Genus/Species, by Family	Mission		Late		Intermediate		Total	
	n	%	n	%	n	%	n	%
Poaceae								
Unknown fragments	106	0.8	18	0.4	—	0.0	124	0.7
cf. *Agropyron* sp.	262	2.0	10	0.2	—	0.0	272	1.6
Avena cf. *sativa*	3	0.02	2	0.05	—	0.0	5	0.03
Bromus cf. *carinatus*	1	0.01	—	0.0	—	0.0	1	0.01
cf. *Dactyloctenium* sp.	3	0.02	—	0.0	—	0.0	3	0.02
Deschampsia cf. *danthonioides*	126	0.9	—	0.0	—	0.0	126	0.7
Hordeum pusillum	3,292	24.7	1,198	28.8	—	0.0	4,490	25.6
Hordeum vulgare	114	0.9	—	0.0	—	0.0	114	0.7
Phalaris sp.	3,736	28.0	1,830	44.0	3	33.3	5,569	31.8
Stipa sp.	222	1.7	67	1.6	—	0.0	289	1.7
Triticum cf. *aestivum*	263	2.0	—	0.0	—	0.0	263	1.5
Zea mays	10	0.1	—	0.0	—	0.0	10	0.1
Plantaginaceae								
Plantago cf. *erecta*	3	0.02	—	0.0	—	0.0	3	0.02
Polygonaceae								
Polygonum sp.	34	0.3	—	0.0	—	0.0	34	0.2
Rumex sp.	5	0.04	1	0.02	—	0.0	6	0.03
Portulacaceae								
Calandrinia cf. *breweri*	83	0.6	4	0.1	—	0.0	87	0.5
Rosaceae								
Heteromeles sp.	7	0.1	—	0.0	—	0.0	7	0.04
Total	13,336	100.0	4,162	100.0	9	100.0	17,507	100.0
Parenchymatous tissue	88		31				119	
Poaceae rachises	8						8	
Nutshell								
Cucurbitaceae								
Marah sp.	84 (0.26g)		48 (0.18g)		—		132 (0.44g)	
Fagaceae								
Quercus sp.	—		4 (0.02g)		—		4 (0.02g)	
Quercus attachments	5 (0.03g)		2 (0.01g)		—		7 (0.04g)	
Juglandaceae								
Juglans sp.	13 (0.04g)		—		—		13 (0.04g)	
Rosaceae								
Prunus cf. *virginiana*	69 (0.14g)		—		—		69 (0.14g)	
Unidentifiable nut fragments	12 (0.06g)		11 (0.04g)		19 (0.05g)		42 (0.15g)	
Sediment floated (liters)	43		196.5		189.5		429	
Seed density (n/liter)	310		21		0.05		41	
Charcoal (g)	172		44.2		0.1		216.3	
Charcoal density (g/liter)	4		0.2		0.001		0.50	

The Mission period collection was diverse and had the highest number of taxa, although the two grasses continued to dominate the collection. The nutshell fragments from the Mission period deposits included those of *Marah* sp., *Quercus* sp., *Juglans* sp., and *Prunus* sp. and unidentifiable fragments. Comparatively, higher amounts of nutshell fragments were recovered from the Mission period deposits.

Temporal associations in the macrobotanical collection from CU 426 at LAN-211 illustrated the following patterns:

- First, seed and charcoal density increased dramatically over time, particularly so in the Mission period, indicating a significantly higher plant-use index and better preservation of organic remains.

- Overall, grass use was a continued trend, and grasses occurred in high frequencies within the unit across time (64.4 percent). Furthermore, grass use increased over time (relative frequencies increased from early to late), and the focus of exploitation was on two particular grasses (*Phalaris* sp. and *H. pusillum*).

- Grass rachises were recovered only from the Mission period deposits. Recovery of these macrobotanical remains from archaeological sites is strong evidence of on-site plant processing and has wider implications for subsistence systems as they relate to logistical planning.

- Legumes were recovered from all deposits and occurred in higher relative frequencies in the Intermediate and Late period deposits and in much lower relative frequencies in Mission period deposits.

- Parenchyma tissue was recovered exclusively from Late and Mission period deposits.

- Wetland taxa accounted for 66 percent of the collection from the unit. There was a long-term change in exploitation of wetland taxa from the Intermediate period to the Mission period, with the highest usage in the Late period and the lowest in the Intermediate period (when wetland habitats were at their peak). A similar pattern (of lower frequencies of wetland-taxa seeds in the Intermediate period) was noted at LAN-62. It is also very likely that non-seed-bearing parts of the plants (which leave very few traces in the archaeological record) were exploited during the Intermediate period.

- The lower seed densities in the Intermediate and Millingstone period deposits could be due to lower plant use or due to poor preservation of organic materials in the Ballona. However, note that similar sediments (age and context) in parts of coastal central California have yielded macrobotanical remains (Hildebrandt and Mikkelsen 1993; Wohlgemuth 1996, 2002; among others).

Features outside FB 1

Three features outside FB 1 were sampled for macrobotanical remains (see Chapter 1, this volume, for details on FB 1). The features included Feature 2 (an artifact concentration), Feature 11 (a pit), and Feature 15 (a rock cluster). Feature 2 dated to the Mission period, and Features 11 and 15 were Intermediate period features. Feature 2 had a higher seed density (6 seeds per liter) than did Features 11 and 15 (0.2 per liter) (Table 254; Appendix L.14.10). Charcoal was recovered in very low quantities, only from Feature 2.

Artifact Concentration

Feature 2, a moderately dense artifact concentration that spanned two 1-by-1-m test pits, yielded large quantities of marine shell and faunal bone (mammal, bird, bony fish, and reptile). A small number of FAR pieces were present in the feature, but direct evidence of in situ thermal activity (sediment oxidation and large charcoal pieces) was absent. Small quantities of utilized flakes and expedient flaked stone tools and a moderate quantity of flaked stone debitage were recovered from Feature 2. Based on the high quantities of faunal remains (vertebrate and invertebrate) and macrobotanical remains, the range of artifacts, and the darker sediment in the feature fill, it is likely that Feature 2 may have been the remnants of food-consumption and -disposal activities. The very low charcoal density (0.003 g per liter) did not support hearth cleanouts or hearth remnants; instead, the feature was more likely the residue of food-dumping activities.

The macrobotanical collection from Feature 2 comprised 524 carbonized seeds, parenchymatous soft tissue, and unidentifiable nut fragments (see Table 254). Grasses accounted for two-thirds (66.6 percent) of the seed collection, and *Phalaris* sp. (43 percent) and *H. pusillum* (19 percent) dominated the grasses. In addition, *Phalaris* sp. occurred in the highest frequencies of all taxa.

Pit

Feature 11, a pit with a deep, basin-shaped profile, was distinct with its dark, clay-rich sediment. The feature dated to the Intermediate period but contained approximately a dozen ceramic fragments, which suggests a historical-period age. It also yielded high quantities of vertebrate remains (mammals, bony fish, birds, and reptiles). A moderate quantity of flaked stone debitage and utilized flakes was also recovered. Patches of mottled, light-colored clay and intermittent pockets of ashy sediment were observed throughout the fill. Toward the bottom of the feature, there was a sharp increase in clay content, immediately below a layer of carbonized plant material. The collection did not indicate plant-processing refuse or consumption remains, given the low density and generalized collection (relative to the other features). The macrobotanical

Table 254. Macrobotanical Remains Recovered from Features outside FB 1, LAN-211

Genus/Species, by Family	Feature 2 (Artifact Concentration)	Feature 11 (Pit)	Feature 15 (Rock Cluster)	Total
Unidentified seed fragments	58	12	7	77
Asteraceae				
Hemizonia sp.	2	—	—	2
Boraginaceae				
Amsinckia sp.	4	2	—	6
Caprifoliaceae				
Sambucus cf. *nigra* ssp. *canadensis*	2	—	—	2
Chenopodiaceae				
Chenopodium sp.	24	4	2	30
Cyperaceae				
Schoenoplectus [*Scirpus*] cf. *californicus*	7	2	1	10
Fabaceae				
Melilotus sp.	4	1	2	7
Pisum cf. *sativum*	3	—	—	3
Trifolium sp.	34	—	—	34
Vicia sp.	—	1	—	1
Lamiaceae				
Salvia cf. *apiana*	9	—	—	9
Onagraceae				
Clarkia cf. *purpurea*	22	3	2	27
Poaceae				
Unknown fragments	6	6	—	12
cf. *Agropyron* sp.	—	1	—	1
Deschampsia cf. *danthonioides*	1	—	1	2
Hordeum pusillum	102	9	1	112
Lolium cf. *temulentum*	11	—	—	11
Phalaris sp.	226	4	—	230
Stipa sp.	3	—	—	3
Portulacaceae				
Calandrinia cf. *breweri*	6	—	1	7
Total	524	45	17	586
Parenchymatous soft tissue	4 (<0.01g)			4 (<0.01g)
Unidentifiable nut fragments	6 (<0.01g)			6 (<0.01g)
Sediment analyzed (liters)	87.5	184.2	75.2	346.9
Charcoal (g)	0.3			0.3
Charcoal density (g/liter)	0.003			0.001
Carbonized-seed density (n/liter)	6.0	0.2	0.2	2

Note: Feature 2 is Mission period; Features 11 and 15 are Intermediate period.

collection from Feature 11 was relatively generalized, with no single taxon dominant (see Table 254).

Rock Cluster

Feature 15 was a moderately dense rock cluster that spanned six 1-by-1-m test pits. The feature was dated to the Intermediate period, and it yielded a small number of unshaped and unmodified cobbles that had been thermally altered. In addition, moderate amounts of flaked stone debitage, unworked and worked bone, and marine shell were also recovered. The absence of oxidized sediment and the lack of charcoal suggested that this feature was not a center of in situ thermal activity. The collection indicated that Feature 15 was not a hearth cleanout, given the absence of charcoal (even in trace quantities); instead, it could have been a discard area of which plants were not a significant component, based on the very low seed density of 0.2 seeds per liter. Alternatively, given that this feature was dated to the Intermediate period, organic preservation may have been a determining factor. The macrobotanical collection from Feature 15 was not distinctive and was akin to that associated with a general habitation midden (see Table 254).

Summary: Outside FB 1

The three features outside FB 1, of three feature types, were characterized by a relatively high variation in seed density; the highest density was associated with the artifact concentration (6 seeds per liter), and the pit and rock cluster had similar low densities (0.2 per liter). Whether this was related to feature type or general variability in seed densities between features could not be discerned, because macrobotanical remains from only one feature of each feature type were analyzed. In addition, the three features were temporally distinct; the artifact concentration (Feature 2) dated to Mission period, and the other two were Intermediate period features.

Based on the plant remains recovered from the three features, refuse disposal is the best interpretation of feature function for all three features. Plant use/disposal was most prevalent in activities associated with the artifact concentration, and the collections from the pit and rock cluster were more akin to those of a generalized midden. Continuing with the general theme noted in the Mission period deposits in the control unit, grasses were important in the Mission period artifact concentration, in particular *Phalaris* sp. (43 percent). In general, grasses accounted for 63.3 percent of the collection from the three features outside FB 1 and were the primary plant group disposed of, both within features and in the midden, suggesting that they were the most important plants used by occupants, regardless of time.

Inside FB 1

Seven features inside FB 1 were sampled for macrobotanical remains: five hearths and two rock clusters (Table 255; see Appendix L.14.10). In total, 26,044 carbonized seeds (145 seeds per liter) were recovered from these seven features. The macrobotanical collection from the seven features was represented by 49 taxa, including 5 that are domesticated plants. All seven features postdated cal A.D. 1540; five dated sometime between the Protohistoric and Mission periods (A.D. 1540–1830), and two, Features 8 (a hearth) and 13 (a rock cluster), dated to the Mission period (A.D. 1770–1830). Because of temporal overlap, discussions of temporal change in plant use will remain conjectural.

Hearths

Five features interpreted as hearths were sampled for macrobotanical remains and yielded 23,651 carbonized seeds; parenchymatous soft tissue; grass rachises; fragments of *Marah* sp., *Quercus* sp. nutshell and attachment fragments, and *Juglans* sp. nutshell; and unidentifiable nut fragments (see Table 255).

These five features were distributed across FB 1, and four of them (Features 4, 8, 14, and 21) were dense collections of diverse artifacts and faunal and floral materials along with fire-affected ground stone and FAR. The fill of four features contained oxidized sediments with ash and moderate to high charcoal. Vertebrate remains, some of which had been calcified and burned, were the majority of the cultural materials in these features. The recovery of Cottonwood points, debitage, and other flaked lithic artifacts suggested secondary use of the hearths as discard areas after their uses as hearths had been exhausted. Feature 51, the fifth hearth, was distinct from the other four in that although there was a large amount of oxidized sediment in the feature, significantly lower quantities of artifacts were recovered. But faunal remains were consistently abundant. The feature fill consisted of various layers of oxidized sediment mixed with sand; charcoal was not observed in the fill. The macrobotanical remains from the five hearths reflected these patterns. For example, Feature 51 had the lowest seed density (9 per liter) and no charcoal.

As a group, the five hearths had a range of seed densities from a low of 9 seeds per liter (Feature 51) to a high of 262 seeds per liter (Feature 21) (see Table 255). The collection was represented by 49 taxa, and grass seeds accounted for 72.5 percent. In particular, *Phalaris* sp. was recovered in the highest frequencies (36.7 percent). Seeds of five domesticates were also recovered. Although they occurred in very low frequencies (0.3 percent), their recovery was very important to understanding the interactions between the aboriginal populations and the European settlements (missions and ranchos). Of the five hearths, two features (Features 4 and 21) had the

Table 255. Macrobotanical Remains Recovered from Features inside FB 1, LAN-211

Genus/Species, by Family	Rock Clusters			Hearths						Total
	Feature 5	Feature 13	Total	Feature 4	Feature 8	Feature 14	Feature 21	Feature 51	Total	
Unidentified seed fragments	83	97	180	871	43	177	387	23	1,501	1,681
Unknown	—	—	—	—	—	—	—	1	1	1
Woody seed	—	—	—	14	—	—	3	—	17	17
Aizoaceae										
Trianthema cf. *portulacastrum*	1	—	1	—	5	1	11	—	17	18
Alismataceae										
cf. *Sagittaria* sp.	—	—	—	—	—	—	17	—	17	17
Amaranthaceae										
Amaranthus sp.	—	—	—	15	—	—	34	—	49	49
Anacardiaceae										
Rhus sp.	—	—	—	23	—	1	—	—	24	24
Asteraceae										
Unknown fragments	—	—	—	1	—	—	—	1	2	2
Ambrosia sp.	—	—	—	1	—	1	—	1	3	3
Hemizonia sp.	—	1	1	12	—	2	11	1	26	27
Layia cf. *platyglossa*	3	—	3	—	—	1	44	3	48	51
cf. *Taraxacum* type	—	—	—	3	—	—	—	—	3	3
Boraginaceae										
Amsinckia sp.	2	7	9	41	4	13	133	—	191	200
Brassicaceae										
Lepidium sp.	—	3	3	1	—	—	13	—	14	17
Caprifoliaceae										
Sambucus cf. *nigra* ssp. *canadensis*	—	3	3	4	—	2	13	—	19	22
Chenopodiaceae										
Chenopodium sp.	1	8	9	72	9	28	120	2	231	240
Cyperaceae										
Cyperus sp.	—	—	—	11	3	1	23	—	38	38
Schoenoplectus [*Scirpus*] cf. *californicus*	14	31	45	191	30	35	80	13	349	394
Ericaceae										
Arctostaphylos sp.	—	—	—	—	—	1	2	—	3	3

Genus/Species, by Family	Rock Clusters			Hearths						Total
	Feature 5	Feature 13	Total	Feature 4	Feature 8	Feature 14	Feature 21	Feature 51	Total	
Fabaceae										
Unknown	—	4	4	80	3	12	82	—	177	181
Cicer cf. *arietinum*	—	—	—	11	—	—	—	—	11	11
cf. *Astragalus* sp.	—	—	—	1	—	—	—	—	1	1
Lupinus sp.	—	—	—	—	—	—	10	—	10	10
Melilotus sp.	57	63	120	72	4	60	195	1	332	452
Pisum cf. *sativum*	—	13	13	22	1	5	20	—	48	61
Trifolium sp.	—	31	31	301	8	55	705	7	1,076	1,107
Vicia sp.	19	—	19	2	—	—	—	—	2	21
Juncaceae										
Juncus sp.	—	5	5	18	2	—	—	—	20	25
Lamiaceae										
Salvia cf. *apiana*	8	67	75	665	45	121	801	—	1,632	1,707
Onagraceae										
Clarkia cf. *purpurea*	—	13	13	87	—	33	31	4	155	168
Papaveraceae										
Papaver sp.	—	—	—	—	—	—	1	—	1	1
Poaceae										
Unknown fragments	25	16	41	61	6	86	163	3	319	360
cf. *Agropyron* sp.	—	6	6	9	4	14	—	—	27	33
Agrostis cf. *exarata*	—	—	—	11	—	—	124	—	135	135
Avena cf. *sativa*	—	—	—	5	—	—	—	—	5	5
Bromus cf. *carinatus*	—	3	3	2	—	7	42	—	51	54
cf. *Dactyloctenium* sp.	—	—	—	21	—	—	—	—	21	21
Deschampsia cf. *danthonioides*	—	—	—	438	2	42	298	—	780	780
Hordeum pusillum	123	309	432	1,591	60	568	4,153	8	6,380	6,812
Hordeum vulgare	—	1	1	2	—	—	—	—	2	3
Leptochloa sp.	—	—	—	31	—	—	83	—	114	114
Lolium cf. *temulentum*	—	—	—	140	—	—	—	—	140	140
Phalaris sp.	853	505	1,358	1,154	111	369	7,018	15	8,667	10,025
Stipa sp.	8	6	14	134	19	24	337	—	514	528
Triticum cf. *aestivum*	—	—	—	1	—	—	—	—	1	1

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Genus/Species, by Family	Rock Clusters			Hearths						Total
	Feature 5	Feature 13	Total	Feature 4	Feature 8	Feature 14	Feature 21	Feature 51	Total	
Plantaginaceae										
Plantago cf. *erecta*	—	—	—	11	—	—	9	—	20	20
Polygonaceae										
Polygonum sp.	—	1	1	44	2	—	5	—	51	52
Rumex sp.	—	1	1	1	—	4	3	1	9	10
Portulacaceae										
Calandrinia cf. *breweri*	—	1	1	7	19	2	2	—	30	31
Rosaceae										
Heteromeles sp.	—	1	1	1	—	1	—	—	2	3
Rubiaceae										
Galium sp.	—	—	—	12	—	—	3	—	15	15
Violaceae										
Viola sp.	—	—	—	17	—	5	326	2	350	350
Total	1,197	1,196	2,393	6,212	380	1,671	15,302	86	23,651	26,044
Parenchymatous soft tissue	11	—	11	19	1	1	33	—	54	65
Poaceae rachises	—	—	—	—	—	—	1	—	1	1
Cucurbitaceae										
Marah sp.	8 (0.01g)	16 (0.03g)	24 (0.04g)	14(0.04g)	—	1 (<0.01g)	8 (0.05g)	—	23 (0.1g)	47 (0.14g)
Fagaceae										
Quercus sp.	—	—	—	9 (0.06g)	—	—	67 (0.57g)	—	76 (0.63g)	76 (0.63g)
Quercus attachments	—	—	—	2 (0.06g)	—	—	—	—	2 (0.06g)	2 (0.06g)
Juglandaceae										
Juglans sp.	—	5 (0.03g)	5 (0.03g)	4 (0.03g)	—	—	3 (0.04g)	—	7 (0.07g)	12 (0.1g)
Unidentifiable nut fragments	—	23 (0.03g)	23 (0.03g)	12(0.03g)	—	9 (0.01g)	15 (0.03g)	—	36 (0.07g)	59 (0.1g)
Sediment analyzed (liters)	10	17.5	27.5	55.5	3	24.6	58.4	10	151.5	179
Charcoal (g)	1.3	3.72	5.02	30.6	1.4	4	48.2	—	84.16	89.18
Charcoal density (g/liter)	0.13	0.2	0.2	0.55	0.47	0.16	0.8	—	0.6	0.50
Carbonized-seed density (n/liter)	120	68	87	112	127	68	262	9	156	145

Note: Features 8 and 13 are Mission period; Features 4, 5, 14, 21, and 51 are Protohistoric period.

higher frequencies of these domesticates, and Feature 51 did not yield any domesticates. Feature 8 was the only hearth that was temporally distinct: it was a Mission period feature; the others dated to somewhere between the Protohistoric and Mission periods. The macrobotanical collection from Feature 8 was distinctive from those of the other four features in that only a single domesticated plant seed (*Pisum* cf. *sativum*) was recovered and no nutshell fragments were recovered.

In terms of plant processing and disposal associated with these hearths, seeds were the primary plant foods utilized at these features. However, roots, tubers, and *Marah* sp. were also being roasted or boiled, as evidenced by the recovery of parenchymatous soft tissue from four of the five hearths. The source of the nutshell fragments could be disposal and/or parching before processing (for example, shelling of *Juglans* sp.). Carbonized seeds in all the features were dominated by grasses—in particular, *Phalaris* sp. (Features 4 and 14) or *H. pusillum* (Features 8, 21, and 51). The source of the carbonized seeds, particularly the grasses, was very likely spillage during preparation (parching to dehusk grains or roasting grain before grinding).

Rock Clusters

The two rock clusters were similar in morphology and contents in that they were both clusters of a small amount of FAR, large quantities of vertebrate remains, and smaller numbers of shell and lithic artifacts. The majority of the vertebrate remains had been burned. The fill of both features was composed of dark, charcoal-stained sediment. Feature 5 was dated to between the Protohistoric and Mission periods, and Feature 13 was a Mission period feature. Macrobotanical remains from two rock clusters were recovered and included 2,393 carbonized seeds, of which grasses accounted for 77.5 percent (slightly higher than in the hearths); *Phalaris* sp. and *H. pusillum* dominated the collection. Seeds of Old World domesticates (*Pisum* cf. *sativum* and *Hordeum vulgare*) also were recovered from Feature 13.

The collections from the two features were distinct in terms of a higher recovery of nutshell fragments from Feature 13 and a higher seed density in Feature 5, especially grasses (84 percent in Feature 5 and 70.7 percent in Feature 13). There were also notable differences in the frequencies of *Phalaris* sp. and *H. pusillum* in the two features. In Feature 5, *Phalaris* sp. dominated (71.3 percent), and *H. pusillum* occurred in lower frequencies (10.3 percent). *Phalaris* sp. was less abundant (42 percent) in Feature 13, and *H. pusillum* was slightly more abundant (26 percent). These differences could be a function of time or space, and given that macrobotanical remains from only two rock clusters were analyzed, these patterns could not be discerned rigorously.

Summary: Inside FB 1

The macrobotanical collection from the seven features inside FB 1 revealed several intriguing distinctions based on context and temporal association. Note that all seven features were post-contact. First, the seed densities in the hearth were statistically different from those of the rock clusters (regardless of time). Plant disposal was higher in the hearth features, most likely spillage during food processing and/or preparation. Furthermore, the temperatures in the hearths were optimal for seed carbonization and preservation. The original sources of the seeds recovered from the hearths were primarily food related; in other words, seeds used as food, based on the dominance of particular plant taxa, were accidentally spilled into the hearth. The sources of the seeds in the rock clusters were similar. The rock clusters were most likely the debris from hearth cleanouts (based on the FAR and burned faunal remains), and the associated seeds represented spillage into the hearths during food processing.

Second, there was a temporal distinction in plant use between strictly Mission period features and those dated to the Protohistoric to Mission period. Seed density in Mission period features within FB 1 was 77 seeds per liter, compared to 154 seeds per liter in the Protohistoric to Mission period features. The significantly higher plant use ($\chi^2 = 759.7$; $df = 1$; $p < .001$) in the Protohistoric to Mission period than in the later Mission period has two behavioral implications. Mission period populations could have consumed higher quantities of green plants (non-seed-bearing plants) than those of the Protohistoric to Mission period. Alternatively, there might have been a decrease in the consumption of plant foods in the Mission period due to decreased population, change in preferences, and/or availability. Regardless, because of the overlap in temporal designations (Mission period versus Protohistoric to Mission period), these interpretations have to remain largely speculative.

The final pattern observed in the distribution of macrobotanical remains within features inside FB 1 was related to the types of plants associated with the feature types. There was subtle differentiation in what types of plants were processed or disposed of in particular feature types (in this case, hearths and rock clusters). For example, although the frequencies of parenchymatous soft tissue and seeds of domesticates were different between the two feature types, they were not statistically different. However, more grasses and legumes were present in the hearths. Of note are the distributions of *Phalaris* sp. and *H. pusillum.* In the rock clusters, there was a greater distinction in the frequencies of these two grasses (56.7 and 18.1 percent, respectively) than in the hearths (36.6 and 27 percent, respectively). Seeds of *Phalaris* sp. were disposed more in the rock clusters, and disposal of the two grasses was more similar in the hearths. In other words, one grass was used more in rock-cluster contexts (hearth cleanouts), and both grasses were used in a largely similar fashion in the hearths. Although similar activities and behaviors created the collections from hearths and rock clusters, different combinations of grasses were used in these features. Nonetheless, given that similar processes created these collections, this finding supports the interpretation of rock clusters as hearth cleanouts.

