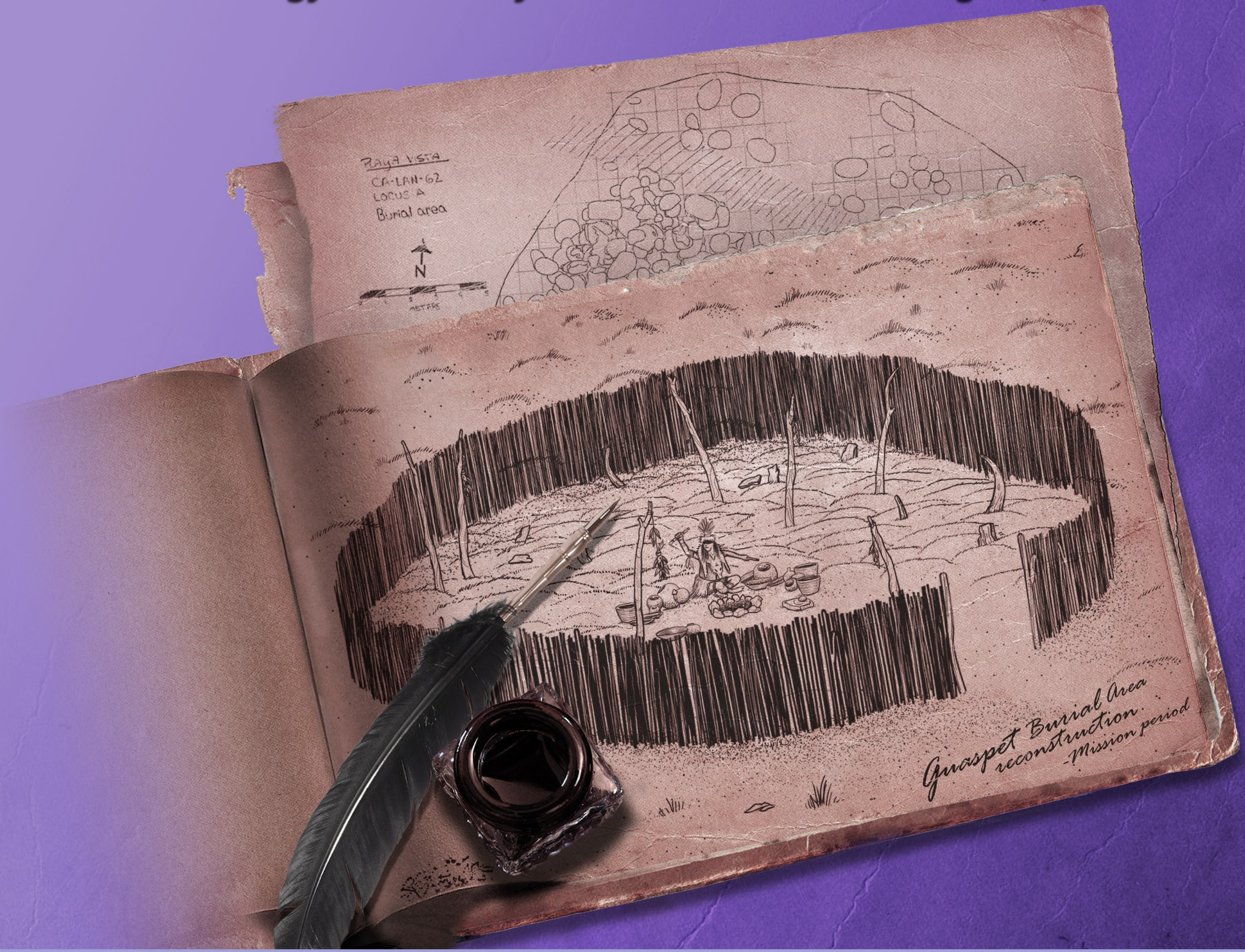
People in a Changing Land

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



VOLUME 4

Bioarchaeology and Paleodemography

edited by Patrick B. Stanton,
John G. Douglass, and Seetha N. Reddy

Statistical Research, Inc.
Technical Series 94

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

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edited by
Patrick B. Stanton, John G. Douglass, and Seetha N. Reddy

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Sponsor: Playa Capital Company, LLC

Volume Title: Bioarchaeology and Paleodemography. People in a Changing Land: The Archaeology and History of the Ballona in Los Angeles, California.

Project Location: The project area is located in the former Ballona Lagoon area, a former wetland complex in west Los Angeles that is known collectively as the Ballona. This area is today bound roughly by Playa del Rey to the west, Marina del Rey to the north, the Ballona Escarpment (a high bluff) and Del Rey Hills/Westchester Bluffs to the south, and Interstate 405 to the east. It is located approximately 0.5 km east of the Pacific Ocean, 1.3 km west of the Baldwin Hills, and 1.6 to 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 part of the of the project area along the base of the Ballona Escarpment.