Plant Use at LAN-211

The LAN-211 macrobotanical collection was both rich and unique for its high seed densities and taxa recovered. Grasses were the most ubiquitous (84 percent)—in particular, *Phalaris* sp. (80 percent) and *H. pusillum* (72 percent). *Phalaris* sp. was also the most ubiquitous of all the taxa recovered from the site. As a collection (52 taxa), the LAN-211 data were relatively homogenous, with only 13 taxa recovered from at least a third of the samples and a low ubiquity index (less than 30 percent) for the majority of the samples.

A significant majority of the plants represented in the macrobotanical sample were locally available from the Ballona, freshwater riparian habitats, and the Los Angeles plains/prairie and were within the daily catchment of the population. Only eight taxa were from nonlocal settings, and they included *Sambucus* cf. *nigra* ssp. *canadensis*, *Arctostaphylos* sp., *Leptochloa* sp. (sprangletop), *Quercus* sp., *Juglans* sp., and *Prunus* sp. The seeds and berries of these plants were likely either obtained through trade with other groups or collected during seasonal gathering excursions into the inland uplands.

There was a distinct spatial variation in macrobotanical recovery from LAN-211 in terms of inside and outside FB 1 (Table 256). Because all the collections at LAN-211, with the exception of CU 426, were from features, they represented strong plant use and disposal contexts. Seed densities and taxonomic diversities were significantly higher inside FB 1 ($\chi^2 = 2{,}373.9$; $df = 1$; $p < .001$ for seed densities and $\chi^2 = 53.9$; $df = 1$; $p < .001$ for taxonomic richness). When the collections from inside and outside FB 1 were compared, several important trends and implications for plant use and disposal were identified. The higher taxonomic diversity inside FB 1 (52 taxa) suggested that the collection was comparatively more generalized (even though grasses as a group, 73 percent, dominated the collection) (Figure 266). The generalized collection in this context could suggest that the sources of the seeds could have been varied and included food, fuel, processing by-products, and inadvertent midden inclusion. Seeds of an introduced, nonnative taxon, *Dactyloctenium* sp., recovered only from within FB 1, primarily from hearth contexts, were noteworthy. These seeds are typically associated with crop fields in the Old World. Furthermore, the seeds are often harvested along with the crop seeds and are selectively removed from the product in the processing pathway during the sieving or winnowing processes/stages (see Reddy 1994, 2003). These "weed" seeds are often used as indicators of crop-processing stages and crops grown by the population versus those obtained through trade (Reddy 1994). Given the absence of by-product indicators (for barley and wheat) that imply local cultivation, it is likely that at LAN-211, FB 1, these seeds were brought in with *Hordeum vulgare* and *Triticum aestivum* crop seeds and were processed into the hearths immediately before food preparation.

Table 256. Comparison of Taxonomic Richness and Selected Macrobotanical Remains from inside and outside FB 1, LAN-211

Item	Outside FB 1[a]		Inside FB 1[b]	
	n	%	n	%
Taxonomic richness	18		52	
Domesticates	3	0.5	81	0.3
Wetland taxa	421	71.8	20,202	77.6
Fabaceae (legumes)	45	7.7	1,844	7.1
Poaceae (grasses)	371	63.3	19,011	73.0
Deschampsia cf. *danthonioides*	2	0.3	780	3.0
Hordeum pusillum	112	19.1	6,812	26.2
Lolium cf. *temulentum*	11	1.9	140	0.5
Phalaris sp.	230	39.2	10,025	38.5
Stipa sp.	3	0.5	528	2.0
Calandrinia cf. *breweri*	7	1.2	31	0.1
Chenopodium sp.	30	5.1	240	0.9
Salvia cf. *apiana*	9	1.5	1,707	6.6
Clarkia cf. *purpurea*	27	4.6	168	0.6
Quercus sp. (acorns)	—		78	
All nutshell (n)	6		149	
Total	586		26,044	
Seed density (n/liter)	2		145	
Sediment (liters)	346.9		179	

[a] Includes Intermediate, Protohistoric to Mission, and Mission period deposits.

[b] Includes Protohistoric to Mission and Mission period deposits.

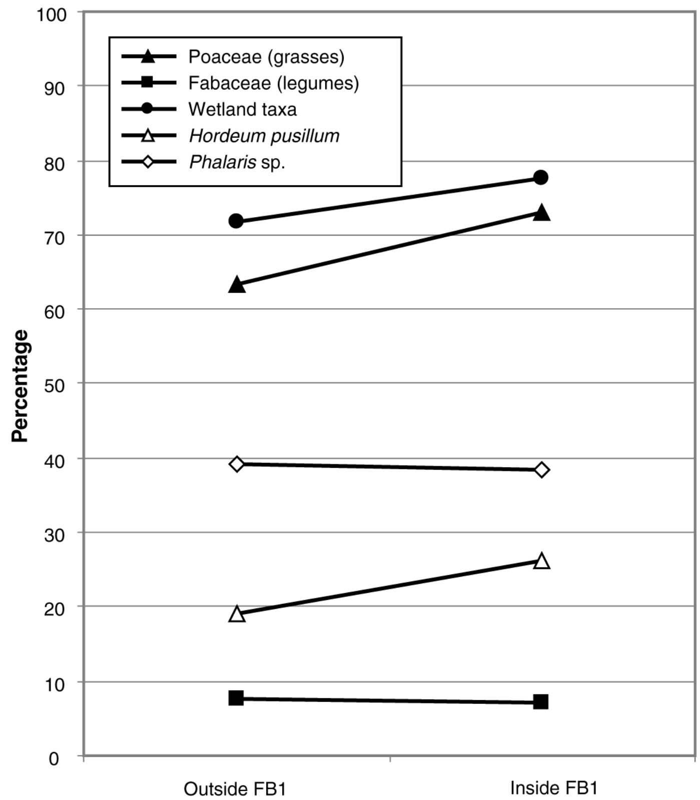

Figure 266. Distribution of selected taxa and plant groups inside and outside FB 1, LAN-211 (note: percentages are not from mutually exclusive categories and do not add to 100; see Table 256).

In general, the contexts inside FB 1 had a higher number of nutshell fragments recovered, and in particular, acorn nutshell was recovered only from inside FB 1.

Several other patterns were noted in the macrobotanical remains inside and outside FB 1 that suggest distinct plant-use behavior. Contexts outside FB 1 included Intermediate, Protohistoric to Mission, and Mission period deposits, and those within FB 1 were only Protohistoric to Mission and Mission period deposits. Thus, some of the patterns could be related to temporal differences and not just contextual ones. Grasses accounted for less than two-thirds of the collection outside FB 1 and almost three-quarters of the collection inside FB 1. There was a greater diversity in grasses within FB 1, with 13 grass taxa, compared to 6 from outside FB 1. Of the 6 grass taxa outside FB 1, 1 taxon (*Lolium* cf. *temulentum*) occurred in higher relative frequencies outside FB 1 than inside FB 1. (Note that *Phalaris* sp. was only very slightly higher outside FB 1—39.2 percent versus 38.5 percent). Among grasses, the 2 main taxa (*H. pusillum* and *Phalaris* sp.) occurred in largely similar ratios inside FB 1 (1.5:2) and outside FB 1 (1:2), and *Phalaris* sp. occurred in relatively higher frequencies in both contexts.

The distributions of legumes, domesticates, and wetland taxa were similar inside and outside FB 1, suggesting comparable plant use. *Salvia* cf. *apiana* was higher inside FB 1 (4.4:1), and *Calandrinia* cf. *breweri* (12:1), *Chenopodium* sp. (5.6:1), and *Clarkia* cf. *purpurea* (7.7:1) were higher outside FB 1. The implications of these patterns for plant use and disposal are that grasses were used both inside and outside FB 1; however, there was considerable difference in use of other plants, such as *Calandrinia* cf. *breweri*, *Chenopodium* sp., *Clarkia* cf. *purpurea*, and *Salvia* cf. *apiana*. The reasons for these differences could be either temporal or spatial.

Change in plant use over time at LAN-211 could be addressed only to a limited extent, because most of the deposits dated to the Protohistoric and Mission periods; there were many fewer contexts sampled from the Late and Intermediate periods. These data did indicate that plant use increased dramatically in the Protohistoric and Mission periods from the earlier periods, although preservation may have also played a role to some degree (Figure 267). The seed densities in the Intermediate, Late, Protohistoric to Mission, and Mission period contexts were significantly different ($\chi^2 = 273$; $df = 2$; $p < .001$). In other words, there is very high confidence that the samples were from statistically different populations. Factors that potentially caused the lower seed densities in the earlier periods include sampling, preservation, and, most importantly, the plant-processing and -consumption methods. Sampling was

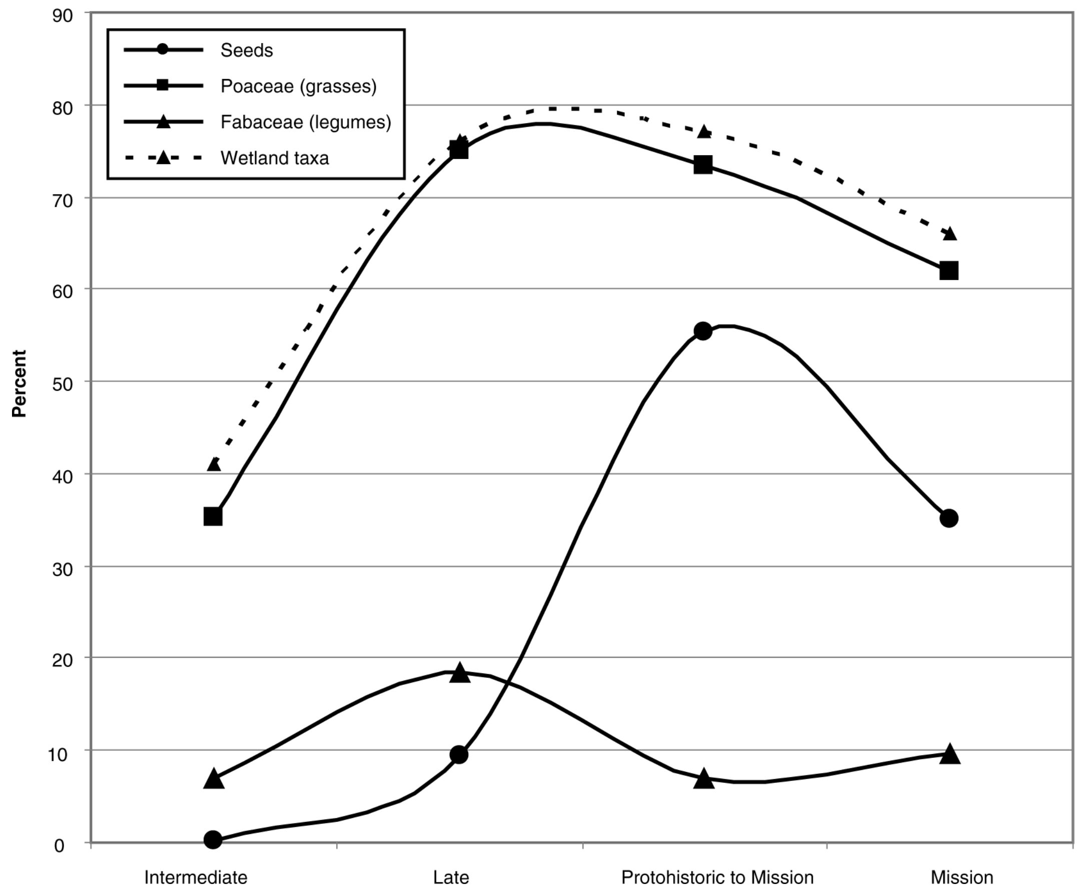

Figure 267. Change in plant use over time at LAN-211.

not a determining factor, and in the case of the Intermediate and Late periods, although there were fewer contexts, the sample sizes were relatively larger than those of the later periods (Table 257). Preservation could be a determining factor, primarily because of the age of the older deposits, especially the Intermediate period deposits. Also, it has been observed that early deposits (such as Intermediate period deposits) in coastal southern California have low seed densities despite adequate sampling (Reddy 2004a; Wigand 2005). This could be due to poor organic preservation in these early deposits. As discussed earlier in the chapter, the low seed densities could also be due to plant use focused on the nonseed parts of the plants, such as leaves, stems, and roots, with seeds as supplements. Use of roots as food is considerably less elusive, because if they have been cooked, especially by charring, they often survive as parenchymatous soft tissue. Parenchymatous soft tissue was recovered from all except the Intermediate period contexts. However, its absence does not necessarily mean it was not used.

Changes in plant use were noted over time, not only with the intensity of plant use (densities) but also with the plant groups exploited (see Table 257). Exploitation of taxa associated with wetlands (both in terms of the number of taxa exploited and the intensity of exploitation) increased from the Intermediate period to the Protohistoric period and then remained largely constant (see Figure 267). This did not correlate well with the model of wetland and settlement evolution for the Ballona that indicated that the size of the wetlands decreased over time. Some of wetland taxa can tolerate fluctuations in salinity; however, it is also likely that social factors were more important than temporal changes in environmental conditions in determining which plants were the foci of gathering activities. For example, larger or more-permanent aboriginal populations during the Protohistoric period may have targeted wetland taxa more intensively. There was little change in legume exploitation over time, with the exception of an increase in the Late period from the earlier Intermediate period and compared to the subsequent Mission period (see Figure 267).

Grasses were more heavily utilized than any other plant group through the cultural sequence and became specialized over time; certain grasses were selectively used. As was the case at LAN-62, there was a striking preference for *Phalaris* sp. through time, with *H. pusillum* a close second. These two grasses became increasingly important over time in the prehistoric diets and were staples in the Protohistoric and Mission period Native American diets. This long-term preference for *Phalaris* sp. had important implications for focused

Table 257. Distribution of Selected Plant Taxa (Seeds) at LAN-211, by Temporal Period

Genus/Species, by Family	Mission		Protohistoric to Mission		Late		Intermediate		Total
	n	%	n	%	n	%	n	%	
Unidentified seed fragments	1,459	9.5	1,541	6.3	94	2.3	21	29.6	3,115
Unknown seeds	26	0.2	18	0.1	2	0.05	—		46
Aizoaceae									
Trianthema cf. *portulacastrum*	7	0.05	13	0.1	—		—		20
Alismataceae									
cf. *Sagittaria* sp.	—		17	0.1	—		—		17
Amaranthaceae									
Amaranthus sp.	242	1.6	49	0.2	3	0.1	—		294
Anacardiaceae									
Rhus sp.	—		24	0.1	—		—		24
Asteraceae									
Unknown fragments	2	0.01	2	0.01	—		—		4
Ambrosia sp.	7	0.05	3	0.01	1	0.02	—		11
Hemizonia sp.	26	0.2	26	0.1	—		—		52
Layia cf. *platyglossa*	23	0.1	51	0.2	20	0.5	—		94
cf. *Taraxacum* type	—		3	0.01	—		—		3
Brassicaceae									
Lepidium sp.	44	0.3	14	0.1	—		—		58
Boraginaceae									
Amsinckia sp.	91	0.6	189	0.8	27	0.6	3	4.2	310
Caprifoliaceae									
Sambucus cf. *nigra* ssp. *canadensis*	13	0.1	19	0.1	2	0.05	—		34
Chenopodiaceae									
Chenopodium sp.	279	1.8	223	0.9	6	0.1	6	8.5	514
Cyperaceae									
Cyperus sp.	13	0.1	35	0.1	—		—		48
Schoenoplectus [*Scirpus*] cf. *californicus*	605	3.9	333	1.4	52	1.2	5	7.0	995
Ericaceae									
Arctostaphylos sp.	30	0.2	3	0.01	9	0.2	—		42
Fabaceae									
Unknown	35	0.2	174	0.7	9	0.2	—		218
Cicer cf. *arietinum*	13	0.1	11	0.04	8	0.2	—		32

continued on next page

Genus/Species, by Family	Mission		Protohistoric to Mission		Late		Intermediate		Total
	n	%	n	%	n	%	n	%	
cf. *Astragalus* sp.	—		1	0.004	21	0.5	1	1.4	23
Lupinus sp.	109	0.7	10	0.04	—		—		119
Melilotus sp.	897	5.8	385	1.6	688	16.5	3	4.2	1,973
Pisum cf. *sativum*	116	0.8	47	0.2	—		—		163
Trifolium sp.	73	0.5	1,068	4.4	18	0.4	—		1,159
Vicia sp.	251	1.6	21	0.1	26	0.6	1	1.4	299
Juncaceae									
Juncus sp.	7	0.0	18	0.1	—		—		25
Lamiaceae									
Salvia cf. *apiana*	1,170	7.6	1,595	6.5	42	1.0	—		2,807
Malvaceae									
Unknown	2	0.01	—		—		—		2
Menispermaceae									
cf. *Menispermum* type	1	0.01	—		—		—		1
Onagraceae									
Clarkia cf. *purpurea*	197	1.3	155	0.6	4	0.1	5	7.0	361
Papaveraceae									
Papaver sp.	—		1	0.004	—		—		1
Poaceae									
Unknown fragments	134	0.9	338	1.4	18	0.4	6	8.5	496
cf. *Agropyron* sp.	272	1.8	23	0.1	10	0.2	1	1.4	306
Agrostis cf. *exarata*	—		135	0.6	—		—		135
Avena cf. *sativa*	3	0.02	5	0.02	2	0.05	—		10
Bromus cf. *carinatus*	4	0.03	51	0.21	—		—		55
cf. *Dactyloctenium* sp.	3	0.02	21	0.1	—		—		24
Deschampsia cf. *danthonioides*	129	0.8	778	3.2	—		1	1.4	908
Hordeum pusillum	3,763	24.4	6,443	26.3	1,198	28.8	10	14.1	11,414
Hordeum vulgare	115	0.7	2	0.01	—		—		117
Leptochloa sp.	—		114	0.5	—		—		114
Lolium cf. *temulentum*	11	0.1	140	0.6	—		—		151
Phalaris cf. *caroliniana*	4,578	29.7	9,409	38.5	1,830	44.0	7	10.3	15,824
Stipa sp.	250	1.6	503	2.1	67	1.6	—		820
Triticum cf. *aestivum*	263	1.7	1	0.004	—		—		264
Zea mays	10	0.1	—		—		—		10

Genus/Species, by Family	Mission		Protohistoric to Mission		Late		Intermediate		Total
	n	%	n	%	n	%	n	%	
Plantaginaceae									
Plantago cf. *erecta*	3	0.02	20	0.1	—		—		23
Polygonaceae									
Polygonum sp.	37	0.2	49	0.2	—		—		86
Rumex sp.	6	0.04	9	0.04	1	0.02	—		16
Portulacaceae									
Calandrinia cf. *breweri*	109	0.7	11	0.04	4	0.1	1	1.4	125
Rosaceae									
Heteromeles sp.	8	0.1	2	0.01	—		—		10
Rubiaceae									
Galium sp.	—		15	0.1	—		—		15
Violaceae									
Viola sp.	—		350	1.4	—		—		350
Total	15,436	100.0	24,468	100.0	4,162	100.0	71	100.0	44,137
Parenchymatous tissue	93		64		31		—		188
Poaceae rachises	8		1		—		—		9
Cucurbitaceae									
Marah sp.	100 (0.29g)		31 (0.11g)		48 (0.18g)		—		179 (0.14g)
Fagaceae									
Quercus sp.	—		76 (0.63g)		4 (0.02g)		—		80 (0.63g)
Quercus attachments	5 (0.03g)		2 (0.06g)		2 (0.01g)		—		9 (0.06g)
Juglandaceae									
Juglans sp.	18 (0.07g)		7 (0.07g)		—		—		25 (0.1g)
Rosaceae									
Prunus cf. *virginiana*	69 (0.14g)		—		—		—		69 (0.14g)
Unidentifiable nut fragments	41 (0.1g)		36 (0.07g)		11 (0.04g)		19 (0.05g)		82 (0.11g)
Sediment floated (liters)	130.5		158.5		196.5		449		934.5
Seed density (n/liter)	118		154		21		0.2		47.2
Charcoal (g)	177.5		84.06		44.2		0.1		305.86
Charcoal density (g/liter)	1.4		0.5		0.2		0.0002		0.3273

Note: Mission period (CU 426 levels, Features 2, 8, and 13); Protohistoric to Mission period (Features 4, 5, 14, 21, and 51); Late period (CU 426 levels); Intermediate period (CU 426 levels, Features 11 and 15).

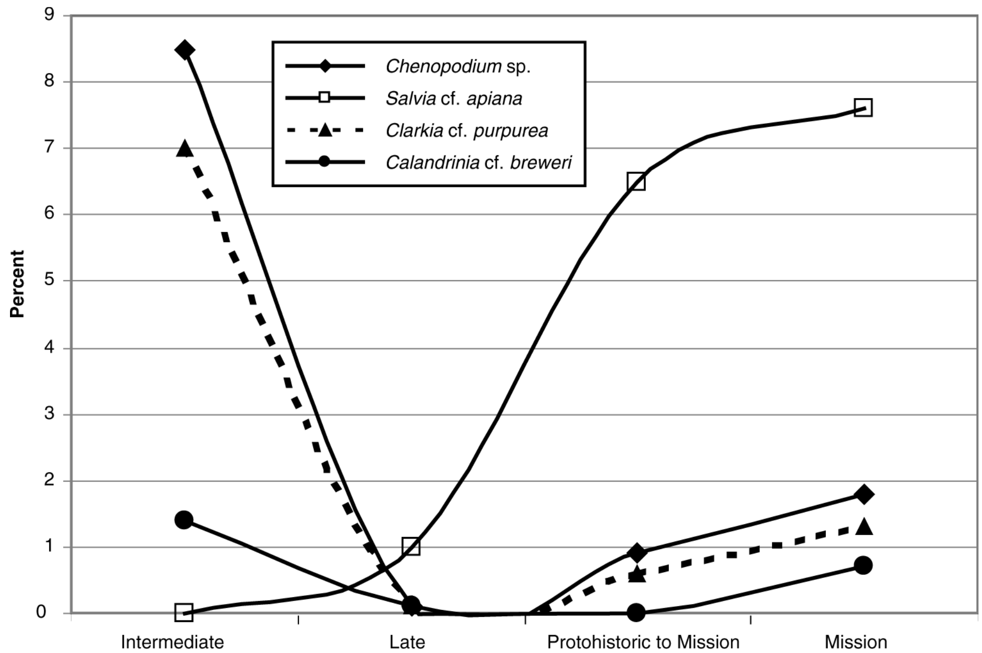

Figure 268. Distribution of four selected other (non-grass or legume) taxa over time at LAN-211.

exploitation. Grass-rachis fragments, important indicators of plant and food processing, were recovered from only the Protohistoric to Mission and Mission period deposits.

The macrobotanical collections from each of the temporally distinct contexts at LAN-211 were dominated by grasses, and other plant taxa (not including legumes) occurred in low to very low frequencies, depending on the period. For example, in the Intermediate period deposits, other taxa (not including grasses and legumes) accounted for between 1.4 and 8.5 percent. In contrast, other taxa accounted for between 0.02 and 1 percent in the Late period deposits and between 0.01 and 7.6 percent in the Mission period deposits (see Table 257). The distribution of four of these other taxa is illustrated in Figure 268, given the variation in their use over time. Use of *Calandrinia* cf. *breweri* did not change over time, whereas *Chenopodium* sp. and *Clarkia* cf. *purpurea* showed a similar trajectory, with higher use in the Intermediate period than in the Mission period. And the exploitation of *Salvia* cf. *apiana* increased steadily over time. The inverse relationship between these plants implies changing preferences and exploitation regimes. These four plants were used as food, with the exception of *Salvia* cf. *apiana*, which had medicinal and religious uses.

Although carbonized seeds were recovered in low to very high densities from the various contexts at the site, nutshell was recovered in generally very low quantities from LAN-211. Nutshell and nut meat occurred in very low densities from the Intermediate period deposits and in only slightly higher densities in the Late period (Figure 269). Only in the Protohistoric to Mission and Mission period deposits was there a notable increase. In particular, acorns (*Quercus* sp.) were consumed in higher quantities post-A.D. 1540. Based on these results, acorn use was a very late adaptation; this is consistent with results documented farther south along the coast (Reddy 2004a) and contradicts many accepted models of acorn exploitation that have argued for intensive use during the Millingstone and Intermediate periods (Basgall 1987; Glassow 1996; Hildebrandt and Mikkelsen 1993:34; Wohlgemuth 1996). In addition, two nut foods (*Juglans* sp. and *Prunus* cf. *virginiana*) were recovered only from Mission period deposits.

Finally, the last key trend noted in the macrobotanical sample from LAN-211 was that domesticated crop seeds were recovered from specific contexts, including 596 carbonized seeds of two legumes (*Cicer* cf. *arietinum* and *Pisum* cf. *sativum*) and four grasses (*Avena* cf. *sativa*, *Hordeum vulgare*, *Triticum aestivum*, and *Zea mays*) (Table 258). Note that all are Old World domesticates, with the exception of *Zea mays*, which is a New World domesticate. *Zea mays* was domesticated in Mesoamerica between 5000 and 6000 B.C. (possibly as early as 7000 B.C., according to recent research in Mexico at Xihuatoxtla Shelter [Piperno et al. 2009]). Although there is considerable contention, an ancestor of *teosinte,* or *teosinte* itself, is widely accepted by scholars as being the progenitor of corn. Although the practice of cultivating corn diffused into the U.S. Southwest from Mexico in prehistory (3000–2000 cal B.C.) (Adams 1994), it was brought into coastal California by the Spanish. (For details on domestication centers for the remaining domesticates, refer to discussion earlier in this chapter.)

As discussed earlier in the chapter (for LAN-62), domesticated plant foods were consumed by the Mission period aboriginal populations in the Ballona but were not cultivated by the aboriginal populations. Instead, they were obtained from surrounding missions and ranchos and the Pueblo of Los Angeles as payment for services or in exchange for other products.

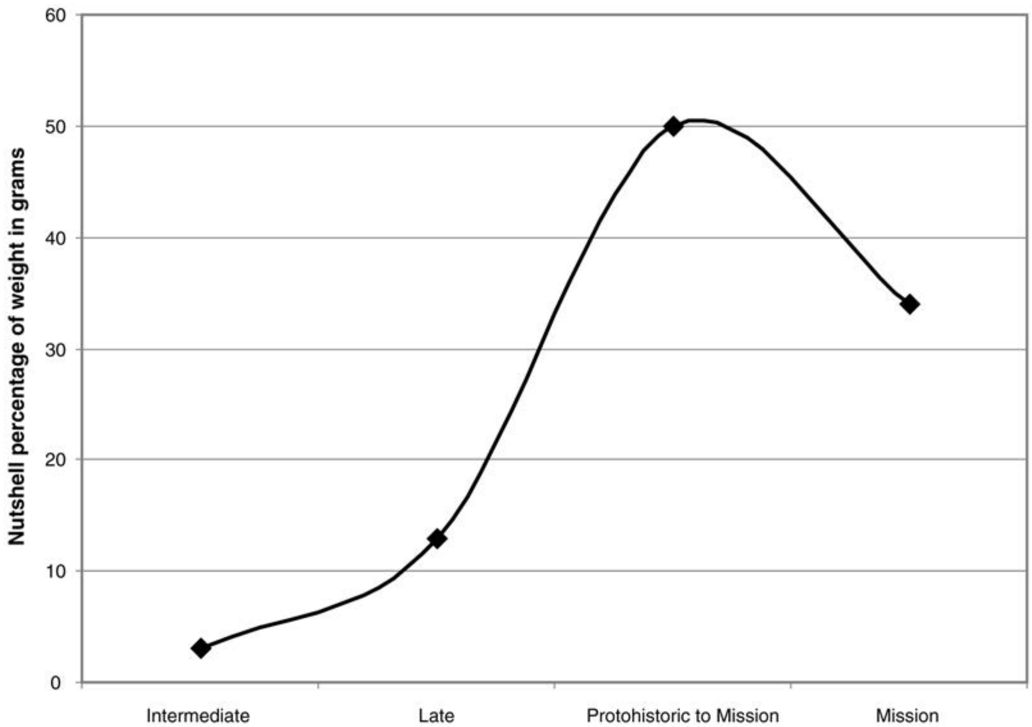

Figure 269. Distribution of nutshell over time at LAN-211.

Table 258. Domesticated-Crop Seeds Recovered from LAN-211

Genus/Species, by Family	CU 426	All Features	Features outside Feature 1	Feature 1 (Subfeatures)	Total from LAN-211	Percent
Fabaceae						
Cicer cf. *arietinum*	21	11	—	11	32	5.4
Pisum cf. *sativum*	99	64	3	61	163	27.3
Poaceae						
Avena cf. *sativa*	5	5	—	5	10	1.7
Hordeum vulgare	114	3	—	3	117	19.6
Triticum cf. *aestivum*	263	1	—	1	264	44.3
Zea mays	10	—	—	—	10	1.7
Total	512	84	3	81	596	100.0

The majority of the domesticated-crop seeds were from the Mission period deposits in CU 426 (n = 512, or 86 percent). *Pisum* cf. *sativum* was the most ubiquitous domesticate seed at the site (28 percent), and *Zea mays* was the least ubiquitous (6 percent) and was recovered only from CU 426. Old World domesticated grasses, also known as cereals, dominated the collection of domesticates (n = 391, or 65.6 percent), with *Triticum aestivum* and *Hordeum vulgare* the most abundant. *Zea mays* occurred in low frequencies (1.7 percent). Wheat was recovered predominantly from CU 426. Note that CU 426 was within FB 1 and adjacent to Feature 21 and theoretically can be viewed as a context inside FB 1. With the exception of three *Pisum* cf. *sativum* seeds, all domesticates were recovered from inside FB 1. In addition, particular domesticates (*Hordeum vulgare, Triticum aestivum,* and *Zea mays*) were recovered in higher frequencies only from CU 426 (inside FB 1) (Table 259). Therefore, there was a distinct spatial patterning in the recovery of particular domesticates. Among the features, three inside FB 1 (Features 4, 13, and 21) had relatively higher frequencies. Two (Features 4 and 21) were hearths, and Feature 13 was a rock cluster. In addition, if CU 426 is considered, there was a pronounced spatial pattern, in terms of both the frequencies and the types of foods recovered. Although the sample was small (only seven features inside FB 1 were analyzed), the distribution in which some features yielded higher frequencies of domesticates could possibly indicate differential

Table 259. Frequency of Domesticates at LAN-211, by Feature

Context	Feature Type	Percent of Total Domesticates	Seeds (n)
CU 426		85.8	512
Feature 2	artifact concentration	0.5	3
Feature 4	hearth	6.9	41
Feature 8	hearth	0.2	1
Feature 14	hearth	0.8	5
Feature 21	hearth	3.4	20
Feature 51	hearth	0.0	—
Feature 5	rock cluster	0.0	—
Feature 13	rock cluster	2.3	14
All hearths		11.2	67
All rock clusters		2.3	14
Total			596

access to foods obtained from the missions/ranchos/pueblos. In other words, these features (Features 4, 13, and 21) were the cooking and food-consumption areas of particular individuals/families that had access to these foods, as opposed to the hearths and rock clusters represented by Features 5 and 51, which had no domesticates but did have wild-plant seeds.

Overall, a higher frequency of domesticates was recovered from LAN-211 (1.35 percentage of the collection) than from LAN-62 (0.2 percent of the collection) (χ^2 = 16.89; *df* = 1; *p* <.001). Because plant use was not lower at LAN-62, the higher frequencies of domesticates at LAN-211 suggests a higher overall usage. This is further strengthened by the Protohistoric and Mission period behavioral contexts at the two sites. LAN-211 had more habitation-related features and midden, and LAN-62 was dominated by burials and mourning contexts. If the Protohistoric and Mission period habitation at LAN-211 was related to the burials and ritual mourning behavior observed at LAN-62, then this distribution of domesticates indicates that the aboriginal populations had access to and consumed domesticated-crop foods in greater quantities than the quantities they deposited in mourning and burial contexts. This is a very important trend that has significant implications for food preferences and sociocultural systems.

Gathering the Past: Major Temporal and Spatial Trends

The PVAHP paleoethnobotanical study entailed flotation of more than 4,700 liters of sediment from five sites in the Ballona lowlands and resulted in the recovery of more than 500,000 carbonized seeds and pieces of nutshell. Overall, spring-/summer-seeding annual grasses, particularly *Phalaris* sp. and *H. pusillum*, dominated the samples. Other native grasses and plants were also recovered, as were various nuts and fruits, but in generally much lower frequencies. Tubers and roots, which are typically difficult to identify archaeologically, were also recovered, but in low frequencies. These wild-plant foods provide a rare opportunity to examine diachronic changes in Native American plant use. Domesticated-crop seeds were occasionally recovered from the Protohistoric and Mission period deposits. The following discussions address four main patterns in the data and their implications: temporal continuity and change in plant use, plant disposal and feature function, use of nuts, and intensive grass exploitation.

Continuity and Change in Plant Use

Macrobotanical remains from contexts with strong chronological and temporal controls were selected to discern the continuity and change in plant use across time. Trends in the data will be discussed using densities and percentages following standard paleoethnobotanical practices that use density as a measure of intensity of use and use percentage of functionally equivalent items to identify relative changes in taxa over time (Miller 1988:74).

The contexts with strong chronological and temporal controls allowed for comparison of five cultural periods: Millingstone (6550–1050 cal B.C.), Intermediate (1050 cal B.C.–cal A.D. 950), Late (A.D. 950–1540 cal), Protohistoric to Mission (A.D. 1540–1830), and Mission (A.D. 1770–1830) periods (Tables 260 and 261). Contexts that were dated to Protohistoric to Mission periods overlapped with those that were just Mission period. The Protohistoric to Mission period contexts

Table 260. Plant Use by Time Period and Context

	Mission			Protohistoric to Mission	Late Period	Intermediate	Millingstone
	Habitation Contexts	Mortuary Contexts	Total				
Sediment (liters)	130.5	447.02	577.52	148.50	697.25	2,580	425.7
Seeds (n)	15,436	377,721	393,157	23,271	5,944	3,066	2,009
Seed density (n/liter)	118	845	681	157	9	1	5
Wetland taxa density (n/liter)	77	727.5	580	122	6	0.3	4
Grass taxa density (n/liter)	73.1	743.6	592.1	114.2	4.9	0.2	4.0
Legume taxa density (n/liter)	11.4	8.9	9.5	11.1	1.5	0.04	—

Table 261. Distribution of Specific Plants over Time, PVAHP

Item	Mission Period Habitation	Mission Period Mortuary	All Mission Period	Protohistoric to Mission Period	Late Period	Intermediate Period	Millingstone Period
				Counts (n)			
Wetland taxa	10,012	325,225	335,026	18,098	4,055	698	1,650
Grasses	9,535	332389	341,924	16,954	3,401	501	1,685
Legumes	1,494	4,000	5,494	1,641	1,067	100	—
Hemizonia sp.	26	3,463	3,489	26	—	13	10
Layia cf. *platyglossa*	23	3,014	3,037	48	21	8	—
Chenopodium	279	2,053	2,332	222	488	300	11
Cyperus sp.	13	301	314	35	139	26	3
Schoenoplectus [*Scirpus*] cf. *californicus*	605	721	1,326	319	132	34	6
Salvia cf. *apiana*	1,170	1,467	2,637	1,587	43	7	—
Clarkia cf. *purpurea*	197	6,134	6,331	155	27	39	4
Deschampsia cf. *danthonioides*	129	7,639	7,768	778	6	44	430
Hordeum pusillum	3,763	45,187	48,950	6,320	1,243	55	76
Phalaris sp.	4,578	267,854	272,432	8,556	1,897	111	1,108
Stipa sp.	250	453	703	495	87	10	—
Calandrinia cf. *breweri*	109	4,008	4,117	11	7	1,116	20
Quercus (g)	0.03	10.01	10.0	0.70	0.04	0.05	0.02
Juglans (g)	0.07	0.87	1.0	0.10	0.00	0.08	0.00
All nutshell (g)	0.64	13.75	14.4	1.00	1.10	0.22	0.02
Parenchymatous (n)	93	1,358	1,451	53	124	110	—
				Item Densities (n/liter)			
Wetland taxa	77	728	580	122	6	0.3	4
Grasses	73	744	592.1	114.2	5	0.2	4.0
Legumes	11	9	9.5	11.1	1.5	0.04	0.0
Hemizonia sp.	0.2	8	6.0	0.2	0.00	0.01	0.02
Layia cf. *platyglossa*	0.2	7	5.3	0.3	0.03	0.003	0.00
Chenopodium	2	5	4.0	1.5	1	0.12	0.03
Cyperus sp.	0.1	1	0.5	0.2	0.2	0.01	0.01
Schoenoplectus [*Scirpus*] cf. *californicus*	5	2	2.3	2.1	0.2	0.01	0.01

continued on next page

Item	Mission Period Habitation	Mission Period Mortuary	All Mission Period	Protohistoric to Mission Period	Late Period	Intermediate Period	Millingstone Period
Salvia cf. *apiana*	9	3.3	4.6	11	0.1	0.003	0.00
Clarkia cf. *purpurea*	2	14	11.0	1.0	0.04	0.02	0.01
Deschampsia cf. *danthonioides*	1	17.1	13.5	5.2	0.01	0.02	1.0
Hordeum pusillum	29	101.1	85	43	2	0.02	0.2
Phalaris sp.	35	599.2	472	58	3	0.04	2.6
Stipa sp.	2	1	1.2	3.3	0.1	0.004	0.00
Calandrinia cf. *breweri*	1	9	7.1	0.1	0.01	0.43	0.05
Quercus (g)	0.0002	0.02	0.02	0.005	0.0001	0.00002	0.00005
Juglans (g)	0.001	0.002	0.002	0.001	0.00	0.00003	0.00
All nutshell (g)	0.005	0.03	0.025	0.01	0.002	0.0001	0.00005
Parenchymatous (n)	1	3	2.5	0.4	0.2	0.04	0.00
	Item Percentages						
Wetland taxa	64.9	86.1	85.2	77.8	68.2	22.8	82.1
Grasses	61.8	88.0	87.0	72.9	57.2	16.3	83.9
Legumes	9.7	1.1	1.4	7.1	18.0	3.3	0.0
Hemizonia sp.	0.2	0.9	0.9	0.1	0.0	0.4	0.5
Layia cf. *platyglossa*	0.1	0.8	0.8	0.2	0.4	0.3	0.0
Chenopodium	1.8	0.5	0.6	1.0	8.2	9.8	0.5
Cyperus sp.	0.1	0.1	0.1	0.2	2.3	0.8	0.1
Schoenoplectus [*Scirpus*] cf. *californicus*	3.9	0.2	0.3	1.4	2.2	1.1	0.3
Salvia cf. *apiana*	7.6	0.4	0.7	6.8	0.7	0.2	0.0
Clarkia cf. *purpurea*	1.3	1.6	1.6	0.7	0.5	1.3	0.2
Deschampsia cf. *danthonioides*	0.8	2.0	2.0	3.3	0.1	1.4	21.4
Hordeum pusillum	24.4	12.0	12.5	27.2	20.9	1.8	3.8
Phalaris sp.	29.7	70.9	69.3	36.8	31.9	3.6	55.2
Stipa sp.	1.6	0.1	0.2	2.1	1.5	0.3	0.0
Calandrinia cf. *breweri*	0.7	1.1	1.0	0.05	0.1	36.4	1.0

Note: Percentages are of the total in each period.

are all from LAN-211. In the Mission period, a distinction was made between habitation and mortuary contexts. As evidenced by the seed-density values, plant use increased steadily and significantly over time. There were differences in plant use before the Protohistoric period and relatively lower use in the Intermediate period than in the earlier Millingstone period and the subsequent Late period. Low sample sizes were not a factor. Relatively low plant use in the Intermediate period coincided with a time segment when the freshwater marsh in the Ballona was at its maximum productivity and would have provided ample plant resources. That period was also immediately before the Medieval Climatic Anomaly. Climate change or drought could not be used to explain low Intermediate period plant use. In general, the Intermediate period deposits had very low densities of charcoal and relative seed frequencies. Two explanations have been offered in this study: poor organic preservation due to the age and low plant use (especially of seed-bearing plants). Another related trend was the dramatic increase in exploitation of taxa associated with wetlands (both marsh and freshwater) in the Protohistoric to Mission period; wetland exploitation was lowest in the Intermediate period.

Another significant pattern, perhaps expected, is that plant use and disposal in the two Mission period contexts (habitation and mortuary contexts) were significantly different ($\chi^2 = 78356$; $df = 1$; $p < .001$) (Figure 270; see Table 260). In addition, the Mission period habitation (including contexts from LAN-62 and LAN-211) had lower plant use than the Protohistoric to Mission contexts (which included only LAN-211) ($\chi^2 = 739$; $df = 1$; $p < .001$). Similar trends were noted for all carbonized seeds, grasses, legumes, and wetland taxa. If the intensity of plant use (seed densities) can be equated to general intensity

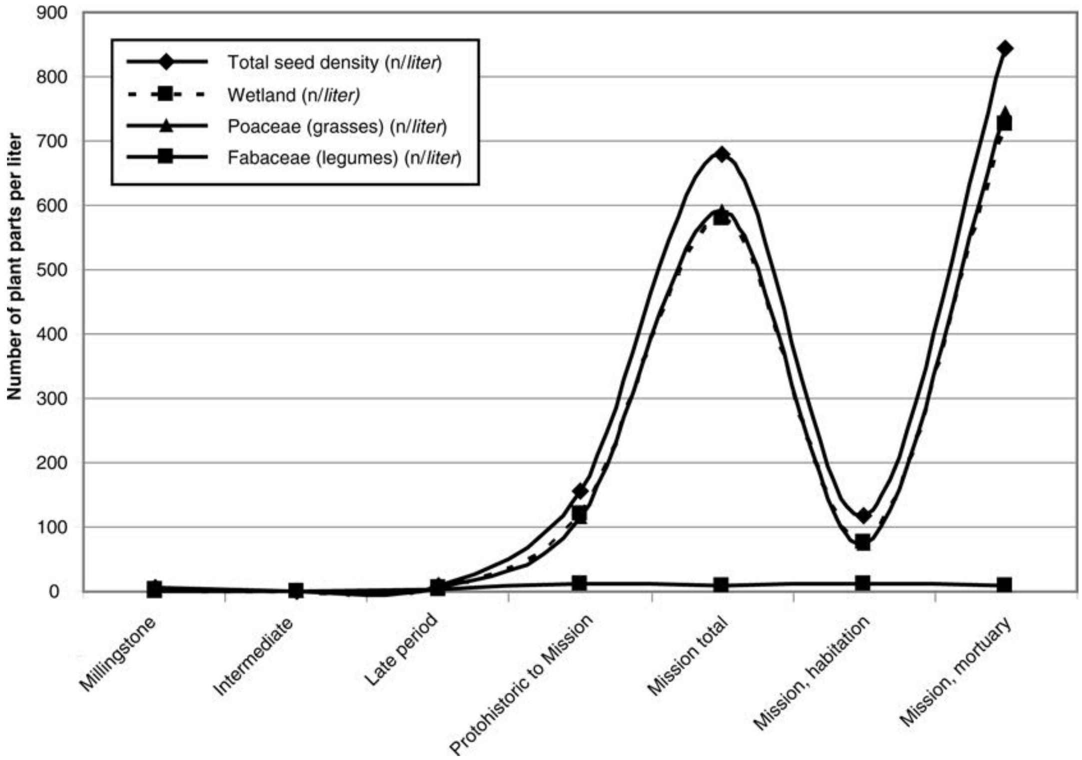

Figure 270. Plant use by time period and context (number of plant parts per liter).

of land use and population, then these data suggest that plant use was lower during the Mission period (when only habitation contexts are considered). In other words, during the Mission period, there was a high incidence of plant disposal in mortuary contexts and a decrease in domestic-related disposal. The higher densities in the Mission period mortuary contexts indicated that aboriginal mortuary practices continued in the Ballona area, perhaps even became more pronounced, although habitation within the Ballona may have decreased. Aboriginal groups from the general area may have been coming into the Ballona both to bury their dead and to participate in annual mourning ceremonies. This has important implications for understanding human settlement of the Ballona area after the establishment of the missions.

Over time, exploitation and utilization of several plants declined. These plants included legumes, *Calandrinia* cf. *breweri, Deschampsia* cf. *danthonioides, Chenopodium* sp., *Cyperus* sp., and *Stipa* sp. (see Table 261). Other plants, such as grasses (particularly *H. pusillum* and *Phalaris* sp.), *Hemizonia* sp., *Layia* cf. *platyglossa, Schoenoplectus* cf. *californicus, Salvia* cf. *apiana*, and *Clarkia* cf. *purpurea*, increased in importance over time. Therefore, there was a change in reliance and replacement of particular plants by others. In the Mission period, certain plants were more important in habitation contexts than in mortuary contexts. These plants included legumes (such as *Cicer* cf. *arietinum*, *Melilotus* sp., and *Trifolium* sp.), *Chenopodium* sp., *Schoenoplectus* cf. *californicus*, *Salvia* cf. *apiana*, *H. pusillum*, and *Stipa* sp. In other words, these plants were consumed more intensively, and other plants were used more often in ritual offerings. Such differences are rarely discernible archaeologically and will be discussed later in this chapter.

Another noteworthy long-term trend in the macrobotanical data was the exploitation of roots/tubers and nuts. There was an overall trend toward increased exploitation over time (see Table 261). In general, exploitation of these resources was very low, and especially so earlier in time. The role of nut foods and their place in coastal southern California prehistoric subsistence will be discussed further below.

Finally, the recovery of particular carbonized plant remains can provide valuable insight into the chronological placement of deposits based on the types of seeds recovered. In the PVAHP, the recovery of Old World domesticated-crop seeds has provided strong evidence for post-contact occupation, because Native Americans did not have Old World domesticated crops prior to Spanish contact and the start of the Mission period. For example, the recovery of both Old and New World domesticated crops from particular deposits at LAN-62 and LAN-211 lends firm evidence that these specific deposits dated to the Protohistoric or Mission periods.

All of these Old World domesticates and the New World domesticated crop (corn) were brought into California by the Spanish during the Mission period and cultivated in the missions. There has been little to no evidence of Native American populations cultivating these crops outside the missions. Instead, Native Americans were often paid for their labor and service in grain, which was then brought back to their villages for storage and consumption. It is also possible that the Gabrielino could have been sharecroppers (growing grain for the ranchers or pueblo residents) and were paid with a portion of the crop. For instance, there are documented cases during the Mission period of neophytes associated with missions trading domesticates (such as wheat, barley, or corn) with gentiles for shell beads and other traditional goods (Hackel 2005:89). In addition, around the Pueblo of Los Angeles, gentiles were able to create economic labor relationships with pueblo settlers and maintain a certain autonomy from the mission system while supplementing their native food sources. Gentiles worked as laborers in the fields and received one-third to one-half of the crops they harvested (Hackel 2005:311). These crops primarily were domesticated wheat, barley, and corn. During the late eighteenth century and early nineteenth century, gentile Gabrielino also worked as vaqueros and cooks and in a variety of other economic capacities and became important parts of the pueblo community (Hackel 2005:311). In contrast to the dietary, economic, and social restrictions forced upon neophytes by the missionaries, a gentile had some amount of freedom to pursue traditional subsistence pursuits and develop mutually beneficial economic relationships with the *pobladores* in the pueblo. Importantly, this relationship came without the social constraints enacted by the missionaries and allowed for some amount of cultural autonomy for Gabrielino people. Given the absence of wheat- and barley-rachis remains (which are good signatures of crop processing) (see Hillman 1981), it is very likely that the crop grain came into the aboriginal settlements as already-processed grain. This indicates trade or payment in harvested crops rather than local cultivation.

In summary, six major trends were noted in the macrobotanical data from the PVAHP:

- First, although the intensity of their exploitation increased, grasses were important plants throughout the sequence. This is analogous to research findings in other parts of coastal southern California but stands in contrast to those in coastal central and northern California (see, for example, Popper [2002] and Wohlgemuth [1996]).

- Second, grass exploitation focused on two particular grasses: *H. pusillum* and *Phalaris* sp. To date, such targeted exploitation has not been documented along coastal southern California.

- Third, small-seeded plants (nongrasses), such as *Hemizonia* sp., *Layia* cf. *platyglossa*, *Schoenoplectus* cf. *californicus*, *Salvia* cf. *apiana*, and *Clarkia* cf. *purpurea*, were an integral part of the plant diet. Similar findings have been made elsewhere in coastal California (Reddy 2004a; Wohlgemuth 2002).

- Fourth, there was decreased plant use during the Intermediate period as a result of different exploitation emphases in the Ballona. Use of vegetative parts of the plants (rather than seeds) could produce such a signal. It is noteworthy that other areas in coastal southern California have reflected an oscillation in plant use at the start of the late Holocene (see Reddy 2004a). However, in other parts of coastal California, indicators of plant use (seed densities) did not decrease as observed in southern California. Indeed, small seeds decreased with an associated increase of acorns (Wohlgemuth 2002) but without a dramatic decrease in plant use. Of course, some scholars would argue that lower preservation of organic materials in older deposits is a critical factor affecting seed densities.

- Fifth, there was a notable decrease in the seed density of wetland taxa during the Intermediate period followed by a substantial increase during the Protohistoric period. These wetland-plant-use trends were inversely correlated with the extent of the Ballona wetlands.

- Finally, during the Mission period, there were significant differences between the mortuary and habitation contexts in terms of both relative frequency of particular plants and their densities. The lower densities in habitation contexts could imply lower populations, and the varied emphases on particular plants could indicate different roles for different cultural practices.

These trends have major implications for human settlement in the Ballona, and they will be explored in greater detail (in concert with other subsistence data) in Volume 5 of this series.

Plant Disposal and Site and Feature Functions

Carbonized macrobotanical remains provide valuable insight into the functions of features and sites. In delineating the functions of the features, defining the ultimate source of the seeds is critical. The nutritionist Victor Lindlahr popularized the phrase, "You are what you eat." It is also true that what you believe influences what and when you eat. Notably, the foods eaten at special occasions, such as feasts, are generally different from those eaten at everyday meals. In addition, modern sociological research tells us that traditional meals, particularly of immigrants or generations undergoing major culture change, can play a key role in reinforcing cultural continuity and intergenerational stability. Recently, Atalay and Hastorf (2006) have eloquently affirmed that food, more than any other human activity area, intensively creates the individual as well as the community through the daily practices of eating. If this is so, then food residues in mortuary contexts are part of that unique medium that acted as the means of cementing the community and extended social networks through ritual behavior.

Although archaeologists studying hunter-gatherers in California have rarely had opportunities to study such issues in mortuary contexts, there is a rich ethnographic and ethnohistoric record for the area that provides examples of the interweaving of food with mortuary-ritual practices. Similarly, the study of plant foods from public and private domains of prehistoric daily and ritual life has remained an elusive avenue, with the exception of a few studies; for example, the work at the Neolithic site Çatal Hüyük in Turkey (Atalay and Hastorf 2006) and at Cahokia in the midwestern United States (Gremillion 1993). Notably, hunter-gatherer contexts rarely offer the opportunity to address this fascinating research question. The PVAHP has proven itself an exception with its rich data set from mortuary and habitation contexts. The following discussion examines spatial and contextual patterns as they relate to function and human behavior.

Spatial Patterns

There is a spatial difference in how plants were used and disposed of during the Protohistoric and Mission periods; however, no such distinction was apparent for the earlier periods. In other words, there was a direct association between site function and plants recovered later in time. This was observed specifically for three different plant groups in the Mission period habitation contexts (primarily LAN-211) versus mortuary contexts (primarily LAN-62). If these two sites and contexts can be considered contemporaneous (and there is good reason to believe this was the case) during the Mission period, the observed patterns have meaningful implications.

First, *Calandrinia* cf. *breweri* was recovered in higher frequencies from LAN-62. Notably, burial Feature 271 at the site (likely a Mission period burial) had a cache of *Calandrinia* cf. *breweri* (more than 80,000 carbonized seeds) with a steatite shaft straightener. It accounted for 19 percent of the total seeds from Mission period contexts (including burial contexts). In contrast, *Calandrinia* cf. *breweri* constituted only 0.3 percent of the LAN-211 Mission period collection. Seeds of *Datura* sp. (n = 10) were recovered only from burial Features 10, 68, 85, and 313 (burial Features 10 and 313 dated to the Mission period, and burial Features 68 and 85 have not been dated) at LAN-62. Both *Calandrinia* cf. *breweri* and *Datura* sp. were used by aboriginal populations for their medicinal qualities and ritual powers (Timbrook 2007). *Calandrinia* sp. was a very important food in ritual offerings and was also included in burials. There has been evidence of such offerings (similar to that observed at burial Feature 271) from a range of Chumash sites, including Goleta Slough (Yarrow 1879:36–37), Santa Rosa Island (Orr 1968:200), Santa Ynez Valley (Harrington 1928:177–178), and the Santa Monica Mountains (King 1969:37), and also from the Gabrielino-occupied San Clemente Island (Eisentraut 1990; McNulty n.d.). Thus, the inclusion of *Calandrinia* sp. seeds in burial Feature 271 at LAN-62 does not necessarily suggest a Chumash practice. *Datura* sp. leaves and roots were used to make a drink that was ingested for its vision-inducing and pain-killing capabilities. The vision-inducing property was highly valued, and the drink was often consumed during important rites of passages, mourning, and ritual events and also on an individual basis within the domestic realm (Timbrook 2007:66–69).

The second observation, regarding direct association between site function and plants during the Mission period, pertained to grasses. Grasses accounted for 88 percent of the mortuary collection (LAN-62) and 68 percent of the habitation collection (LAN-211) (Table 262). The ritualized offerings at LAN-62 were heavy on the grasses, but a less-specialized collection was represented in the habitation deposits at LAN-211, perhaps because grasses were more heavily used in the mortuary collection or because the habitation collection was biased toward the remnants of food consumption (as opposed to the actual food consumed) and the resulting collection was an inaccurate representation of what was consumed. Particular grasses, including *H. pusillum*, *Phalaris* sp., *Deschampsia* cf. *danthonioides*, and

Table 262. Relative Frequencies of Plant Taxa in Mission Period Habitation and Mortuary Contexts

Taxa	LAN-62 (Mortuary)		LAN-211 (Habitation)	
	n	%	n	%
Legumes	4,000	1	1,494	11
Grasses	332,389	88	9,535	68
Chenopodium sp.	2,053	1	279	2
Schoenoplectus [*Scirpus*] cf. *californicus*	721	0.2	605	4
Salvia cf. *apiana*	1,467	0.4	1,170	8
Deschampsia cf. *danthonioides*	7,639	2	129	1
Hordeum pusillum	45,187	12	3,763	27
Phalaris sp.	26,7854	71	4,578	33
Stipa sp.	453	0.1	250	2
Total	377,721	100	13,951	100

Table 263. Distribution of Domesticated-Crop Seeds

Genus/Species, by Family	Origin/Source	LAN-62 (Mortuary)		LAN-211 (Habitation)	
		n	%[a]	n	%[a]
Fabaceae					
Cicer cf. *arietinum*	Old World	1	0.1	32	5
Pisum cf. *sativum*	Old World	815	87	163	27
Poaceae					
Avena cf. *sativa*	Old World	21	2	10	2
Hordeum vulgare	Old World	15	2	117	20
Triticum cf. *aestivum*	Old World	81	9	264	44
Zea mays	New World	—	0.0	10	2
Total		933	100.0	596	100.0
Total density/percent[b]		0.57	0.2	0.62	1.4

[a] Percent of domesticated-crop seeds.
[b] Percent of total seed assemblage.

Stipa sp., showed distinct associations with these two contexts (habitation and mortuary). *H. pusillum* and *Stipa* sp. were in lower frequencies in the mortuary collections (12 percent and 0.1 percent, respectively) than in the habitation contexts (27 percent and 2 percent, respectively) (see Table 262). In contrast, *Phalaris* sp. and *Deschampsia* cf. *danthonioides* occurred in higher frequencies in the mortuary contexts (see Table 262). In general, there was a preference for *Phalaris* sp. during the Mission period that was very pronounced in the mortuary contexts. The habitats and availability of the two grasses (*H. pusillum* and *Phalaris* sp.) are similar. Nonetheless, there was a continued preference of *Phalaris* sp. through time in the Ballona (see Table 261). The preference of one grass over the other as food versus ritual offering was likely a cultural preference, which is not measurable.

The third observation involves domesticated-crop grain recovered in Mission period mortuary and habitation contexts (Table 263). The densities of domesticated-crop grain recovered from LAN-62 and LAN-211 were not statistically different. However, the percentages were distinct. A lack of distinction in densities between the two contexts suggests that the aboriginal populations did not use domesticated-plant foods any more or less intensively in those contexts. However, the differences in percentages indicated that those particular foods were more important in the habitation contexts (1.4 percent) than in the mortuary contexts (0.2 percent). In addition, the domesticated-crop-seed collection from the mortuary contexts was dominated by *Pisum* cf. *sativum*, which accounted for 87 percent of the domesticates. However, the collection from habitation contexts was dominated by *Triticum* cf. *aestivum* (44 percent). Therefore, the offerings of domesticated grain focused on peas, although wheat was more important as a food (amongst domesticated crops). The ritualized use of nonnative foods during a period of immense cultural change, dominance, and rebellion has not been documented previously in southern California. Other plants that occurred in higher percentages in habitation contexts included legumes, *Chenopodium* sp., *Schoenoplectus* cf. *californicus*, and *Salvia* cf. *apiana*.

Contextual Patterns

A majority of the archaeological samples, especially for macrobotanical remains, is often focused on features rather than midden, because focus on the former allows for a more rigorous control of context, stratigraphy, and chronology. In addition, there is a general unwritten bias toward sampling some types of features more heavily than others, with an underlying understanding that some features, such as hearths and pits, will yield higher seed frequencies than will other features, such as rock clusters. The PVAHP provided ample contexts with varied temporal associations to explore patterned variability between feature types. These included artifact concentrations (n = 6), activity areas (n = 2), hearths (n = 3), pits (n = 6), rock clusters (n = 11), and a structure.

Data from these 29 temporally distinct feature groups showed that higher carbonized-seed recovery was not related to feature type; instead, it was related to the period: higher seed densities were invariably associated with historical-period deposits (as discussed earlier) (Table 264). Features with the highest densities were Mission period pits (6,112 seeds per liter) and artifact concentrations (2,216 seeds per liter) at LAN-62. However, not all Mission period pits and artifact concentrations had higher densities (see Table 264). Of the 8 individual features with the highest seed density, all of them dated to the Protohistoric to Mission period, except the Intermediate period rock clusters in FB 4 at LAN-62. The data from the PVAHP indicated that the relationship between higher recoveries (higher densities) and feature types cannot be construed as a simple relationship, and the complexity of the relationship can be addressed only through adequate sampling of the full range of features and feature types represented at a site.

Table 264. Feature Types and Seed Densities, PVAHP

Feature Type	Site	Temporal Period	Seed Density (n/liter)	Density
Artifact concentrations (outside FB 1)	LAN-211	Mission	6	low
Artifact concentrations (burial areal)	LAN-62 A	Mission	3	low
Artifact concentrations (FB 3)	LAN-62 A	Mission	2,216	very high
Artifact concentrations	LAN-62 G	Intermediate to Late	17	moderate
Artifact concentrations	LAN-2768	Intermediate	0.4	very low
Artifact concentrations	LAN-54	early Intermediate	0.04	very low
Activity areas	LAN-62 G	Intermediate to Late	22	moderate
Activity areas (FB 4)	LAN-62 A	Intermediate	23	moderate
Hearths (inside FB 1)	LAN-211	Mission	127	high
Hearths (inside FB 1)	LAN-211	Protohistoric to Mission	156.7	high
Hearths	LAN-2768	Intermediate	0.1	very low
Pits (FB 3)	LAN-62 A	Mission	6,112	very high
Pits (outside FB 1)	LAN-211	Intermediate	0.2	very low
Pits	LAN-2768	Intermediate	0.33	very low
Pits (FB 4)	LAN-62 A	Intermediate	4	low
Pits	LAN-54	late Millingstone	0.03	very low
Pits (sitewide)	LAN-62 A	unknown	45.5	moderate-high
Rock clusters (inside FB 1)	LAN-211	Mission	68	moderate-high
Rock clusters (FB 3)	LAN-62 A	Mission	8	low
Rock clusters (inside FB 1)	LAN-211	Protohistoric to Mission	120	high
Rock clusters	LAN-62 G	Intermediate to Late	13	moderate
Rock clusters (outside FB 1)	LAN-211	Intermediate	0.2	very low
Rock clusters	LAN-2768	Intermediate	0.02	very low
Rock clusters (FB 4)	LAN-62 A	Intermediate	567	high
Rock clusters	LAN-54	early Intermediate	0.1	very low
Rock clusters (FB 7)	LAN-62 A	Millingstone	49.1	moderate-high
Rock clusters	LAN-54	late Millingstone	0.1	very low
Rock clusters (sitewide)	LAN-62 A	unknown	8.3	low
Structure	LAN-2768	Intermediate	0.01	very low

Strong contextual data from the PVAHP, in particular the macrobotanical data from particular groups of features, have provided valuable insights into prehistoric and ethnohistoric ritual practices and food-consumption behaviors. One such example highlighted here was the sample from pits in FB 3 at LAN-62 (see Table 242), which included high quantities of seeds placed in baskets and burned as part of mortuary practices. The seeds were primarily grasses—in particular, *H. pusillum* and *Phalaris* sp., which accounted for 82 percent; the remaining 18 percent included other plants. Given the high ratios of wild-grass seeds to nongrass seeds, these seed offerings in baskets may have been collections of seeds that would have been used to make a particular type of pinole. Different pit features within FB 3 had different taxa and ratios of nongrass seeds that could have been various combinations of wild seeds to make different types of pinole offered to the deceased. These combinations could have either been idiosyncratic or had a special meaning to the group.

In a Nutshell: Use of Acorns by the Ballona Populations

The apparent minimal use of nuts by the aboriginal populations in the Ballona does not fit with the expectations of pan-California models of food reliance that have linked acorn use and intensification with the Millingstone and Intermediate periods in California (Basgall 1987; Wohlgemuth 1996, 2002). Previous investigations in coastal southern California have yielded only meager quantities of nuts, despite rigorous sampling (Reddy 1999a, 2004a). Typically, recovery rates are slightly higher in younger deposits but still much lower than is typically documented in central California. The PVAHP samples were no different; nuts were recovered in very low densities from the PVAHP. The Millingstone deposits had the lowest nut use, and there were only slightly higher values from the Intermediate and Late periods (Table 265). A very slight

Table 265. Nutshell Recovered from PVAHP, by Period

Period	Item		
	Quercus **(g)**	***Juglans*** **(g)**	**All Nutshell (g)**
Mission Period Habitation			
g	0.03	0.07	0.64
g/liter	0.0002	0.001	0.005
Mission Period Mortuary			
g	10.01	0.87	13.75
g/liter	0.02	0.002	0.03
All Mission Period			
g	10	1	14.4
g/liter	0.02	0.002	0.025
Protohistoric to Mission Period			
g	0.7	0.1	1
g/liter	0.005	0.001	0.01
Late Period			
g	0.04	0	1.1
g/liter	0.0001	0	0.002
Intermediate Period			
g	0.05	0.08	0.22
g/liter	0.00002	0.00003	0.0001
Millingstone Period			
g	0.02	0	0.02
g/liter	0.00005		0.00005

increase in acorn use was noted only in the Protohistoric period. Among the nut foods, acorns were the most ubiquitous across time, and the acorns exploited by the Protohistoric period Ballona occupants were mostly *Quercus agrifolia* and/or *Quercus wislizeni*. Therefore, based on these results, acorn use appeared to have been minimal in the Ballona, and this is consistent with results documented further south along the coast (Reddy 1999a, 2004a). These patterns do, however, contradict many accepted models of acorn exploitation that have argued for intensive use during the Millingstone and Intermediate periods. So, why was there increased nut use in the Ballona Protohistoric period, particularly of acorns?

There are several possible explanations, including an increased need for perceived traditional foods by the occupants during a time of cultural flux (the Protohistoric period). It is also possible that acorns could have replaced a protein- and fat-rich food that was no longer available in the Protohistoric period. In the Protohistoric period, populations were tied more locally to the Ballona; so, the macrobotanical sample represented all seasons of occupation, versus the Intermediate period, when there was pronounced seasonality, and acorns may have been part of the winter camps inland.

Alternatively, what could have been at play may be much more basic: visibility of the acorns in the archaeological record. The role of acorns in the prehistoric diet has been subject to debate not only in California archaeology but also in the Near East. The following discussion draws on the acorn-usage debate in the Near East, which has considerable applicability to the PVAHP. Natufian plant diet was traditionally interpreted as primarily focused on cereals; however, more recently, it has been suggested that acorns may have also been an important part of the diet (see Barlow and Heck 2002; Mason 1995; McCorriston 1994). Note that almonds and *Pistacia* (pistachios) were consumed by the Natufian populations—two native plants from the same habitat as acorns in the Near East. A possible explanation is that the extensive processing necessary for acorns was a deterrent to their exploitation by the Natufian populations. One of the challenges faced in identifying dietary resources of the Natufian period is that acorn remains are infrequent to rare, although oaks occur within the catchment of many Natufian sites in the Near East. We have a similar challenge in southern California, with low recovery rates of acorn nut and nutshell. In both cases, wild grasses (also referred to as wild cereals in the Near East) and acorns were available for exploitation. However, in studying time periods when both were available, it becomes important to determine which of these foods would have been most attractive in terms of energy returns. Barlow and Heck (2002) argued that when acorns are included in the diet, their archaeological visibility is related to the types of acorns—that is, counterintuitively, large acorns are less visible than small acorns. Using cost-benefit analysis, the authors proposed that large acorns were more likely processed at procurement locations and small acorns were more likely to be processed within residential bases (Barlow and Heck 2002:139–141). They also argued that wild grasses became more important when the effective abundance and encounter rate of acorns was low (Barlow and Heck 2002:137). Applying these arguments to the southern California context, the oaks were most likely *Quercus agrifolia* and/or *Quercus wislizeni*, both of which have small acorns. As per Barlow and Heck (2002), if the abundance and the encounter rate of acorns were higher than those of wild grasses, acorns would have been exploited more heavily by the Ballona occupants. But they were not located in the immediate vicinity of the Ballona; in other words, the effective abundance and encounter rate were low.

When discussing visibility of acorns in the archaeological record, one must explore the process by which acorns get incorporated into the archaeological record (Mason 1995; McCorriston 1994; Reddy 2003) (Figure 271). Incorporation of acorns is highly variable and based on the method of preparation, the potential for use of acorn shell as fuel, and, most importantly, accidental loss and spillage. The degree of spillage and accidental loss is obviously directly related to the intensive use of acorns as a primary food. In other words, the more one uses the resource, the higher the probability of spillage and loss during processing and consumption. Therefore, higher densities of acorn shell are observed in the archaeological record only if plant use was high (therefore, contexts for plant carbonization were high), and whether acorns themselves were intensively used. The processing-pathway model (see Figure 271) is a generalized pathway for all types of acorns. It highlights processing stages, products, and by-products likely to survive in the archaeological record. Processing by leaching in water and/or burying in clay is associated with central and

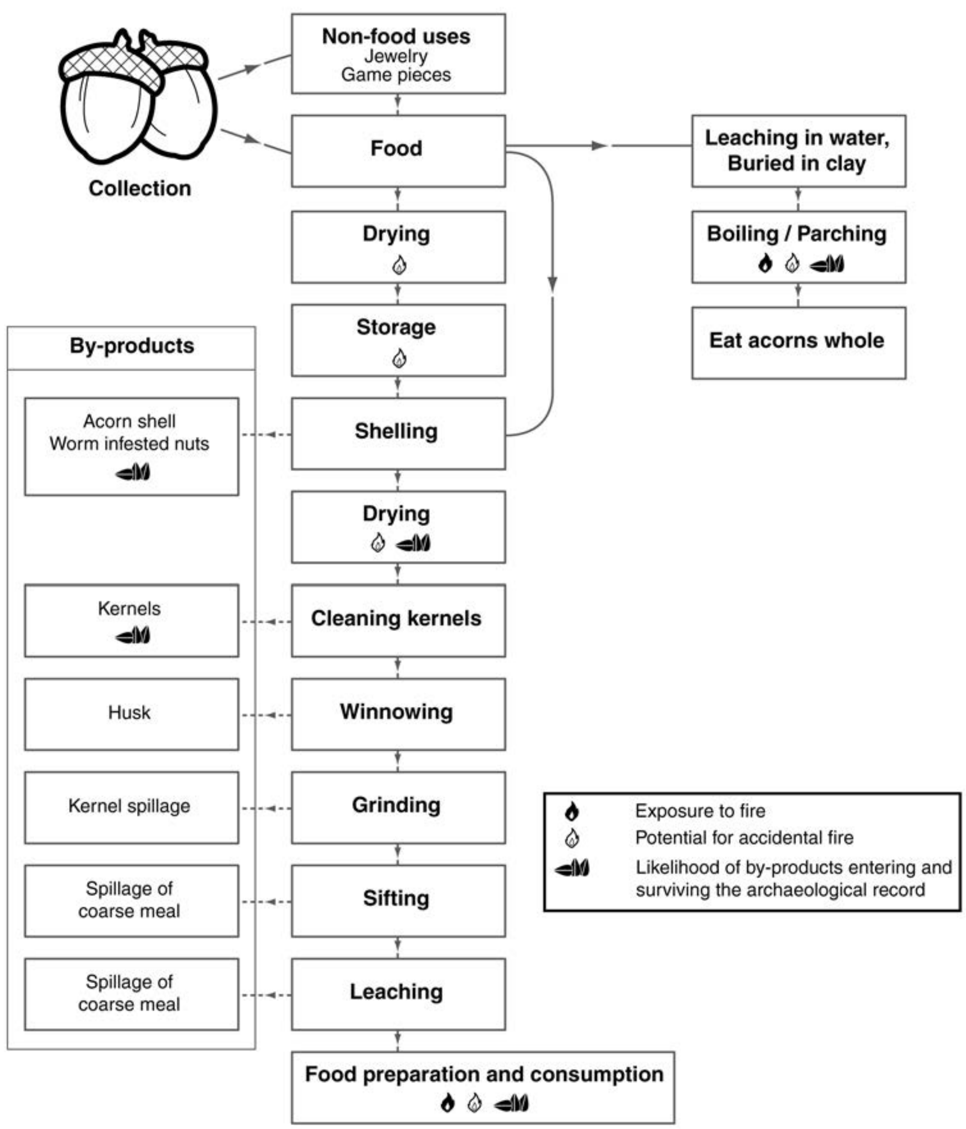

Figure 271. Acorn-processing pathway.

northern California species and not those of coastal southern California. Acorns would be enclosed in clay, parched in coals, and then shelled from the clay encasements before consumption. Of importance is that acorns were not roasted or parched (directly over fire without clay casings), as was the case for grasses, other small seeds, and also nuts, such as gray pine nuts. Instead, the likelihood of carbonization in acorn processing was only through accidental fires, which severely limited instances of carbonization, especially if acorns were not abundant for exploitation and the encounter rate was low.

Use of acorn nutshell as fuel would have produced ample carbonized remains, but there has been very little evidence of such use in coastal southern California. There has been documented evidence of Miwok (in central California) storing acorn by-product shell as fuel, because they made a hot and lasting fire (Barrett and Gifford 1933:143). If they had been readily available to the Ballona populations, the use of acorn shell as fuel would have been ideal because of the lack of large quantities of wood in the Ballona area.

In summary, the overall lack of acorn use by the Ballona populations was very likely for two reasons. First, this food was not important in the subsistence system because of the low encounter rate. Second, when they were utilized in low quantities, the processing methods did not facilitate their carbonization and, thus, survival into the archaeological record. The most parsimonious explanation is that acorns were a minor part of the diet and played only a minor role in ritual activities.

Seeds of Change: Intensive Plant Exploitation in Protohistoric Coastal Southern California

Protohistoric period subsistence studies in coastal southern California have been held captive to the region's rich ethnohistoric record. Although modeling past human adaptations using ethnohistoric information is one effective avenue to understanding prehistoric behavior, direct analogies are limiting and often one-dimensional. The paleoethnobotanical results from the PVAHP demonstrated a lack of fit between the ethnohistoric assessments and paleoethnobotanical data from archaeological sites in coastal southern California, particularly in terms of two research issues. The first is the disjunction between recent archaeological results and Shipek's (1977, 1989) ethnohistoric-based assertion that the Native Americans in the San Diego area were incipient food producers at Spanish contact in 1770. The second is the ubiquitous recovery of two particular grasses, *Phalaris* sp. and *H. pusillum*, at Mission period Native American sites in the Los Angeles Basin, but their lack of reference in ethnohistoric accounts. These results reaffirm that models of past plant utilization must be derived largely from archaeological macrobotanical data.

In the 1970s and 1980s, Florence Shipek (1977, 1989) asserted that Kumeyaay Native Americans in southernmost California practiced plant husbandry at the time of Spanish contact. Shipek's insights into Native plant husbandry, water management, and fire management were based on twentieth-century interviews with 17 Kumeyaay elders for a water-rights case. These included some individuals who moved between Mexico and the United States at the time of the interview and were not in residence in San Diego or Imperial County. Ten of these individuals asserted that the Kumeyaay were engaged in two types of "plant husbandry" in the late eighteenth and early nineteenth centuries. The first plant-husbandry practice entailed the cultivation of a now-extinct "semidomesticated" grain. The Kumeyaay were described to have broadcast the grain, harvested it by cutting stalks, and gathered the stalks into sheaves (similar to the European methods). Shipek (1977, 1989) argued that this "semidomesticated" grass no longer exists, because the Kumeyaay stopped cultivating it, and it then returned back to its original wild state. The second practice entailed experimental mixed planting of other species. This included planting of acorns in varied settings, native desert palm in inland Jamul, wild plum in varied locations, and mesquite in both desert and coastal settings. Shipek (1977, 1989) considered hybridization of oaks and ownership of planted oak groves, both of which were noted in earlier ethnohistoric accounts, along with the use of flood-control structures, to be key elements of this subsistence strategy.

Shipek's (1977, 1989) plant-husbandry reconstruction has recently been discussed in the secondary literature and accepted at face value. For example, Bean and Lawton (1993) discussed the Kumeyaay's sowing of native grasses and thus setting a path for "protoagriculture," referring to Shipek (1971) as the primary source. More recently, Smith (2001) has categorized the Kumeyaay as low-level food producers without domesticates, based solely on Shipek's (1977, 1989) writings. He considered the Kumeyaay a prominent example of an extremely variable set of societies that developed successful long-term socioeconomic solutions, including low-level food production. Therefore, Shipek (1971, 1977, 1989) is not the only scholar who has argued for protoagriculture. Bean and Lawton (1976, 1993) have proposed that the aboriginal populations had sophisticated knowledge about plant husbandry and that incipient agriculture may have existed. Lawton and Bean (1968) argued for "kitchen gardens" by the Cahuilla and Tipai-Ipai shortly before European contact. In contrast, Lightfoot and Parrish (2009:124–140) have recently made convincing arguments for why the Native populations of California were neither farmers nor protoagriculturalists.

If Native American populations in San Diego County were indeed protoagriculturalists at the time of Spanish contact and continued on as such into the Mission period, then one would expect several lines of archaeobotanical evidence to support this assertion. For instance, acorns should occur in high densities and also be recovered outside their natural habitat. Similarly, if there was some form of cultivation or tending of an extinct "semidomesticated" grain, this plant seed would be recovered in high densities both within and outside its natural habitat. One might also expect domesticated New World products (such as corns, beans, and squash) that were cultivated nearby in the Southwest to be present in low frequencies.

None of the just-mentioned expectations have been met through analysis of macrobotanical data sets from a series of sites in coastal and inland San Diego during the last 10 years (e.g., Klug and Popper 1995; Reddy 1996, 1997a, 1997b, 1999a, 2004a, 2004b, 2004c). These macrobotanical samples (and additional ones analyzed by other scholars) have documented varied strategies of gathering locally available wild-plant resources. Although resource emphasis varied spatially and temporally within the region, there was no evidence of cultivation of semidomesticated grasses, such as *H. pusillum*. Nor have any New World domesticates been recovered from pre-contact contexts. Furthermore, no prehistoric water-control features have been documented. In short, despite considerable macrobotanical investigation, there has been no evidence of Kumeyaay plant cultivation or low-level food production. There is a strong incongruence between the prehistoric archaeological record and the twentieth-century ethnographic record compiled by Shipek (1977, 1989).

The PVAHP paleoethnobotanical research has revealed a more complex trajectory of plant usage and intensification. Through these data, varied trajectories in the intensification of small-seeded-plant use along the coast of the Los Angeles Basin (125 km north of Kumeyaay territory) are evident. In other words, although there has not been evidence for plant cultivation and low-level food production in the San Diego area, the macrobotanical data from the PVAHP suggested that there might have been rudimentary plant cultivation farther to the north during the Protohistoric period.

The second example used to demonstrate a lack of fit between the ethnohistoric data and paleoethnobotanical data is the ubiquitous recovery of two particular grasses (*H. pusillum* and *Phalaris* sp.) from the archaeological deposits of the PVAHP but their lack of reference in ethnohistoric accounts. Macrobotanical remains recovered from Mission period deposits at LAN-62 and LAN-211 yielded large quantities of carbonized seeds, particularly grass seeds. For example, 88 percent of Mission period carbonized seeds from LAN-62 were grasses (*H. pusillum* and *Phalaris* sp.), and 62 percent of Mission period carbonized seeds recovered from LAN-211 were grasses (*H. pusillum* and *Phalaris* sp.). These two grasses were ubiquitous in the Mission period deposits of both sites. *Phalaris* sp. was also the most ubiquitous plant, with a ubiquity score of 98 percent, and *H. pusillum* had a ubiquity score of 82 percent. These results demonstrate that there was a preference for *Phalaris* sp. over *H. pusillum*. For example, *Phalaris* sp., at 71 percent, was the main plant-seed offering in mourning ceremonies, and in domestic contexts, it constituted far more than 33 percent of the plant collection (see Table 262). *H. pusillum* constituted a rougly similar 27 percent of the plant collection in domestic contexts, but was offered in a lower percentage (12 percent) in mourning ceremonies.

Based on these data, it is evident that both *Phalaris* sp. and *H. pusillum* were staples in the Mission period Native American diet and also the predominant offerings in ritual ceremonial contexts. These two plants were also ubiquitous in Late and contact period contexts along coastal San Diego on Camp Pendleton Marine Corps Base (Reddy 1999a, 2004a). Historical sources, including Crespi's memoirs, have noted that grasses were a significant part of the diet of coastal Native American populations. There is minimal information, however, about what these grasses were or whether they were just small-seeded plants (such as *Chenopodium* sp., *Salvia* sp., and *Calandrinia* sp.) that were categorized as grasses (Hackel 2005; Pourade 1969; Simpson 1938). It is surprising, therefore, that ethnohistoric accounts have made no mention of the use of these grasses. The lack of ethnohistoric information on grasses, therefore, could be a reflection of limitations in the ethnohistoric accounts, which were informal and subjective. The lack of ethnohistoric information, particularly details of Native American use of grasses as food, is not due to a lack of their use. In contrast to the lack of reference of specific grasses used as food, Spanish accounts did mention the use of specific nuts (such as acorns and pine nuts), berries (e.g., *Arctostaphylos* sp. and *Sambucus* sp.), and small seeds, such as chia (*Salvia*).

This Spanish bias against discussing grasses, which were the apparent dietary staple of most southern California aboriginal populations at time of contact, brings to question whether Native Americans specifically de-emphasized the use of grasses. In particular, there could have been an emphasis on the use of acorns, pine nuts, and berry plants as reflecting a perception of perceived cultural prestige. In other words, nuts and berries were culturally perceived as more prestigious foods than grass seeds; therefore, they were emphasized in the Spanish accounts. Alternatively, the lack of information on grasses could also be a reflection of limitations in the ethnohistoric accounts, which were informal and subjective.

A Shift to Planting during a Time of Turmoil

Putting aside the lack of congruence between the archaeological and ethnohistorical records momentarily, the focus on the exploitation of *Phalaris* sp. and *H. pusillum* has two important implications for Mission period Native American adaptations. First, if, indeed, there was an impact on the native vegetation with the onset of the Mission period, this should be reflected in the macrobotanical remains. With the establishment of the missions in California, thousands of Old World domesticated animals, such as cattle, horses, and pigs, were brought into the region. Scholars, such as Hackel (2005), Larson et al. (1994), and Johnson and Walker (1992), have argued that these Old World grazing animals competed with native wild animals and Native Americans for wild forage. Such intensive competition, however, is not consistent with the recovery of high densities of carbonized wild-grass seeds in the archaeological contexts at Mission period sites in the Ballona. If, indeed, domestic grazing animals heavily impacted the Ballona, Native Americans would not be expected to have continued to offer wild plants to the degree noted in the mourning-ceremony contexts at LAN-62. Instead, one would predict that the offerings would have been more symbolic and significantly less profuse. This was not, however, the case.

The second implication of the recovery of *Phalaris* sp. and *H. pusillum* in high quantities is that there was a strong preference for these plants by the Native populations. Although these two grasses were specifically targeted and collected for food, it is unclear whether they were cultivated, which would involve sowing, tending, and harvesting. Did the occupants of these two sites practice rudimentary cultivation? It is possible that they could have adopted the practice of cultivation from the Spanish and practiced it in an imitative form with wild grasses. The motivation for such an adoption could have been the desire to continue with their traditional-plant-food diet despite increasing competition with mission-owned animals. Cultivation could explain the presence of high quantities of preserved wild-grass seeds in archaeological contexts at a time when, many scholars believe, there was a depletion of native vegetation.

To elucidate whether these two grasses were simply collected or whether they were also cultivated, seeds taken from temporally distinct contexts were measured (lengths and widths). Initial cultivation of morphologically wild plants is very difficult to discern in the archaeological record. However, an increase in seed size is widely recognized as one of the early indicators that the selective pressures on a wild-plant species have changed (Baker 1972; Blumler 1998, 2002; Fuller 2007). This is particularly true for grasses and legumes. Fuller (2007) argued that general trends toward an increase in seed (or fruit) size in the domestication process likely reflect selection in open environments in which larger seeds have an advantage (ecological and taphonomic) (see also Harlan et al. 1973; Smith 2006).

Seed Size and Intensification

In total, 942 carbonized seeds were measured, including 592 *Phalaris* sp. seeds and 350 *H. pusillum* seeds. The measurements (length and width) were taken with a Motic Moticam 1000, which is a high-resolution microscope camera with a maximum live-image resolution of 1,280 × 1,024 pixels. The measurements were calibrated to 0.07 mm (error range of 0.07 mm). The 592 measured *Phalaris* sp. seeds were from Millingstone, Intermediate, and Mission period deposits (Table 266). The measurements of *Phalaris* sp. fell within the known sizes (1.8–2.3 mm in length and 0.9 and 1.8 mm in width) (Cowan 1978; Radford et al. 1968:122). Experiments conducted by Asch and Asch (1985:190) indicated that *Phalaris* sp. fruits may shrink an average of 10 percent after carbonization, depending on the carbonization conditions. Unfortunately, the sample size for this grass was low in the Intermediate period sample (n = 18). The general trend for the LAN-62 seeds, however, was an increase in mean seed size (both length and width) from the Millingstone period to the Mission period (from 2.56 to 2.97 for length [a change of 0.41 mm] and from 1.56 to 1.75 for width [a change of 0.19 mm]). Interestingly, when the LAN-62 Millingstone sample was compared to the LAN-211 Mission period sample, seed size decreased, although the ratio of length to width remained largely similar; in other words, the seeds were not changing shape. Miksicek (1994) also observed a similar increase in *Phalaris* sp. seed sizes over time at LAN-60 (Centinela Site). Miksicek (1994) compared *Phalaris* sp. seeds from lower and upper levels of a test pit (lower levels were Intermediate period) and concluded that there was a change in *Phalaris* sp. seed size; however, given the small sample (n = 20), he refrained from making further interpretations.

The sample sizes (192 for Millingstone and 142 for Mission period) have lent weight to the findings, and the change was similar to that noted by Miksicek (1994). Unpaired *t*-test results presented in Table 267 indicated that the differences in lengths ($t = 2.7$; $df = 572$; $p < .0069$) and widths ($t = 4.09$; $df = 572$; $p < .0001$) between Millingstone and Mission period

Table 266. Summary Measurements of *Phalaris* sp., PVAHP

Period	Count	Length (mm)		Width (mm)		Ratio (Length/Width)
		Mean	Standard Deviation	Mean	Standard Deviation	
	LAN-62					
Millingstone	192	2.564	0.224	1.569	0.153	1.63
Intermediate	18	2.582	0.304	1.555	0.128	1.66
Mission	142	2.971	0.295	1.753	0.176	1.69
	LAN-211					
Mission	240	2.174	0.191	1.333	0.113	1.63
	LAN-62 and LAN-211					
Mission	382	2.470	0.451	1.489	0.247	1.66
Total	592					

Table 267. Comparison of *Phalaris* sp. Seed Sizes across Time, PVAHP

Comparison of Temporal Periods	*t*	*df*	Two-Tailed *p*	Standard Error of Difference	Interpretation
Lengths					
Millingstone and Intermediate (all LAN-62)	0.3232	208	0.7469	0.057	Seed length increases significantly from Millingstone to Intermediate period.
Millingstone and Mission (LAN-62 and LAN-211)	2.7082	572	0.0069	0.035	Seed length increases significantly from Millingstone to Mission period (all).
Millingstone and Mission (all LAN-62)	14.3183	332	<0.0001	0.028	Seed length increases significantly from Millingstone period to LAN-62 Mission period.
Millingstone (LAN-62) and Mission (LAN-211)	19.4967	430	<0.0001	0.02	Seed length decreases significantly from Millingstone period to LAN-211 Mission period.
Intermediate (LAN-62) and Mission (LAN-62 and LAN-211)	1.0412	398	0.2984	0.108	There is no significant difference in seed lengths of Intermediate and Mission period (all).
Intermediate and Mission (all LAN-62)	5.2404	158	<0.0001	0.074	Seed length increases significantly from Intermediate period to LAN-62 Mission period.
Intermediate (LAN-62) and Mission (LAN-211)	8.3227	256	<0.0001	0.049	Seed length decreases significantly from Intermediate period to LAN-211 Mission period.
Mission (LAN-62) to Mission (LAN-211)	31.9763	380	<0.0001	0.025	Seeds lengths of Mission period LAN-62 are significantly greater than Mission period LAN-211.
Widths					
Millingstone and Intermediate (all LAN-62)	0.3766	208	0.7069	0.037	There is no significant difference in seed widths of Millingstone and Intermediate periods.
Millingstone and Mission (LAN-62 and LAN-211)	4.0901	572	<0.0001	0.019	Seed width decreases significantly from Millingstone to Mission period (all).
Millingstone and Mission (all LAN-62)	10.1895	332	<0.0001	0.018	Seed width increases significantly from Millingstone period to LAN-62 Mission period.
Millingstone (LAN-62) and Mission (LAN-211)	18.381	430	<0.0001	0.013	Seed width decreases significantly from Millingstone period to LAN-211 Mission period.
Intermediate (LAN-62) and Mission (LAN-62 and LAN-211)	1.1192	398	0.2637	0.059	There is no significant difference in seed widths of Intermediate and Mission periods (all).
Intermediate and Mission (all LAN-62)	4.6199	158	<0.0001	0.043	Seed width increases significantly from Intermediate period to LAN-62 Mission period.
Intermediate (LAN-62) and Mission (LAN-211)	7.9568	256	<0.0001	0.028	Seed width decreases significantly from Intermediate period to LAN-211 Mission period.
Mission (LAN-62) to Mission (LAN-211)	28.3753	380	<0.0001	0.015	Seeds widths of Mission period LAN-62 are significantly greater than Mission period LAN-211.

Table 268. Summary Measurements of *Hordeum pusillum*, PVAHP

Period	Count	Length (mm)		Widths (mm)		Ratio (Length/Width)
		Mean	Standard Deviation	Mean	Standard Deviation	
			LAN-62			
Millingstone	37	2.862	0.445	1.555	0.251	1.84
Intermediate	12	2.822	0.427	1.663	0.186	1.70
Mission	154	3.559	0.373	1.898	0.242	1.88
			LAN-211			
Protohistoric	37	3.020	0.421	1.594	0.224	1.89
Mission	110	2.647	0.328	1.266	0.198	2.09
			LAN-62 and LAN-211			
Mission	264	3.179	0.573	1.635	0.385	1.94
Total	350					

seeds were significant, suggesting that there was a change/increase in seed size over time. The comparison of Intermediate period seeds with those Mission period seeds (including both LAN-62 and LAN-211) showed the differences as not significant. In other words, the seed size decreased from the Intermediate period to the Mission period when both LAN-62 and LAN-211 seeds were included in the Mission period sample. This is because of the larger sample of LAN-211 Mission period seeds, which were significantly smaller than the seeds of the LAN-62 Mission and Intermediate periods.

The 350 *H. pusillum* seeds were from Millingstone, Intermediate, Protohistoric, and Mission period deposits (Table 268). The measurements of *H. pusillum* fell within the known sizes (average length and width of carbonized *H. pusillum* caryopses were 2.76 and 1.44 mm [Hunter 1992:29]). Experiments conducted by Hunter (1992) indicated that *H. Pusillum* sp. fruits may shrink an average of 5–9 percent after carbonization, depending on the carbonization conditions. In the PVAHP sample, the Intermediate deposits unfortunately did not have high frequencies of this grass (or any other plants); therefore, that sample size was low (n = 12), smaller than the Intermediate period *Phalaris* sp. sample. The general trend for the LAN-62 seeds was an increase in mean seed size (both length and width) from the Millingstone period to the Mission period (from 2.862 to 3.559 in length, a change of 0.697 mm). Interestingly, and similar to *Phalaris* sp., when the LAN-62 Millingstone sample was compared to the LAN-211 Mission period sample, seed size decreased. The ratio of length to width changed over time, and the seeds generally became longer (see Table 268). Miksicek (1994) observed an increase in *H. pusillum* seed sizes at LAN-60 when he compared *H. pusillum* seeds (from the same contexts as the *Phalaris* sp.) from lower and upper levels of a test pit (lower levels were Intermediate period) and concluded that there was a change in *H. pusillum* seed size; however, given the small sample (n = 8), he refrained from making further interpretations.

The differences in lengths and widths between Millingstone and Mission period seeds were significant ($t = 9.82$; $df = 189$; $p < .0001$ and $t = 7.6972$; $df = 189$; $p < .0001$) (see *t*-test results in Table 269), suggesting that there was an increase in seed size over time. Similarly, there was a significant increase in seed size from the Intermediate period to the Mission period, particularly with LAN-62 samples. However, the seed sizes (both length and widths) of *H. pusillum* from LAN-211 were significantly smaller than seeds from any of the other components.

Why were the *Phalaris* sp. and *H. pusillum* seeds from Mission period habitation contexts at LAN-211 significantly smaller than those from Mission period mortuary contexts at LAN-62? Given the recovery of the larger seeds from LAN-62, larger seeds were clearly available and exploited. So why were larger seeds not equally represented at LAN-211? Selecting considerable quantities of only larger seeds for mortuary offerings would be culturally maladaptive because of higher energy costs. Instead, it is more likely that certain individuals provided offerings of seeds from storage contexts—seeds that were, on average, larger. Alternatively, the LAN-211 habitation contexts have provided us with data that represent accidental spillage and discard of unwanted smaller seeds during plant processing and food preparation. Which of these two factors was at play is very difficult to discern; however, what is of importance in this discussion is that the seed sizes of both *Phalaris* sp. and *H. pusillum* increased from the Millingstone period to the Mission period.

The change in the seed sizes of these two grasses, in addition to their ubiquitous recovery, has important implications. These changes in seed size in the PVAHP samples were consistent with general expectations for initial grass cultivation, and they were due to intentional human activities. It is, however, important to eliminate possible noncultural factors that may have caused a change in seed size. For example, it is conceivable that in certain situations, environmental factors may possibly have influenced seed size. Ecologists have suggested that seasonal droughts, grazing, and burning may have had positive impacts on seed sizes among annuals (Baker 1972; Blumler 1998, 2002; Dyer 2002). Although

Table 269. Comparison of *Hordeum pusillum* Seed Sizes across Time, PVAHP

Comparison of Temporal Periods	*t*	*df*	Two-Tailed *p*	Standard Error of Difference	Interpretation
Lengths					
Millingstone (LAN-62) and Mission (LAN-62 and LAN-211)	3.232	299	0.0014	0.098	A significant increase in seed lengths between Millingstone period and LAN-211 Mission period.
Millingstone (LAN-62) and Mission (LAN-62)	9.8249	189	<0.0001	0.071	A significant increase in seed lengths between Millingstone period and LAN-62 Mission period.
Millingstone (LAN-62) and Mission (LAN-211)	3.1361	145	0.0021	0.069	A significant decrease in seed lengths between Millingstone period and LAN-211 Mission period.
Intermediate (LAN-62) and Mission (LAN-62 and LAN-211)	2.1279	274	0.0342	0.168	A significant increase in seed lengths between Intermediate period and LAN-211 Mission period.
Intermediate (LAN-62) and Mission (LAN-62)	6.5233	164	<0.0001	0.113	A significant increase in seed lengths between Intermediate period and LAN-62 Mission period.
Intermediate (LAN-62) and Mission (LAN-211)	1.7057	120	0.0907	0.103	No significant difference in seed lengths between Intermediate period and LAN-211 Mission period.
Protohistoric (LAN-211) and Mission (LAN-62 and LAN-211)	1.6231	299	0.1056	0.098	No significant difference in seed lengths between Protohistoric period and LAN-211 Mission period.
Protohistoric (LAN-211) and Mission (LAN-211)	5.564	145	<0.0001	0.067	A significant decrease in seed lengths between Protohistoric period and LAN-211 Mission period.
Protohistoric (LAN-211) and Mission (LAN-62)	7.6933	189	<0.0001	0.07	A significant increase in seed lengths between Protohistoric period and LAN-62 Mission period.
Mission (LAN-62) and Mission (LAN-211)	20.5857	262	<0.0001	0.044	Seeds lengths of Mission period LAN-62 are significantly greater than Mission period LAN-211.
Widths					
Millingstone (LAN-62) and Mission (LAN-62 and LAN-211)	1.227	299	0.2208	0.065	No significant difference in seed widths between Millingstone period and LAN-211 Mission period.
Millingstone (LAN-62) and Mission (LAN-62)	7.6972	189	<0.0001	0.045	A significant increase in seed widths between Millingstone period and LAN-62 Mission period.
Millingstone (LAN-62) and Mission (LAN-211)	7.1719	145	<0.0001	0.04	A significant decrease in seed widths between Millingstone period and LAN-211 Mission period.
Intermediate (LAN-62) and Mission (LAN-62 and LAN-211)	0.252	274	0.8012	0.112	No significant difference in seed widths between Intermediate period and LAN-211 Mission period.
Intermediate (LAN-62) and Mission (LAN-62)	3.2917	164	0.0012	0.072	A significant increase in seed widths between Intermediate period and LAN-62 Mission period.
Intermediate (LAN-62) and Mission (LAN-211)	6.6491	120	<0.0001	0.06	A significant decrease in seed widths between Intermediate period and LAN-211 Mission period.

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Comparison of Temporal Periods	***t***	***df***	**Two-Tailed *p***	**Standard Error of Difference**	**Interpretation**
Protohistoric (LAN-211) and Mission (LAN-62 and LAN-211)	0.6285	299	0.5302	0.065	No significant difference in seed widths between Protohistoric period and LAN-211 Mission period.
Protohistoric (LAN-211) and Mission (LAN-211)	8.4486	145	<0.0001	0.039	A significant decrease in seed widths between Protohistoric period and LAN-211 Mission period.
Protohistoric (LAN-211) and Mission (LAN-62)	6.9628	189	<0.0001	0.044	A significant increase in seed widths between Protohistoric period and LAN-62 Mission period.
Mission (LAN-62) and Mission (LAN-211)	22.5671	262	<0.0001	0.028	Seeds widths of Mission period LAN-62 are significantly greater than Mission period LAN-211.

these factors cannot be fully discounted, they do not appear to be the most likely explanation for these patterns in the macrobotanical data. Although prescribed burning was noted by initial Spanish explorers in southern California, it was an activity that undoubtedly was more frequent before the Mission period. Similarly, prolonged droughts appear to have been more pervasive before the Mission period. For example, Wigand (2005) argued that conditions returned to more normal during the Mission period, and the Late period was characterized by alternating drought and floods.

So, if the change is due to human intervention, how did the selection process start? In other words, was it a conscious decision (sowing as a deliberate practice by the aboriginal populations) or an accident that was later opportunistically exploited? If it was a conscious decision, then cultivation is the most likely human action that caused these changes in seed size. Both selective sowing of larger seeds and tending of fields, including weeding, could have been primary causal factors in that context. Cultivation also may have resulted in fairly rapid changes in seed size. For example, Harris and Hillman (1989) argued that initial cultivation of grasses in the Near East may have resulted in changes in seed morphology within a relatively short time, perhaps less than 50 years. It is also conceivable that selective gathering of only the larger seeds of each species in a wild context could have also created larger collections. However, this is a much less likely explanation, given that this would have been inefficient in terms of time and energy.

What was at play may be an example of co-evolution. For example, foragers harvesting these plants would have necessarily harvested and retained more of the variants that were larger. Subsequently, if the humans accidentally dispersed this variety to new locales by spilling some seeds in middens, which later propagated naturally, the fitness of this variety would have been enhanced, and natural selection would have favored its evolution and spread. If co-evolution is the explanation, then the process would have been gradual. Processing of grass seeds (wild or domesticated) involved a necessary set of processing stages, depending on the seed morphology (husked or not, type of inflorescence head, etc.) (see Hillman 1981; Jones 1983; Reddy 2003). Some of the stages included threshing, winnowing, pounding, and grinding (Figure 272). During each of these stages, particular plant and seed parts were selected to leave the pathway as by-products while others remained in the pathway. What specific plant and seeds were removed as by-products would have depended on the type of processing method (Reddy 2003). For example, Hillman (1984:32–38) observed that sieving removed only small weed seeds from grain samples (wheat and barley) and

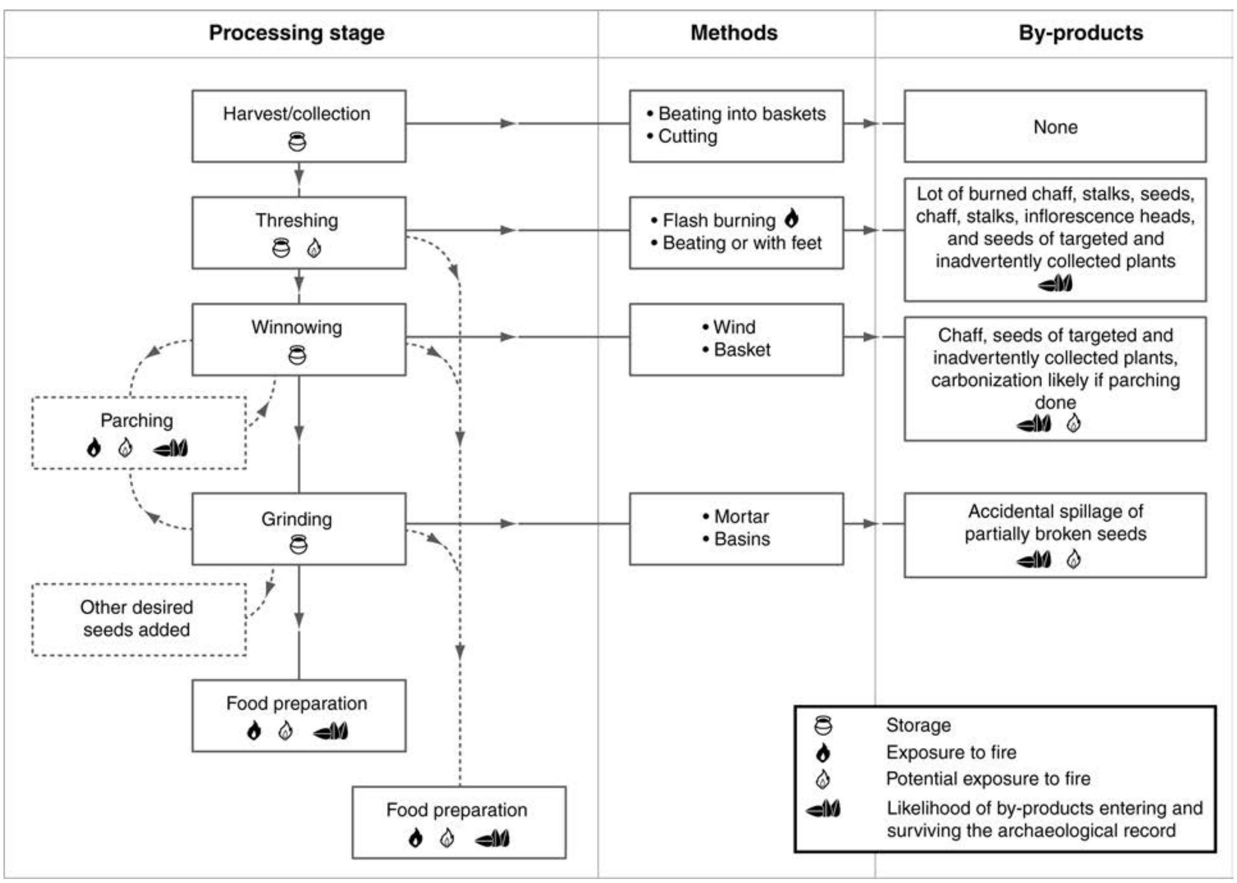

Figure 272. Small-seed-processing pathway.

that manual sorting was necessary to remove cereal-sized weed seeds. Similar observations were made for millet grains (smaller than cereal grains) by Reddy (2003). Ethnohistoric accounts of native-grass processing by aboriginal populations in California have identified methods that were more common. Harvesting with a seed beater was more labor intensive but more efficient, and that method was preferred over uprooting or breaking off the seed heads (Anderson 1993; Barrett and Gifford 1933). This contradicts Shipek's (1971) report that the Diegueño harvested wild grasses in sheaths (a practice considered to be of European origin in southern California). In the processing pathway of wild grasses, removing undesirable plant parts would inevitably have involved accidental removal of desired seeds. Such processing usually occurred in the residential bases (see Barlow and Heck 2002). Thus, accidental spilling of these selected larger seeds into middens would have resulted in their subsequent propagation, followed by continued and increased contribution to the gene pool of what the aboriginal populations exploited.

There has been interesting but intermittent ethnohistoric evidence of sowing practiced by the aboriginal Californians—for example, the Chumash, who scattered seeds in cleared areas around their villages (Miller 1988), and other small-scale sowing by the Southern Paiute (Bye 1972), Mohave (Kroeber 1925), Central Sierra Miwok (Hudson 1901), and Karuk of the Klamath River (Harrington 1932), among others. Cuero (1968) reported that the Diegueño planted seeds close to their dwelling. And of course, Shipek (1971) asserted that the Diegueño prepared the land first by burning and then broadcasting seeds. Perhaps the most commonly cited reference of the practice of sowing by aboriginal groups is Palou's account, which described aboriginal populations engaged in the planting of wild plants (Pourade 1969).

Wild grasses were certainly a low-ranking food with a resulting high diet breadth. In other words, the cost for exploitation of small seeds was very high unless they were abundant. However, as succinctly demonstrated by Gremillion (2004), these return-rate calculations and models do not take into account lower time costs during the winter season, when there were few other productive tasks. The data from the Mission period deposits at LAN-62 and LAN-211 clearly demonstrated the intensive exploitation of grasses—in particular, two grasses (*Phalaris* sp. and *H. pusillum*). These same two grasses are also part of the eastern North American corpus of small-seeded grasses that were intensively exploited in prehistory (Gremillion 2004). Both were cultivated prehistorically in Illinois, Tennessee, and elsewhere in eastern North America (Asch and Asch 1985; Chapman and Shea 1981). The PVAHP data (with very high densities and ubiquity for the two grasses and increased seed sizes over time) suggested targeted exploitation of these grasses in the Los Angeles Basin. This focus of exploitation over time would have caused strategic shifts in human behavior, and such shifts would have also entailed manipulations of the environment (sediments, land clearance, preferential seeding, and tending).

Broadcast sowing and co-evolution are the most likely explanations for the documented changes in seed size over time. The Mission period populations at LAN-62 and LAN-211 may have emulated the practice of Old World plant cultivation occurring at the missions and begun applying it to wild native grasses. The motivation for adopting these methods may have been to ensure continued success of traditional plant foods, especially if they were competing with mission-owned animals grazing on these wild cereals. Wild-grass cultivation may have been a means to keep traditional food practices in place in a rapidly changing context.

Intensive competition among Old World animals, wild animals, and aboriginal populations in the Los Angeles Basin is not very plausible, given the recovery of high densities of carbonized seeds of wild grasses and other plants from Mission period deposits at LAN-62 and LAN-211. These high densities do not fit with a model of marginalized and decreased native vegetation. Instead, it is likely that native populations cultivated wild grasses and, at least for a short time, successfully kept traditional grasses as a diet staple even while native vegetation as a whole was being depleted. The results from the PVAHP (in terms of high frequencies and densities of wild-grass seeds) suggest that at least initially, the Native Americans outcompeted Old World animals for this finite resource.

Summary

This chapter has presented a comprehensive summary of the paleoethnobotanical study of the carbonized seeds from the PVAHP and offered a range of interpretations of plant use and disposal. Several discussions, including the intensive exploitation of grasses, acorn use, defining collections of grasses and other seeds as pinole, the lack of seed use during the Intermediate period, and other issues, need further research and elucidation. Nonetheless, the PVAHP has provided a unique opportunity to study plant use over an 8,000-year period and valuable insights into Native American plant use and diet during the Protohistoric and Mission periods—a time of considerable cultural change, upheaval, and changing environment as a result of introduced plants and animals. It has also provided unprecedented data regarding cultural behaviors revolving around particular plants and the preference of particular plants over others. *Phalaris* sp. and *H. pusillum* were staples in the Mission period Native American diet and also the predominant offerings in mortuary contexts. Changes in seed size documented for the Mission period appear to have been due to human actions and intentional cultivation, and they suggest the initial steps toward agriculture.

Glossary

Family	Genus	Common Name
Aizonaceae	*Trianthema* cf. *portulacastrum*	desert horse purslane
Alismataceae	Cf. *Sagittaria* sp.	arrowhead
Amaranthaceae	*Amaranthus* sp.	pigweed
Anacardiaceae		
	Rhus sp.	sumac
	Pistacia sp.	pistachios
Asteraceae (sunflower family)		
	Ambrosia sp.	bursage
	Artemisia	sagebrush
	Aster-type	sunflower
	Helianthus annus	wild sunflower
	Hemizonia sp.	tarweeds
	Layia cf. platyglossa	tidytips; coastal tidytips
	cf. *Taraxacum* type	dandelion
Boraginaceae		
	Amsinckia sp.	fiddleneck
	Phacelia sp.	phacelia
Brassicaceae	*Lepidium* sp.	pepperweed
Caprifoliaceae	*Sambucus* cf. *nigra* ssp. *canadensis*	elderberry
Chenopodiaceae (goosefoot family)		
	Atriplex-type	saltbush
	Chenopodium sp.	goosefoot
	Chenopodium berlandieri	goosefoot; pigseed goosefoot
	Chenopodium californicum	goosefoot; California goosefoot
Cyperaceae (sedge family)		
	Cyperus sp.	flat sedge; sedge
	Schoenoplectus [*Scirpus*] cf. *californicus*	bulrush; California bulrush
Cucurbitaceae	*Marah* sp.	wild cucumber; manroot
Cupressaceae	*Juniperus*	juniper
Ericaceae	Arctostaphylos sp.	manzanita
Fabaceae		
	Astragalus sp.	locoweed; milkwetch
	Lathyrus sp.	wild pea; peavine
	Cicer cf. *arietinum*	chickpea
	Lupinus sp.	lupine
	Melitotus sp.	sweet clover
	Pisum cf. sativum	pea; garden pea
	Trifolium sp.	clover
	Vicia sp.	wild vetch
Fagaceae		
	Quercus sp.	oak
	Quercus agrifolia	coast live oak
	Quercus wislizeni	interior live oak
Juncaceae	*Juncus* sp.	rush
Juglanaceae	*Juglans* sp.	wild walnut
Lamiaceae	*Salvia* cf. *apiana*	white sage
Malvaceae		
	Unknown	
	Malvaceae-type	mallow
Menispermaceae	cf. *Menispermum* type	moonseed
Onograceae	*Clarkia* cf. *purpurea*	winecup clarkia; farewell to spring
Pinaceae		

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Family	Genus	Common Name
	Pseudotsuga	Douglas fir
	Pseudotsuga cf. *macrocarpa*	bigcone Douglas fir
	Pseudotsuga menziesii	Douglas fir
Papaveraceae	*Papaver* sp.	mustard
Poaceae		
	Agropyron sp.	wheatgrass
	Agrostis cf. *exarata*	bentgrass
	Avena cf *sativa*	oats
	Bromus cf. *carinatus*	California brome
	cf. *Dactyloctenium* sp.	crowfoot grass
	Deschampsia cf. *danthonioides*	hairgrass
		annual hairgrass
	cf. *Eragrostis*	lovegrass
	Hordeum pusillum	little barley
	Hordeum vulgare	domesticated barley
	Leptochloa sp.	pepper grass
	Lolium temulentum	ryegrass
		darnel
	Panicum sp.	panicgrass
		switchgrass
	Phalaris sp.	maygrass; canarygrass
	Phalaris cf. *caroliniana*	Carolina canarygrass
	Stipa sp.	needle grass
	Triticum aestivum (cf)	bread wheat
	Zea mays	corn
Platanaceae	*Platanus racemosa*	California sycamore
Plantaginaceae	*Plantago* cf. *erecta*	dotseed
Polygoneaceae		
	Eriogonum sp.	buckwheat
	Polygonum sp.	knotweed, smartweed
	Rumex sp.	dock
Portulacaceae		
	Calandrinia cf. *breweri*	redmaids; Brewer's redmaids
	Calandrinia ciliata	redmaids; fringed redmaids
Ranunculaceae	cf. *Ranunculus* type	buttercup
Rosaceae		
	Heteromeles sp.	toyon
	Prunus sp.	chokecherry, plum
	Prunus cf. *virginiana*	common chokecherry
Rubiaceae	*Galium* sp.	bedstraw
Salicaceae		
	Salix sp.	willow
	Salix exigua	narrowleaf willow
	Salix gooddingii	Goodding's black willow
	Salix laevigata	red willow
	Salix lasiolepis	arroyo willow
	Salix lucida	shining willow
	Salix sitchensis	sitka willow
Solonaceae		
	Solanum cf. *douglasii*	nightshade
	Datura sp.	jimsonweed
Taxaceae	*Taxus*	yew
Typhaceae		
	Typha sp.	cattail
	Typha angustifolia	narrowleaf cattail
Ulmaceae	*Celtis* sp.	hackberry
Violaceae	*Viola* sp.	violet

Decoding Past Lifeways in the Ballona: Comments on Material Culture and Paleodiet

Seetha N. Reddy and John G. Douglass

Research Themes

The overarching research objective of the PVAHP is to obtain a deeper understanding of human occupation in the Ballona area and how it relates to the cultural systems in southern California. The Ballona has a great time depth of human occupation (dating back at least 8,000 years) in a dynamic environmental context. Prehistoric settlement ranged from seasonal hunter-gatherer camps on the bluff tops during the earliest occupations in the Ballona to complex settlements during the early historical period. During this long aboriginal occupation, there were immigrations of outside groups to the coast (Takic groups), changes in settlement patterns and site structure, and the emergence of large, residential base camps and dispersed communities. In addition, the Ballona area evolved dramatically through time, from a freshwater lagoon to, eventually, a silt-choked saltwater marsh with, at times, the volume of the Los Angeles River flowing into the Ballona. Finally, the establishment of Hispanic colonial settlements in the area greatly affected Native Californians. Discerning the patterns of change and continuity in the Ballona is an important step toward elucidating the human habitation of the Ballona and, ultimately, understanding its relationship to surrounding regions.

In conducting the data collection and analysis, our research was guided by broad research themes first identified by Altschul et al. (1991) and then expanded on by Altschul, Ciolek-Torrello, et al. (1992); Altschul et al. (1998); Altschul et al. (1999); Altschul et al. (2003); Vargas and Altschul (2001); and Vargas et al. (2003) as we gained insight into human occupation through new data during 20 years of research. The 13 data chapters in this volume offer detailed information related to the research questions for the PVAHP outlined in the research design (see Volume 1 of this series). There are several major research themes related to the PVAHP. First, human-land relationships are viewed as extremely important; the ebb and flow of the Ballona Lagoon and the Los Angeles River over the past 8,000 years certainly had effects on the prehistoric human inhabitants of the area. Topics studied within this general rubric include paleoenvironment and prehistoric subsistence. Although much of the project's study of a paleoenvironmental reconstruction was detailed in Homburg et al. (2015), Wigand's study of paleoclimate and pollen analysis from archaeological sources is presented in this volume, which has two sections; Section 1 presents analysis of material culture, and Section 2 addresses subsistence issues.

Another major research theme for the PVAHP is that of culture history and the cultural dynamics of prehistoric settlement. Several research topics within this general theme include chronology; technology; site function and cultural interaction; cultural affiliation; settlement, community, and persistent places; and cultural adaptation. All of the chapters in Section 1 of this volume, as well as many in Section 2, offer data related to these general themes. Lithics, shell beads, glass beads, historical-period artifacts, and many other aspects of material culture, for example, offer detailed insight into the chronology of sites, among other important information. Chapters on basketry and ceramics offer insight into the topic of cultural affiliation. Historical-period artifacts, lithics, glass and shell beads, and aboriginal ceramics help focus on the decidedly complex topic of cultural adaptation. Together, the data and discussion presented in this volume create a basis for evaluating research themes and questions in the final volume of this series.

Transformation and Continuity: Material Culture and Subsistence Data

The PVAHP project yielded large, chronologically and contextually distinct data sets from five multicomponent sites: LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768. In addition, data were collected from two sites that were redeposited: LAN-1932 and LAN-2676; limited analysis was undertaken and reported for these two sites. Only the five intact, multicomponent sites from the PVAHP are discussed in this chapter. The rich and diverse data have provided us the opportunity to delineate synchronic and diachronic trends in lifeways, sociocultural choices, and both stability and change in cultural systems. Aboriginal settlement in the Ballona has a long time depth, extending back 8,000 years, with evidence of denser occupations in the Protohistoric and Mission periods, which could be due to better preservation of younger deposits, more inhabitants packed into a smaller area, a higher population later in time, or a combination of these factors. Summaries of the primary findings and interpretations of the main data sets are presented below.

Stone Tool Kits through Time

The five sites in the PVAHP yielded a large collection of 60,000 lithic artifacts representing a diversity of materials and artifact types; more than 50,000 lithic artifacts were analyzed (see Chapter 2 of this volume). The bulk of the raw materials for all tool types (flaked, ground, and unshaped) was derived from readily accessible alluvial cobbles and pebbles. Finished obsidian tools were imported into the area beginning in the Intermediate period. Fused shale and steatite were two other nonlocal materials represented in the collection that were obtained as finished goods from various sources. The lithic-artifact collection comprised a subsistence-related tool kit and ritual-related artifacts.

The primary findings of the lithic-artifact analysis were related to technology, subsistence, and ritual. The PVAHP tool kit revealed that there was considerable continuity in technology and tool use over time, interrupted by punctuated changes. Throughout the Millingstone period, there was continuity in stone-tool technology and use. Long-term patterns in ground-stone-tool use suggested that deposits gradually increased from very low densities during the Millingstone period to the highest densities during the Late and Mission periods. This trend contradicts previous models of ground stone use in California, which have defined the Millingstone Horizon as a culture marked by extensive use of ground stone (milling stones) (Basgall 1987; Fitzgerald and Jones 1999; Jones et al. 2008). The first major change in tool technology appeared during the early Intermediate period with the transition from atlatl darts to bow-and-arrow technology. The commonly accepted date for the widespread use of arrows is A.D. 500, but the PVAHP data suggested that this shift commenced between 200 and 1,500 years earlier. The next innovation occurred during the Mission period with the introduction of steatite *comales*. Interestingly, the introduction of metal tools during the Mission period did not appear to result in a decrease in stone tools.

A distinct collection of ritual-related stone artifacts was recovered from the Protohistoric and Mission period burial area and FB 3 (possibly related to the ethnographically recorded mourning ceremony) at LAN-62. The range of materials and artifact types was slightly greater in mortuary contexts than in domestic contexts. The ritualized collection from burial and mourning contexts included objects made especially for ritual (i.e., effigies and figurines). Charm stones, plummets, pipes, stone bowls, perforated steatite disks, steatite tablets, figurines, and effigies only appeared in the burial area at LAN-62. Additionally, clamshell effigies were exclusive to the mourning-ceremony feature (FB 3) and the burial area. However, the majority of burial goods were tools that had very likely served utilitarian functions (i.e., *comales* and shaft straighteners) before their deposition as burial or mourning-ceremony offerings. FB 1 at LAN-211 and the burial area at LAN-62 were the only contexts in the PVAHP that yielded shaft straighteners and stone pendants.

The study also noted differences between ritual mortuary items in Intermediate period contexts and those in Mission period contexts in the Ballona, suggesting an expansion and diversification in ritual behaviors, as well as some continuity (e.g., pestles and broken bowls and the use of ocher). Perhaps the most dramatic difference is that during the Intermediate period, ritual objects were restricted to mortuary and mourning-ceremony contexts with very few to no artifacts in individual graves. By contrast, Mission period burials had numerous stone items; sometimes several individuals were connected to each other by the dispersal of purposefully broken items among several different burials. In some cases, the role and/or status of an individual within society was suggested by the presence of large quantities of grave goods.

The Protohistoric and Mission period occupation observed in FB 1 at LAN-211 provided an insight into site structure and the use of space. There were distinct differences between activities conducted within FB 1 and those conducted outside the feature block; different aspects of food-preparation activities were evident in the two contexts, as reflected by the presence of a variety of tools, including manos and metates, in conjunction with the by-products of tool-production/–maintenance activities outside FB 1. In addition, FAR was also discarded outside FB 1. By contrast, the area inside FB 1 contained more informal tools and a general lack of evidence of tool-maintenance activities.

In comparing the Protohistoric and Mission period tool kits from LAN-211 with those from burials and FB 3 at LAN-62, the precise nature of their relationship has remained unresolved. One research question, discussed in Volume 5 of this series, asks whether FB 1 at LAN-211 was an area of intensive domestic activities or one for short-term feasting associated with mortuary activities at LAN-62. The lithic-artifact data and distribution within and outside FB 1 suggested activities related to intensive domestic activities, primarily food processing and preparation, and were found in association with high densities of faunal and floral remains in thermal features. Alternatively, certain objects with ritual connotations (such as shaft straighteners, stone pendants, pipes, quartz crystals, waterworn pebbles, and ocher) were recovered from both the burial area at LAN-62 and FB 1, which may imply that ritual activities occurred at both locales. However, objects with ritual connotations were recovered in much lower frequencies from FB 1 than in the burial area at LAN-62. Whether FB 1 at LAN-211 was associated with feasting related to LAN-62 burial and mortuary events could not be discerned from lithic artifacts alone and will be discussed in a synthetic fashion with other types of material culture in Volume 5 of this series.

Shell Beads and More

The PVAHP collection included more than 93,000 worked-shell artifacts recovered from the five sites (see Chapter 3 of this volume). The collection included ornaments and other worked-shell artifacts manufactured from 30 different types of shellfish taxa available locally or in the neighboring area. Shell ornaments by far comprised the bulk (99.6 percent) of the analyzed collection, which included 94 varieties of shell beads manufactured primarily from olivella. The "other" (other than beads) worked-shell collection consisted of ornament and fishhook blanks, containers, scoops, tools, perforated whole shells that were likely the result of ritual destruction or "killing," asphaltum-coated shell, and indeterminate worked-shell fragments representing manufacturing and processing debris or artifacts in different stages of manufacture.

The worked-shell collections from LAN-54 and LAN-2768 were relatively small compared to those from LAN-211 and LAN-62 and comprised less than 30 specimens, primarily from midden contexts. A scallop-shell pendant recovered from a late Millingstone to early Intermediate period burial at LAN-54 provided the earliest evidence of worked shell associated with burials in the PVAHP area. Both LAN-54 and LAN-2768 yielded Pismo-clam ornaments and blanks highlighting localized shell-ornament manufacture in the Ballona.

Nearly all of the PVAHP worked shell (96.8 percent) was recovered from LAN-62, and 90 percent of that was recovered from burials containing shell ornaments, containers that held ritual offerings, and whole shells that were ritually perforated, or "killed." LAN-62 yielded more than 90,000 shell beads. Of the 80 different bead types, olivella varieties made up the bulk of the collection, which dated to as early as the Intermediate period. Although shell beads were present in early contexts, shell-bead frequencies increased dramatically following the introduction of olivella-callus beads shortly after A.D. 1150, during the beginning of the Late period. Shell-bead frequencies peaked during the late Mission period as a result of the availability of mass-produced beads (aided by the use of newly introduced iron needles for shell-bead perforation) yet were nearly absent during the subsequent terminal and post-Mission periods.

Shell beads were interred with individuals in the burials regardless of sex or age. Mission period olivella disks constituted the most common bead type in the burials. Shell-bead strands and burned beads occurred more frequently in the burial area than in surrounding nonritual contexts. Some burials contained both glass and shell beads, although the two types were rarely deposited together in high frequencies. Based on shell-bead data, there was no evidence for differential spatial distribution of individuals by social status. Instead, shell-bead distributions in the burial area likely reflected temporal patterns, with different bead types used during different periods. Issues of status and wealth will be discussed in detail in Volume 5 of this series.

The possible mourning area associated with the LAN-62 burial area (FB 3) contained relatively moderate frequencies of shell beads, including fused and burned beads. Some of the beads may have been scattered, deposited in strands, and burned during mourning-ceremony activities associated with the burial area. Fused and burned shell beads were uncommon in nonritual contexts. Nonritual contexts, including midden and rock-cluster features, contained much lower frequencies of loose shell beads and nonbead shell ornaments.

LAN-211 yielded more than 2,700 worked-shell artifacts similar to those recovered from LAN-62. Shell beads made up the bulk (97 percent) of the LAN-211 collection, and nearly 40 percent of the collection was from inside FB 1. Most (94 percent) of the FB 1 collection was from excavation units adjacent to hearths and rock features and included shell scoops and containers likely associated with food consumption and cleaning out of hearths, as well as asphaltum-coated shell and indeterminate worked shell indicative of artifact processing and manufacturing. Similar types of other worked-shell artifacts were recovered from the area outside FB 1, though in much lower frequencies. The area outside FB 1 yielded high frequencies of olivella-callus, needle-drilled-olivella, and abalone disk beads.

The Protohistoric and Mission period contexts at LAN-62 and LAN-211 yielded similar shell-bead frequencies and distributions clustered within relatively confined areas. An exception to this trend was that shell beads dated slightly earlier at LAN-211, between the late Intermediate and early Late periods. Beads from that time period were loosely clustered in the center of the LAN-211 excavation block.

Of note is that finished shell fishhooks and hooks in different stages of manufacture were nearly absent from the PVHAP collections, suggesting that shell-fishhook technology was not prominent in the Ballona. Olivella-bead production also did not appear to have occurred in the Ballona. The Ballona occupants were therefore consumers, rather than producers, of olivella beads and likely obtained them through direct or indirect exchange from other locales, including the Channel Islands.

Awls, Punches, and Whistles

Over 1,000 artifacts of bone, antler, tooth, or claw were recovered from the five PVAHP sites (see Chapter 4 of this volume). These collections represent a range of activities. Worked-bone artifacts were likely used for symbolic and utilitarian purposes, as well as, in some cases, a combination of the two functions. Osseous objects included musical instruments, ornaments, gaming pieces, mortars or dishes, whalebone markers, spatulate objects, fishing equipment, and a variety of pointed tools. Use-wear analysis of pointed tools suggested that pointed tools were likely used for a variety of activities, including basket making, fiber processing, leather or hide working, pressure flaking, multiple-use tasks, and other tasks. These tasks seem to have cross-cut different tool shapes and cross sections, casting doubt on some of the traditional divisions between kinds of pointed tools (i.e., punch, reamer, needle, pin, or awl).

The largest collections of worked-bone artifacts were recovered from LAN-62 and LAN-211. Somewhat surprisingly, there were few overall differences in bone-artifact types or tool uses between LAN-62 and LAN-211. For example, the percentages of pointed and spatulate tools, which were relatively common, were quite similar. There were small differences in the proportions of objects identified as ritual items; 12 percent of the material from LAN-62 was placed in the general ritual category, as were 15 percent of the bone artifacts from LAN-211. However, when these artifact types were examined within the larger ritual and musical-instrument categories, certain differences were identified. Ethnographic discussions indicated that deer-tibia whistles, primarily found in burials, were associated with certain rituals, and most of the deer-tibia whistles were found at LAN-62. By contrast, far more bone markers, which may have been ultimately used in marking graves or specific areas, were identified at LAN-211 than at LAN-62. It is possible that these objects were manufactured at LAN-211 for use at LAN-62. More decorative objects were found at LAN-62 than at LAN-211, but more objects identified as fishing equipment were recovered from LAN-62.

Coils, Twines, and Cords

A remarkably well-preserved collection of textiles and basketry remains was recovered from LAN-62 and provided an unparalleled opportunity to define Gabrielino textile traditions (see Chapter 5 of this volume). In total, 438 carbonized textile items were analyzed, including a wide range of coiled and twined baskets and several types of nets and bags (see Chapter 5 of this volume). The coiled basketry had grass-bundle and *Juncus* three-rod foundations, *Juncus* and *Rhus* stitches, flush-cut and mission splices, and backstitched and herringbone coil terminations but no rim tics. Interestingly, the twined basketry had both open and close weaves, with an unexpected dominance of the down-to-the-right slant of turn heretofore ascribed to Chumash rather than Takic twining. Asphaltum-covered water bottles were likely produced in the Ballona using a simplified weave rather than obtained from the neighboring Chumash through trade. The cordage was hard-spun zzS string similar to cordage otherwise ascribed to Takic peoples. The close-knotted-cordage textiles present in the collection were similar to those known from Chumash and Gabrielino archaeological collections and have added important data to the understanding of those bag textiles.

The functional forms represented in the LAN-62 textile remains were similar to those known in the ethnographic record of southern California. There were examples of coiled baskets and coiled-basket hats; an ethnographically rare, small, coiled trinket basket or "treasure basket"; coiled plates and bowls for gathering, preparing, serving, and storing food; coiled basketry for gathering, carrying, and storing food; and gap-stitched basketry for winnowing. In addition, baskets that served as receptacles and leaching baskets for acorn meal were also present. Missing from the collection was a seed beater of woody shoots, which would have been part of a related tool kit. The coiled basketry represented was what has been termed "mission basketry." The LAN-62 basketry as a collection showed ethnic affiliation to the Gabrielino.

Fine cordage from LAN-62 was similar in twist (zzS) to that from Channel Island sites and inland Los Angeles County sites. Coiled remains from the island and inland Los Angeles sites were also similar to those from LAN-62. The reliance on *Juncus balticus* for coiled foundations by the weavers of LAN-62, however, was similar to that of Chumash weavers and contrasted with the choices of Takic weavers to the east and south. This reliance or lack of it could have been a factor related to geography and habitat rather than cultural affiliation. Nonetheless, there was a similarity between Chumash twining and the down-to-the-right slant of weft turn at LAN-62. This could indicate that the Gabrielino copied Chumash exemplars, water bottles in particular. The emulation of the technique could very well have been due to the success of the Chumash method.

Pots and Clay

In total, 120 Native American ceramic artifacts were recovered from the PVAHP project area (see Chapter 7 of this volume), almost all of which (115 sherds, or 96 percent) were recovered from LAN-211. Five ceramic artifacts (4 percent) were recovered from LAN-62, LAN-193, LAN-2676, and LAN-2768. The ceramic remains were primarily small fragments from undecorated brown or gray pottery vessels used for everyday domestic tasks, such as cooking. Additional ceramic remains included 5 modeled artifacts (likely figurines or figurine fragments), 3 cylindrical fragments of uncertain function, and 19 morphologically indeterminate artifacts.

Most of the ceramic remains were from well-defined Protohistoric to Mission period contexts, including 100 artifacts from LAN-211 and 2 modeled artifacts from the burial area in LAN-62. It was unclear whether any of the other ceramic artifacts predated the Protohistoric to Mission period, because they were found in deeper strata in LAN-211. It is likely, though, that these artifacts had moved downward as a result of bioturbation. Postdepositional mixing also probably explains the presence of single ceramic remains at LAN-2676 and LAN-2768. At the latter site, a cylindrical fragment was recovered from a nonfeature stratum dated to the middle Intermediate period occupation, but the item may have been intrusive from a more recent Rancho period component. LAN-2676 consisted entirely of redeposited materials, and thus the context of the sherd found at this site is highly suspect. A possibly earlier effigy or figurine fragment was recovered from LAN-193 in an activity area (Feature 9) that dated to the late Intermediate period. A later occupation has not been documented at LAN-193, although shallower strata may have been truncated by modern construction.

The spatial distribution of ceramic remains suggested variability in the ceramic materials used for ritual and domestic functions. Most of the 115 ceramic artifacts from LAN-211 were vessel sherds recovered from FB 1. Some of these sherds exhibited surface carbon deposits from postmanufacture exposure to fire, probably indicating use in cooking. The low-density accumulations of vessel sherds in Feature 1 likely reflected occasional discard of broken cooking vessels in "toss zones" surrounding the hearths. Conversely, at LAN-62, 2 three-dimensional-effigy or -figurine fragments were recovered from the burial area and were probably deposited with human remains as grave items. Hence, the spatial distribution of vessel sherds and figurines at LAN-211 and LAN-62 reflected a distinction between the use of ceramic technology for secular activities and its use for ceremonial activities during the Protohistoric and Mission periods.

Beads of Many Colors

More than 58,000 glass beads and several ceramic beads were recovered from LAN-62, LAN-193, LAN-211, and LAN-2768; all but several hundred were recovered from the burial area at LAN-62 (see Chapter 6 of this volume). Single examples of glass beads were collected from LAN-1932 and LAN-2676. Glass beads were introduced to Alta California primarily during the Mission period as trade items for colonists interacting with indigenous groups. Although glass beads were used in a variety of ways, they were primarily used as a medium of exchange. The majority of glass beads in Alta California were imported by the missions and presidios via colonial Hispanic routes from central Mexico, allowing Native Californians access to these items through their interactions with colonists. In addition, black-market merchant ships also sailed along the coast during the late eighteenth and early nineteenth centuries and traded with both Native Americans and colonists for local items, such as sea-otter pelts. The glass beads from LAN-62 and LAN-211 were manufactured in Europe between approximately 1769 and the 1850s.

The glass-bead collection from the PVAHP comprised classes consisting of four primary and two secondary methods of manufacture and four methods of finishing. Glass beads from PVAHP contexts included drawn, wound, and molded varieties and were sorted into nine classes based on material, methods of manufacture, and finishing; 46 types based on layering, shape, and decoration; and 113 varieties based on diaphaneity, color, luster, and perforation. Whereas almost all beads recorded from PVAHP sites were loose, the burial area at LAN-62 did contain 53 glass-bead strands and 5 patterned groups of glass beads. Glass beads in the PVAHP collection generally fell into one of seven color categories: clear/white, black, red, brown/yellow, green, blue, and purple. Whenever possible, the PVAHP bead varieties were tied to the Karklins (1985) glass- and ceramic-bead typological system to offer data comparable to those from other sites. A great deal of effort was focused on comparing contextual and typological information for the bead varieties from the PVAHP with information from other archaeological contexts in western North America. Analysis of glass beads and comparison with other sites allowed the identification of four chronological phases within the burial area.

Approximately half of the glass beads were found within burial contexts; the rest were found either in nonburial features or in general, nonfeature contexts within the three-dimensional burial area at LAN-62. Within the burial area at LAN-62, 155 burial features contained glass beads, ranging from 1 to nearly 3,000 beads per burial. Fifty-seven percent of the glass beads found within burial contexts were associated with only 8 burial features, each of which had more than 1,000 beads. Of the 155 burial features, 114, or roughly 74 percent, had fewer than 100 beads each, whereas 71, or roughly 46 percent, had fewer than 10 beads each. For many of the burials with small numbers of beads, it was unclear whether the beads were actually associated with the burial features or were intrusive, because small numbers of beads were identified in feature fill. Of the 29 cremations at LAN-62, none had glass beads directly associated. The demographic distribution of primary individuals associated with the 155 burial features containing glass beads included 3 fetuses, 10 infants, 4 children, 8 subadults, and 100 adults. Adults included 48 females and possible females and 25 males or possible males. Fetuses, infants, children, and subadults had almost twice as many glass beads as did adult females and four times as many as did adult males. Most burials had single-colored beads; inlaid- and overlaid-decorated beads were rare for burial features. Only 9 burial features had decorated beads, and those burials had only 1 or 2 each. Glass beads were found placed in various portions of burials, including on the head, neck, chest, arms, and legs, suggesting that beads in these areas may have originally been strung. In addition, glass beads were also found in patterns, suggesting that they were sewn onto clothing as decoration. Glass beads appeared to have also been either distributed in clusters of unstrung beads or scattered across the burial area. Only in rare instances were glass and shell beads found strung together.

Comparisons of glass-bead patterns with those of other southern California burial areas was difficult, because only a relative few had comparable published data. The collection from the PVAHP sites appeared to be later than those of the Chumash burial areas at Medea Creek and Humaliwo. The distribution of glass beads at the Mission period burial area of Humaliwo (LAN-264) suggested some similarity to that of LAN-62, as well as differences. At Humaliwo, for example, males had more glass beads on average than females, which was the opposite of the pattern seen at LAN-62. LAN-62 and Humaliwo were similar in that only a portion of the burial features at each site contained glass beads; whether this was related to status, wealth, or simply chronology is unclear at this time. There did appear, however, to be general spatial patterns related to the distributions of glass beads in the burial areas of both sites. These patterns will be detailed and analyzed further in Volume 5 of this series.

Historical-Period Artifacts

The Historical period artifacts from the PVAHP sites offered unique vantage points for understanding the economy, behavior, and events of the Historical period (see Chapter 8 of this volume). Historical period artifacts from the PVAHP hailed from two distinct contexts. Late-eighteenth- and early-nineteenth-century artifacts hailed from aboriginal contexts at LAN-62 and LAN-211. Historical period artifacts from LAN-62 primarily were recovered from the aboriginal burial area, whereas Historical period artifacts from LAN-211 were from domestic contexts. In addition to these Mission period contexts, SRI also analyzed specific early-twentieth-century contexts at three sites: LAN-54, LAN-62, and LAN-193. All of these early-twentieth-century contexts were secondary trash deposits associated with the agricultural and hog farms in the project area prior to the construction of the Howard Hughes Industrial Complex. It is important to note that these two temporal contexts—the late eighteenth century to early nineteenth century and the early twentieth century—were behaviorally and temporally distinct from one another and represent two specific time periods in the history of occupation of the project area: (1) aboriginal and early Hispanic occupation and use during the Mission period and (2) early development during the American period. In total, 3,402 artifacts dating to the Historical period were analyzed, including the metal, glass, ceramic, and "other" categories.

Analyses of late-eighteenth- and early-nineteenth-century contexts located in the burial area at LAN-62 and in the domestic context at LAN-211 revealed a great deal of detail regarding Mission period aboriginal identity, possible activities undertaken by individuals buried at LAN-62, and aboriginal access to and use of nonindigenous materials. A number of items of Hispanic origin were found in the burial area at LAN-62, including clothing fasteners (a variety of buttons and a likely pair of shoe buckles), weapons (portions of several possible gun barrels, a metal lance tip, and portions of several metal knives), a pair of scissors or shears, a glass projectile point, two chocolate pots, nonlocal ceramics, glass, bits of metal, horse trappings (including saddle pieces, a horseshoe, and copper bells), an iron skeleton key, and other material. Finding items of foreign origin in aboriginal contexts during the Mission period is not unusual. What is unusual is that the Native peoples used these foreign items in ways that were not Hispanic but, rather, indigenous. Based on the material in the burial area, it appeared likely that some Native residents of the Ballona were working on local ranchos and likely accessing these items of Hispanic origin through those connections. In addition, it is possible that the Native residents of the Ballona were also trading with black-market merchant ships, which reportedly traded sea-otter pelts with Native Californians for Hispanic, Chinese, and European goods. Perhaps the most striking find from this research was the difference between Historical period items found in the burial area at LAN-62 and those in the more domestic context at LAN-211. Numerous Mission period items were found in burial features or the general burial area at LAN-62 (including hundreds of pieces of unidentified metal and tens of thousands of glass beads), but only a handful of Mission period items were found at LAN-211, including small numbers of ceramics and the glass projectile point. It is clear that these artifacts of Hispanic origin were important to the Gabrielino in the Ballona and that they were used and treated in uniquely indigenous ways.

The late-nineteenth- and early-twentieth-century deposits from LAN-54, LAN-62, and LAN-193 contained a mixture of domestic and commercial debris. One of the most intriguing results was that both LAN-62 and LAN-193 contained hotelware from the same facility, the Ocean Park Casino located in the Ocean Park/Venice area, just north of the project area. These deposits were located at sites far apart from one another, in different portions of the project area. Deposits from all three sites appeared to date primarily to the 1920s and 1930s. Documentary evidence showed that a hog farm located at LAN-193 had contracts with local cities to collect garbage for feeding the hogs. It is possible that the similar material at LAN-54 was related to this same type of dumping activity. Material from LAN-62 also contained banded hotelware similar to that found at LAN-54 and LAN-193, in addition to more construction-type material. It is clear that these three contexts, together, have offered important data for understanding early-twentieth-century use of the PVAHP area. The features and contexts analyzed from these three sites suggested that there was a connection between the development of the Venice/Ocean Park area and early-twentieth-century dumps in the PVAHP area.

Palynology

Pollen analysis has offered a great deal of data for reconstructing the past vegetation and estuarine history of the Ballona Lagoon area (see Chapter 9 of this volume). Previous work in the area (Homburg et al. 2015; Wigand 2005, 2015) has focused on the lagoon itself and archaeological sites on the bluff tops overlooking the Ballona. This current work focuses on 309 pollen samples collected from the five intact archaeological sites in the project area. In addition to these 309 pollen samples from prehistoric contexts, an additional 23 modern surface samples collected from both estuarine and bluff contexts located as far south as the Tijuana Estuary and as far north as Point Mugu State Park were processed. Finally, an additional 11 samples were extracted from pollen collected from voucher plant collections to confirm the identities of some of the more common, as well as some of the rarer, plant-pollen types that appear in the coastal-shrub community.

The results of this work suggested that although there were many pollen types (a total of 37) present in the samples, only a few of the pollen types were abundant. These included (in relative order of abundance) *Aster*-type, Malvaceae-type, *Typha*-monad (*T. angustifolia*), cheno-am (or Chenopodiaceae), *Ambrosia*-type, and Cyperaceae (sedge, rush, and tule) pollen. The pollen was grouped into several types based on relative preservation, overall abundance, and whether the plants were native or introduced species. Pollen preservation overall was poor, as elsewhere in the Ballona. A detailed scan of the pollen samples indicated that they did not appear to reflect the relative abundance of the pollen types expected in current or past pollen accumulation. The lack of diversity of grass, sagebrush, and other pollen types strongly suggested that these expected types were eroded away after deposition of the sediments from which samples were collected. The coarseness of the surrounding soil matrix and the basic pH of the soil may have been two factors that contributed to poor preservation of samples.

Conclusions of this work suggested that current sea levels stabilized in the area in approximately 7000 cal B.P. but that there has been uplifting of the Ballona area since that time. Pollen samples from the Ballona suggested that there was an early Holocene establishment of a chaparral-type vegetation community in the hills of the Los Angeles Basin by approximately 9000 cal B.P. The maximal Holocene expansion of this vegetation type was between 7800 and 5700 cal B.P., when, as climatic modeling has suggested, winter and spring precipitation was at its maximum. More locally, isolated coastal-chaparral communities, such as those on the north-facing Westchester Bluffs overlooking the Ballona, became wetter in aspect as species that were favored by wetter climates became more dominant during this same time period. After 5700 cal B.P., there was a regional decline in chaparral-type vegetation communities to the levels that currently characterize southern California.

In the Ballona between 6000 and 3000 cal B.P., extensive marshes developed and were punctuated by major expansions of cattail marsh, which was the result of increased spring precipitation that kept water chemistry favorable to the survival of cattail species. After 3100 cal B.P., there was a rapid westward expansion of the salt marsh south of the main outlets for Ballona and Centinela Creeks, between the freshwater marsh centered in the eastern portion of Ballona Lagoon and the shoreline dunes on the west. This timing coincided with the decline of the cattail marsh in the eastern portion of the Ballona estuary, which likely was the result of a decline of spring precipitation. Reduced spring rains would have resulted in a reduced flow of freshwater into the marshes, creating a more-brackish environment. After that time, reduced stream flow would have resulted in increased deposition of sediment at the mouths of the creeks and accelerated the formation of salt marsh where the sediments were deposited. Overall, the Ballona Lagoon area silted in slowly, over several thousand years, as decreased precipitation led to reduced plant cover on the bluff slopes and, therefore, more sediment deposition due to erosion of the slopes.

The estuarine/riparian and coastal-chaparral and prairie vegetation surrounding the project area were the primary Native American resources available during prehistoric times. The variations in their compositions, locations, and extents through time affected Native American lifeways and seasonal activities. Coastal-chaparral communities in the Ballona, although highly varied during the Holocene, would have been an important resource for the many weedy species of plants collected by these Native people and found archaeologically in macrobotanical samples, such as those identified by Reddy in this volume. Late Holocene growth of Native populations in the Ballona Lagoon area corresponded to the expansion of the salt-marsh habitat and, likely, to increased productivity in the Ballona. The shift between the late Millingstone and Intermediate periods appears to have coincided with a decline in spring precipitation and resulted in the accelerated formation and expansion of the salt marsh in the western portion of the Ballona estuary while the freshwater marsh declined in the eastern portion. The most intensive and expansive occupation in the Ballona, during the Intermediate period (specifically between 2200 and 1900 cal B.P.), corresponded with one of the most dramatic wet episodes in the last 8,000 years in southern California. Biotic productivity likely peaked during this period as the result of high, increased precipitation.

Rabbit Stew and Venison Roasts: Vertebrate Faunal Remains

Nearly 500,000 vertebrate remains were analyzed from the PVAHP (see Chapter 10 of this volume). The dietary pattern that emerged in the Millingstone period featured mammals, which represented 58 percent of the bones, as the bulk of the diet. Despite the population's proximity to the water, fishing seems to have been only of minor importance, given that all fish bones together composed only 5 percent of the entire Millingstone sample. Bird hunting seems to have been of about the same importance as fishing; birds made up 6 percent of these deposits. Reptiles and amphibians made up just 2 percent of the sample, suggesting that they may have been accidental inclusions.

During the Intermediate period, the Ballona area apparently reached a peak in human occupation. Fishing was not the main source of animal protein; all fish bones made up just 6 percent of the collection. Reptiles and amphibians composed 4 percent of the collection, and birds were close, at 5 percent. The focus of hunting remained on mammals. In spite of more people and possible ethnic shifts, the Ballona population maintained a very similar diet to that of the earlier era.

The subsequent Late/Protohistoric/Mission period mostly continued prior dietary patterns, although there were significant divergences, as well. Mammals dominated the collection, as previously, and reptiles (3 percent) and birds (7 percent) contributed relatively little. However, a significant difference was that fish bones made up 15 percent of the samples. Another important change was the increase in artiodactyls, due mainly to sharply increased hunting of deer. A final important difference was the presence of significant numbers of sea-mammal bones. These represented 4 percent of identifiable mammal bones and made up less than 1 percent of the Intermediate and Millingstone period collections.

LAN-62 and LAN-211, with contemporary occupations during the Protohistoric and Mission periods, provided the opportunity for spatial comparison. They were primarily similar to one another in relative abundance of taxonomic groups. The only major difference between the two areas was that artiodactyl remains were much more abundant at LAN-211 than at LAN-62. This may have to do with LAN-211's possible function as a domestic site and LAN-62's primary function as a burial area. Another anomaly was that sea-mammal bones represented 5 percent of identifiable bones at LAN-62 and 4 percent at LAN-211. The similarity between the sites' faunal collections suggested that they were connected in purpose, as in rituals relating to burial.

Aboriginal Butchery

In total, 81 vertebrate remains from Native American contexts were analyzed for butchery marks, and the largest collection of butchered bones was recovered from the Protohistoric and Mission period contexts at LAN-211 (see Chapter 11 of this volume). The butchered bone from the project demonstrated continuity of earlier practices as well as new, presumably Hispanic, ways of harvesting meat from animal carcasses. Although deer and other native animals continued to be consumed, newly introduced species, including cattle and sheep/goats, were also consumed by the Native residents of the Ballona. The PVAHP collection, unlike other published collections from colonial Alta California, did not have specific meat cuts attributable to Hispanic food preferences. Instead, there was a strong interest by the Native Ballona occupants in obtaining the within-bone nutrients of marrow fat and grease. In addition, there was a persistence of stone-tool use for butchering, although the evidence on bones also suggested the use of metal tools.

Although Hispanic influence was visible in terms of nonnative butchering implements, metal tools did not immediately replace stone tools, as evidenced by the higher frequency of cut marks made by stone tools than of those made by metal tools. This disparity could have been a factor of scarcity and accessibility of metal tools or an expression of cultural resistance, conscious or unconscious. This mix of technology was evident on a deer bone that had both impacts from a hammerstone (to collect marrow) and cuts from a thin-bladed instrument, likely a metal knife. Adopted metal technology was used alongside stone tools for those tasks that Hispanic people also, separately, engaged in, such as skinning, dismembering, filleting, and butchering carcasses. There was, however, no metal tool introduced by Hispanic colonial society that could replace the blunt-force utility of a hammerstone for cracking open marrow and grease-rich bones. This butchering tool, as well as butchering pattern, suggests a hybridization of technologies and traditions. Metal blades and cleavers were used at the same time as, and in similar fashion to, stone flakes and bifaces, and heavy, blunt hammerstones continued to be used for opening up marrow cavities.

The study of the butchered-bone collection from LAN-211 suggested that Native American dietary patterns continued into the Mission period. New tools as well as new species were introduced into the dietary regimen, but these, at least at first, complemented rather than replaced earlier traditions. The results suggested that the Gabrielino borrowed Hispanic metal tools but did not necessarily abandon all previous tools and traditional practices. This study demonstrated that butchering studies can contribute useful information in regard to cultural identity and the process of ethnogenesis.

Twentieth-Century Butchery

More than 10,000 vertebrate remains were recovered from the twentieth-century historical-period contexts at LAN-193, LAN-62, and LAN-54 (see Chapter 12 of this volume). The collections from LAN-62 and LAN-54 were small (fewer than 10 bones each) and are not discussed here. LAN-193 contained a large historical-period refuse scatter (Feature 600) that yielded more than 10,000 vertebrate remains with butcher-sawn retail meat cuts, along with many ceramic and glass fragments that dated to the mid-1920s, based on associated historical-period artifacts. The faunal remains consisted primarily of pig bones and a few cattle and chicken bones. These remains, based on the historical-period artifacts commingled with the faunal bones, likely were discards associated with the Ocean Park Casino and restaurant in nearby Venice/Ocean Park, just north of the Ballona. These remains were likely fed to hogs associated with the Kitahata Hog Ranch established in the Ballona in the 1910s (Bancroft Library, UCB 2006). The Kitahata Hog Ranch was located at LAN-193, and most of the pig bones probably were from the farm itself.

The collection provided insights into the various retail meat cuts that were discarded at LAN-193 and the economic status of the individuals who contributed the food refuse. Nearly all the meat cuts were of moderate value. Roasts provided a large amount of meat for the money, whereas steaks of less-than-premium value were also a moderate economic investment. Chickens were apparently purchased piecemeal and consisted principally of low- to moderate-range body parts, which is logical if they were primarily used for soup. Ample evidence from faunal remains associated this bone collection with an Asian population. Marks indicating Chinese-style cleavers and cuts of meat were noted on the remains. This collection of bones has added valuable knowledge about the maintenance of ethnic boundaries by the overseas Asian community.

Clamming for Dinner: Invertebrate Faunal Remains

The shellfish remains from the PVAHP demonstrated that a narrow range of mollusk species was exploited through time (see Chapter 13 of this volume). Although exactly which species were of greatest importance varied somewhat through time, it was clear that, with some important exceptions, the most prevalent taxa were venus, Pismo, and littleneck clams; scallops; and Pacific oysters. In addition to these, gaper and jackknife clams as well as red and/or black abalone were significant but of secondary importance to the former five.

Patterns of shellfish exploitation differed over time. During the Millingstone period, venus clams predominated, bolstered by Pismo clams, scallops, and oysters. The low frequency at which oysters occurred in the samples from Millingstone period deposits is surprising and makes one wonder whether environmental reconstructions to date have underestimated the amount of siltation that had occurred already by this era. Also, the relatively high abundance of Pismo clams, a sandy-beach-/open-surf-loving organism, is surprising for the Ballona area. Today, these mollusks are most common well to the north of the Los Angeles area, along the central California coast. Even current environmental reconstructions have not posited that a highly open and sandy Ballona environment existed at that time. However, it is certainly possible that Native American foragers could have gathered the clams along beaches beyond the Ballona.

During the Intermediate period, shellfish harvesting at the various PVAHP sites focused on three species: venus and littleneck clams and scallops. Scallops predominated at the Intermediate period site of LAN-2768 but not in the contemporary deposits of other sites. The number of scallop shells at LAN-2768 was so overwhelming that it accounted for just over half (53 percent) of all the identifiable specimens taken together for this period. At other Intermediate period sites, venus and littleneck clams were both more abundant than scallops, which generally ranked third in frequency. It was unclear whether this difference was a chronological one related to slight differences in habitation periods between sites or one related to possible functional differences between contemporary sites.

The Late, Protohistoric, and Mission periods, taken together, demonstrate a dual emphasis on venus clams and scallops. Therefore, there existed a degree of continuity through time in the thrust of shellfish-harvesting efforts among the Ballona's people, such that from the Millingstone through the Mission period, venus clams were consistently among the most abundant species in most of the PVAHP site deposits. One anomaly that appeared in Late/Protohistoric/Mission period contexts was the large quantity of abalone. The shells were mostly identified from the burial area at LAN-62 and were associated with ritual paraphernalia or perhaps food donations to the deceased, rather than consumption by those occupying the Ballona during this period. It is possible that empty abalone shells were obtained in trade from neighboring coastal groups to the north or south or from the Gabrielino inhabiting the Channel Islands or the nearby Palos Verdes Peninsula area.

Grasses as Staples: Paleoethnobotanical Research

The paleoethnobotanical analysis of more than 530,000 carbonized seeds (94.3 seeds per liter) has elucidated long-term plant use in the Ballona (see Chapter 14 of this volume). The carbonized-seed collection from the project comprised 63 taxa, including 6 introduced domesticated crops (*Cicer* cf. *arietinum* [chick pea], *Pisum* cf. *sativum* [pea], *Avena* cf. *sativa* [oats], *Hordeum vulgare* [cereal barley], *Triticum* cf. *aestivum* [wheat], and *Zea mays* [corn]). Grasses were the most important plant food throughout the sequence, with particular emphasis on two grasses: *Hordeum pusillum* (little barley) and *Phalaris* sp. (maygrass). There was an overall lack of acorn use by the Ballona populations, which could be due to acorns' lesser importance as food in the subsistence system because of the low encounter rate. Alternatively, the methods used to process acorns did not facilitate their carbonization and survival into the archaeological record.

Plant use (as indicated by seed densities) increased steadily and significantly over time; the lowest relative usage occurred during the roughly 8,000-year time span of occupation in the Ballona. This lower use was likely not due to a lack of resources but, rather, to poor organic preservation resulting from the ages of the deposits and perhaps lower use of seed-bearing plants. The Intermediate period populations in the Ballona may have focused their exploitation on tubers, leaves, and other vegetative parts of plants rather than on seeds. Another related trend was the dramatic increase in exploitation of taxa associated with wetlands (both marsh and freshwater) in the Protohistoric and Mission periods; wetland exploitation was lowest in the Intermediate period. Plant use and disposal in the Mission period contexts indicated that aboriginal plant-use and -exploitation practices continued in the Ballona area despite the cultural upheaval of Spanish colonization. During that time, certain plants were more important in domestic contexts than in mortuary contexts. These plants included legumes (such as *Cicer* cf. *arietinum*, *Melilotus* sp., *Trifolium* sp., *Chenopodium* sp., *Schoenoplectus* [*Scirpus*] cf. *californicus*, *Salvia* cf. *apiana*, and *Stipa* sp.). In other words, these plants were consumed more intensively, whereas other plants were used more often in ritual offerings. Old World and New World domesticated-crop grains may have been obtained by Ballona populations during the

Mission period as payment for labor at the rancho or pueblo. There was no macrobotanical evidence that Native American populations of the Ballona cultivated these crops. It is also possible that the Gabrielino were sharecroppers (growing grain for ranchers or pueblo residents) paid with portions of the crops.

Phalaris sp. and *Hordeum pusillum* were staples in the Mission period Native American diet and were also the predominant offerings in mortuary contexts. These two grasses were ubiquitous in the Mission period deposits; *Phalaris* sp. was a more ubiquitous plant (98 percent) than *Hordeum pusillum* (82 percent). The recovery of high densities of native grasses contradicted earlier suggestions that grazing by newly introduced Old World domesticated animals quickly disrupted Native American gathering practices during the Mission period (e.g., Hackel 2005; Johnson and Walker 1992; Larson et al. 1994). Given the immense focus on grasses, especially *Phalaris* sp. and *Hordeum pusillum*, seeds of these two grasses were measured and analyzed. Changes in seed size were documented from the Millingstone to the Mission period, and they appeared to be due to human actions and intentional selection. However, the morphological changes did not culminate in a partially domesticated crop, because the brittle rachises remained through the sequence. The Native populations cultivated wild grasses and, at least for a short time, successfully kept traditional grasses as a diet staple, even while native vegetation as a whole was being depleted.

Direct association between site function and plants was observed in Mission period deposits when comparing the burial contexts (mortuary) at LAN-62 and the domestic contexts (food consumption) at LAN-211. Some plants, like *Calandrinia breweri* (Brewer's redmaids), were recovered in higher frequencies from LAN-62 burial contexts, although because of restrictions on the treatment of burial contexts, collection methods for burials were not similar to those used for nonburial contexts. Seeds of *Datura* sp. (cf. jimsonweed) were recovered only from four burials. Both *Calandrinia* cf. *breweri* and *Datura* sp. were used by aboriginal populations for their medicinal qualities and ritual powers (Timbrook 2007). Although domesticated plant foods were recovered from Mission period mortuary and domestic contexts, these particular foods were more important in domestic contexts. In addition, the domesticated-crop-seed collection from mortuary contexts was dominated by *Pisum* cf. *sativum* (garden pea), whereas the collection from domestic contexts was dominated by *Triticum* cf. *aestivum* (wheat). Therefore, the mortuary offerings of domesticated plants focused on peas, although wheat was more important as a food (among domesticated crops). The ritualized use of nonnative foods during a period of immense cultural change has not been documented previously in southern California.

Strong contextual macrobotanical data from specific groups of features have provided valuable insights into prehistoric and ethnohistoric ritual practices and food-consumption behaviors. For example, the FB 3 pit features at LAN-62 included high quantities of seeds that were placed in baskets and burned, possibly as part of mortuary and ceremonial practices. The seeds were primarily grasses, in particular *Hordeum pusillum* and *Phalaris* sp., accounting for 82 percent of the charred plants recovered from these features. Seed offerings in baskets may have been collections of seeds that would have been used to make a particular type of pinole. Different pit features had different combinations of wild seeds to make different types of pinole offered to the deceased. These combinations could have either been idiosyncratic or had a special meaning to the group.

Changing Landscapes and Traditions

Amassing the most important kernels of insight from the large and diverse data sets of the PVAHP and delineating the major findings is a necessary step in understanding the changing cultural landscapes of the Ballona. Data from the varied artifacts and subsistence remains have repeatedly identified continuity in tradition with occasional punctuated changes. The most pronounced changes occurred at the beginning and end of the Intermediate period and at the start of the Protohistoric and Mission periods. In elucidating the major diachronic and synchronic trends in the PVAHP data, we have identified five research issues—chronology and culture contact, technology and trade, site function, subsistence, and mortuary ritual—into which the data have provided valuable insight.

Chronology and Culture Contact

The PVAHP included extensive radiocarbon and archaeomagnetic dating of samples from both middens and features and produced more than 200 radiocarbon dates (see Chapters 2 and 3, Volume 2 of this series). The data have allowed us to move toward tracking the pace of change at a more sophisticated level and addressing explicit questions. Dating facilitated the construction of a cultural chronology for the Ballona (see Figure 6) for human occupation starting 8,000 years ago. The cultural chronology for the project distinguishes the Millingstone, Intermediate, Late, Protohistoric, Mission, Rancho, and twentieth-century periods. Three major issues related to chronology and culture contact that have been discerned—socioeconomic interactions with the desert and islands, interaction between the Chumash and the Gabrielino, and culture contact with Hispanic cultures—are discussed below.

Desert and Island Interactions

An ongoing debate in coastal southern California concerns the antiquity, timing, and nature of interactions between the coast and the inland desert areas. In particular, this debate centers on the timing of the influx of Takic populations into the southern California coastal area. This migration is also known as the Shoshonean Wedge, which refers to a body of linguistically similar people in the central part of southern California. It has traditionally been thought that there was a migration of Takic groups from the east to southern California perhaps as early as 2,000 years ago (approximately 50 B.C.), although more-recent arguments have been made for this intrusion to have occurred in ca. 1500 B.C. (3500 cal B.P.) (Sutton 2009). Takic cultural characteristics include the use of small, triangular projectile points; mortars and pestles; steatite ornaments and containers; perforated stones; circular shell fishhooks; and numerous and varied bone tools as well as bone and shell ornamentation (Meighan 1954). In addition, elaborate mortuary customs, along with the generous use of asphaltum and the development of extensive trade networks, also characterize this linguistic group. Archaeologically, lithic tools are typically used as markers of this cultural influx, both tool types and the raw materials used. If, indeed, the Cottonwood points from LAN-2768 were the signature of a new culture, then the Takic presence on the coast could have occurred at the end of the Millingstone period (approximately 1050 B.C.–A.D. 350). Use of steatite, shell ornaments, and shell fishhooks are all coastal, Chumash indicators, and the typical indicators of Takic intrusions are the desert point styles and cremation burial.

The presence of various exotic raw materials suggests that local and regional communication/trade networks were in play. The most common materials used and exchanged were lithic raw materials. Much of the lithic raw material represented at the PVAHP sites was of local origin. Nonlocal materials, such as obsidian and fused shale, were present, but they occurred in low frequencies, and any change in interaction over time is unclear. Nonetheless, exchange occurred with populations to the north, east, and west. For example, petrified wood, recovered from FB 1 at LAN-211, was obtained from the Mojave Desert; obsidian was obtained from Obsidian Butte and Coso; and fused shale was obtained from Grimes and Happy Camp Canyons.

The presence of steatite bowls from LAN-62 and LAN-211 suggests the likelihood that the aboriginal populations of the Ballona had socioeconomic ties with the populations on the Channel Islands—in particular, Santa Catalina Island. Also, *comales* were introduced to the Mission period occupants of the Ballona, and all were made from steatite. Rosenthal and Williams (1992) demonstrated the potential to distinguish different steatite sources microscopically. There are two well-known sources for steatite extraction and production: Santa Catalina Island and Sierra Pelona in north-central Los Angeles County, near Palmdale (Heizer and Treganza 1972; Kroeber 1925:629–630; Rosenthal and Williams 1992). Furthermore, there are smaller local sources of steatite within San Diego County: Stonewall Peak in Cuyamaca Rancho State Park, Jacumba Valley, and Boiling Springs on Mount Laguna (Graham 1981; Heizer and Treganza 1944; Parkman 1983, 1985; Polk 1972; Treganza 1942). Santa Catalina Island could have been the source of other distinctive lithic materials found at the PVAHP sites, including serpentine, chlorite schist, dacite porphyry, gneiss, andesite, basalt, and limestone.

Gabrielino and Chumash Weavers

Analysis of the basketry remains from LAN-62 revealed that both Takic and Chumash traits were present. For example, the twined basketry had Chumash markers (down-to-the-right slants of turn), whereas the cordage string had Takic traits and some Chumash signatures. The coiled basketry represented what has been termed "mission basketry." Fine cordage from LAN-62 was similar in twist (zzS) to that from island and inland Los Angeles County sites. Overall, the basketry showed ethnic affiliation to the Gabrielino and some Chumash influence, which could reflect copying of the successful Chumash basketry techniques.

Interaction with Hispanic Societies

As illustrated in a number of chapters in this volume, the aboriginal populations of the Ballona had a variety of different types of contact and interaction with, and incorporation into, Hispanic society. Various artifact classes discussed in this volume—including glass beads, early-historical-period artifacts, vertebrate remains, macrobotanical remains, and aboriginal ceramics—have all offered insight into these patterns. Many items of Hispanic origin, but not all, were found with burials at LAN-62, suggesting that these exotic items were perhaps personal items of the departed members of the Ballona community. Glass beads, copper chocolate pots, portions of firearms, horse trappings, clothing fasteners, knives, bits of metal, imported ceramics, and other items were all recovered from the burial area and have offered insight into some interactions with Hispanic society. For example, as discussed in Chapter 8 of this volume, some of these items suggested that members of the Ballona worked in the Pueblo of Los Angeles and on adjacent lands or at nearby ranchos, performing tasks related to everyday operation of these facilities. Many of the items of Hispanic origin in the burial area may have been related to employment on colonists' lands (e.g., as a cowboy or house help), scrounged from everyday detritus associated with those operations, or given as gifts to Native Americans. Alternatively, Native Americans may have obtained these items by trading directly with black-market ships or may have even scavenged some of these items from shipwrecks along the coast.

Domestic and mortuary contexts at LAN-62 and LAN-211 offered very different types of information regarding the socioeconomic interaction between the Native populations of the Ballona and the Hispanic colonists, suggesting that particular aspects of food or material culture had different types of emic importance to members of the Ballona community. These patterns will be explored further in Volume 5 of this series.

Technological Conservatism

Technological innovations reflect human interaction with the environment, ingenuity, and the sharing of knowledge—in some instances as a result of contact with different cultural groups. The technological change expressed in the PVAHP material culture was slow and could have been the result or cause of the cultural continuity and the slow pace of culture change. The data from the project have provided insight into two particular research issues that are important not only for the Ballona but also for coastal California in general: Millingstone period acorn use and maritime adaptation (canoe and shell-bead manufacture and fishhooks and maritime adaptation).

No Shift in Technology to Indicate Use of Acorns vs. Small Seeds

Models of ground stone use have defined the Millingstone period as a culture marked by extensive use of ground stone (milling stones) (Basgall 1987; Fitzgerald and Jones 1999; Jones et al. 2008). Researchers have argued that the development of the mortar and pestle (5000–3500 B.P.) enabled Native Californians to expand their resource base from just small seeds to include acorns. However, the Millingstone period deposits in the Ballona had low densities of ground stone, including mortars; instead, there was a general trend of gradual increase in ground stone during the Intermediate period and highest densities in the Late and Mission period deposits. Acorns and mortars did not show up in any meaningful quantities in the Ballona until the Protohistoric and Mission periods.

Maritime Adaptation

Despite its location along the coast and proximity to the southern Channel Islands, there was no evidence for canoe construction or shell-bead manufacture in the Ballona. Furthermore, the lithic collection did not have any elements of tool kits associated with canoe manufacture, such as those defined by Cassidy et al. (2004) for the early Holocene on San Clemente Island. Arnold (1995, 2001) theorized that the plank canoe was refined around A.D. 800–1000. The shell beads recovered from Ballona prehistoric, Protohistoric, and Mission period deposits had been obtained as finished goods through either direct or indirect exchange from other locales.

Based on the location of the Ballona at the edge of the Santa Monica Bay, marine-resource exploitation was expected to be a large part of the prehistoric subsistence strategy. However, finished shell fishhooks and hooks in different stages of manufacture were nearly absent from the PVHAP collections and elsewhere in the Ballona, suggesting that shell-fishhook technology was not prominent in the Ballona. Strudwick (1985) noted that initial use of the shell fishhook began in southern California approximately 3,500 years ago, if not earlier. The lack of fishhooks (in association with the types of fish exploited) suggests that fishing was predominately focused on the use of nets and spears to capture schooling fish in the surf and in the lagoon shallows.

Site Function

The variety of artifact analyses in this volume has illustrated the breadth and depth of artifact diversity at PVAHP sites across time and space. Individual artifacts, by themselves and without context, offer little in the way of information related to the function of a particular site. The relationship between material classes and their contexts is essential to the interpretation of our findings. By simply viewing artifacts in isolation, we are unable to view and understand patterns. The burial area at LAN-62 is a good example. Diverse artifact classes were placed in particular contexts within the burial area that, together, offered an important understanding of the process and patterns related to the deposition of these artifacts and how that deposition changed through time. The burial area was incorporated into the existing midden of the site, making interpretations more difficult at times. These artifacts, together with other types of data on sites, offered insight into Gabrielino/Tongva ethnogenesis and hybridization during a complex time for the Native inhabitants of the Ballona. In general terms, sites in the PVAHP, based in part on the artifact analyses reported in this volume, may be defined in broad terms as functionally related to habitations, collection and/or processing locales, and ritual and burial areas.

Continuity in Food

Interpretations of prehistoric adaptations in the Ballona included exploitation of high-ranked resources (large mammals and small seeds) and resource intensification focused on particular resources (shellfish, small mammals, and small seeds). There was no evidence of a dramatic shift in exploitation from terrestrial to aquatic resources between the late Millingstone and late prehistoric periods, as originally postulated by Altschul et al. (1991). Instead, there appeared to be considerable continuity in the exploitation, despite the environmental changes, at least in terms of animal resources. For example, terrestrial mammals provided the staple animal foods from the Millingstone period through the Mission period, with a minor change in the Mission period, when there was increased exploitation of artiodactyls. Fish were rarely exploited until the Protohistoric and Mission periods, when they and sea mammals increased relative to the earlier periods (but were still not in high frequencies). A similar continuity of exploitation was noted among the invertebrate remains: venus clams were the most favored shellfish through time. Overall, the Ballona occupants ate a narrow range of shellfish through time. Abalone, when present, was primarily from the LAN-62 burial area and was consciously selected as ritual paraphernalia or perhaps food donations to the deceased. The empty shells could have been obtained in trade from neighboring coastal groups to the north or south or from the Gabrielino inhabiting the Palos Verdes Peninsula area or the Channel Islands. In light of this continuity and conservatism in food, four major topics related to this general trend are discussed below.

Maritime Adaptation: Fact or Fantasy?

Despite the coastal setting of the Ballona, fishing was not an important subsistence strategy through time, which is similar to archaeological findings further to the south, near San Diego (Wake 1999b). Fish became more important in the diet during the Protohistoric and Mission periods than it was in earlier times but was never a primary food source. A question that stems from these findings is whether the Ballona subsistence was a maritime or a littoral adaptation. Terrestrial mammals were the most important vertebrate-animal-food sources throughout the aboriginal occupation of the Ballona, and perhaps there was a secondary dietary shift from birds to fish from the Late period onward. But if so, the shift was not significant. Based on the vertebrate analysis, the Ballona occupants did not practice a maritime subsistence economy; rather, it was more akin to a littoral adaptation that focused on the coast, from the inshore areas to adjacent inland areas.

Discerning Palates: Continuity and Change in Plant Diet

Plant foods were an important part of the diet of Ballona occupants through time. Grasses were heavily exploited throughout the sequence, with particular focus on two grasses: *Phalaris* sp. and *Hordeum pusillum*. There was evidence of intensified exploitation of these two native grasses during the Protohistoric to Mission period and perhaps emergent evidence of the cultivation of native plants. Nut usage was infrequent throughout most of the cultural sequence in the Ballona and only increased in the Protohistoric period. This trend was different from that observed in central California, where nuts, particularly acorns, become an important part of the diet by 4000 B.P. Similarly, in the Chumash area, archaeologists have asserted that acorns were an important part of the diet from the Intermediate period onward. This low-level use of nut plants in the Ballona conforms to the paleoethnobotanical trends seen along the coast further to the south, in the San Diego area (Reddy 2004a).

Domesticated plants were introduced into the area by the Spanish in the Protohistoric to Mission period. Some of these introduced plants may have been obtained by the Ballona occupants as payment for labor from the ranchos or pueblos and included wheat, barley, oats, corn, peas, and chick peas. The introduction of corn into the Ballona most likely coincided with the use of *comales* in the area. These new foods (including domesticated animals) were accepted readily as part of the diet, but more caution was exercised in incorporating them into the ritual and ideological realms of the lifeways.

Impact of Historical-Period Fauna and Flora on Native Diet and Landscape

The macrobotanical data from the PVAHP also provided insight into how the landscape was impacted (or not) during the Mission period by the introduction of nonlocal fauna and flora. Hispanic settlers entered the Los Angeles Basin in the 1770s and were using the Ballona as communal pastureland before 1800. There is documented evidence that by the early 1800s, Hispanic ranchers associated with the Rancho de los Quintos were actively farming (Old and New World domesticated crops) and herding animals in the Ballona. Several scholars (Hackel 2005; Larson et al. 1994; Millikan 1995) have argued that the large increase in both farming and herding of cattle, sheep, and horses during the Mission period had a deleterious effect on the ability of Native Americans to continue their traditional subsistence patterns. In addition, the introduced plants (crops and their associated weeds) were considerably more aggressive and invaded the landscape. Common diseases that infected these domesticated crops had a much more virulent impact on the native grasses (for example, the Barley Yellow Dwarf Virus) and wiped them out indiscriminately (Malmstrom 1998).

The macrobotanical data revealed that native grasses continued to be available and exploited by the Ballona residents during the Mission period. The sheer quantities of grasses recovered from the Mission period contexts at LAN-62 and LAN-211 indicated that these grasses were available and in considerable quantities on the landscape. Similarly, the vertebrate remains indicated the continued presence of wild artiodactyls and small mammals. Based on this evidence, the Ballona-area landscape during the Mission period appears not to have been impacted significantly by the changing ecology. The dramatic alteration of the landscape most likely occurred after the sites were abandoned, and perhaps abandonment was related to the lowered availability of native resources. Certainly, although cattle had been in the Ballona for several decades, there was a peak in baptisms from Guaspet, located somewhere in the Ballona, soon after the Quinto Zuniga family began ranching in the area. Steven Hackel (see Volume 5 of this series) has suggested that this peak in baptisms was the beginning of the abandonment of the village of Guaspet. The relationship between the establishment of the rancho and the decline of the village of Guaspet was likely not merely coincidental.

Ritual and Mortuary

Artifact analysis has revealed that distinct patterns characterized the ritual and mortuary contexts, patterns that have not been observed at other sites in the region. For example, the burial area at LAN-62 had a large number of specific types of artifacts not found at other sites (without burials) that dated to the same time periods. The burial area contained hundreds of fragments of metal and other historical-period artifacts, tens of thousands of shell and glass beads, some whalebone and worked bone, musical instruments, and a variety of other items not recovered from, or found only in small numbers at, its contemporaneously occupied, neighboring settlement, LAN-211. There were over 59,000 glass beads in the burial area at LAN-62, whereas less than 100 were recovered from LAN-211. Nearly all shell beads collected from all PVAHP contexts were recovered from the burial area. Although whalebone was found in other contexts, the overwhelming amount hailed from the burial area. A large variety of early-historical-period artifacts were recovered from the burial ground, whereas only a handful of such items were identified at LAN-211.

Within the burial area at LAN-62, some burials had large numbers of glass and/or shell beads, whereas the majority did not. The distribution of glass and shell beads, as well as other types of early-historical-period artifacts, appeared to cross-cut gender and age. These differences could be related to status differences within the burial area or could indicate temporal variability in glass- and shell-bead use and availability. These types of differences between burials, with a minority of burials containing nearly all of the glass and shell beads, constituted a pattern also noted at the Chumash site of Humaliwo. Issues related to status and wealth have been touched upon in this volume but will be addressed in detail in Volume 5 of this series, in which the detailed analyses of these data will allow for a much richer and deeper understanding of Gabrielino/Tongva ritual and mortuary behavior.

Final Thoughts

It is clear that the data presented in this volume have offered significant information on the material culture, subsistence, and everyday life of the Native inhabitants of the Ballona over a roughly 8,000-year period. The analysis and interpretation of hundreds of thousands of artifacts have allowed for a greater depth and breadth of understanding of the initial settlement in the Ballona area when the lagoon was just being established, as well as thousands of years of human occupation and the development of more-permanent occupation by Native Californians. It is likely that the initial occupants of the Ballona were not the direct descendents identified by Spanish colonists in the mid-eighteenth century as living in the Los Angeles Basin. The Gabrielino/Tongva, Takic groups likely arrived several thousand years after the arrival of the initial settlers. One of the final cultural constructions by these Native inhabitants involved the creation, intensive use, and abandonment of a major burial area that was likely used by Native members of the larger Ballona region.

The artifactual and subsistence data, in addition to their cultural and theoretical contexts as offered in this volume, have laid a strong foundation for discussing these trends in a synthetic manner in Volume 5 of this series.

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