Project Description: Statistical Research, Inc. (SRI), conducted data recovery at five sites in the Ballona (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- and the suffix /H will be omitted]) which involved bioarchaeological analyses of human remains discovered during the investigations or subsequent archaeological monitoring. These five sites were recommended eligible for listing in the National Register of Historic Places (NRHP) (Altschul 1991; Altschul et al. 1991, 1998, 1999, 2003; Denniston and Douglass 2007; Van Galder et al. 2006; Vargas and Altschul 2001; Vargas et al. 2005). A total of 386 burial features were recovered from these five sites, the majority from LAN-62 (n = 374). The burials at LAN-62 were concentrated in a small portion of the southern part of the site and were associated with distinctive mourning features characterized by high densities of material culture, including unique artifacts. The study focused on delineating the chronological sequence of the burial ground at LAN-62, mortuary treatments, paleodemography, variation, dentition, and paleopathology. Fundamental research questions posed include, who were the people living in the Ballona Wetlands? and, how did they change over time?

Project Summary: The bioarchaeological study of human remains from the Playa Vista Archaeological and Historical Project (PVAHP) has revealed significant insights into the health, diet, and cultural affinity of the prehistoric and early historical-period populations of the Ballona. The burial area at LAN-62 has complex stratigraphy, spatial relationships, and association of material culture. To aid in defining the chronological relationship between outlying burials and the main burial ground at the site—and also to distinguish historical-period and prehistoric burial areas in the absence of clear chronological indicators—SRI developed a sophisticated system that delineates specific spatial and sequential relationships based on the Harris matrix but significantly more robust. The spatial and temporal analysis through this system identified unique spatiotemporal patterns. For example, the Mission period features were located in the southwestern portion of the burial area in a relatively discrete area measuring 6 by 8 m. The prehistoric burial features were located either in the northernmost part of the burial area or in the northern and eastern portions of the main burial area. Comparatively fewer features were identified as protohistoric. Other subgroups within the burial area at LAN-62 were identified to help researchers answer specific questions regarding the formation of the site using small groups of closely related burial and nonburial features.

During prehistoric times, individuals were clearly interred close to where inhabitants were living. Therefore, it is likely that either LAN-62 was not a centralized burial ground for the region prior to the Mission period or cultural norms at the time did not necessitate one. Prior to the protohistoric period, the function of LAN-62 changed from a domestic to a ceremonial one.

Overall, burial features at LAN-62 consisted primarily of flexed primary inhumations with uncommon or rare occurrences of partial or complete cremations. The burials were concentrated in an area over a meter in depth, and most of the burials were intrusive to, or impacted by, other burials as well as nonburial features which likely predated the use of the area for burials. Various calculations, based on different elements, were used, and the exact number of individuals buried at LAN-62 will never be known; however, SRI has estimated roughly 349 to 377 individuals as the most likely range. Female individuals greatly outnumbered the males, and very few children and young adolescents are represented. The base burial population consisted mostly of young adults.

An important research question for the PVAHP is related to the ethnic and cultural identity of the populations residing in the Ballona wetlands. Through comparisons of the PVAHP craniometric data to other sites in coastal southern California and to five Native American samples, we conclude that the individuals represented at LAN-62 were related to southern California Native Americans, most likely the Gabrielino/Tongva.

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 Alcala, Richard Alcala, Dana Alcala, Evan Alcala, Tonantzin Carmelo, Virginia Carmelo, Jordan David, Katy Dorame,

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

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

LIST OF ABBREVIATIONS AND ACRONYMS

3-D	three-dimensional
ARB-30	arbitrary 30-cm soil buffer
ASA	Archaeological Survey Association of Southern California
ASU	Arizona State University
BLAD	Ballona Lagoon Archaeological District
CDC	Centers for Disease Control and Prevention
Corps	U.S. Army Corps of Engineers
DISH	diffuse idiopathic skeletal hyperostosis
DPR	California Department of Parks and Recreation
ECPP	Early California Population Project
FRED	Feature Relationship Empirical Diagram
GIS	geographic information system
HBI	Human Bone Inventory
HLA	human leukocyte antigen
LAT	*Los Angeles Times*
LI	Lincoln/Peterson Index
Macko	Macko, Inc.
MLD	Most Likely Descendant
MNI	minimum number of individuals
MLNI	most likely number of individuals
NAHC	California Native American Heritage Commission
NRHP	National Register of Historic Places
PA	programmatic agreement
PCAS	Pacific Coast Archaeological Society
PCE	pulp-chamber exposure
PD	provenience designation
PVAHP	Playa Vista Archaeological and Historical Project
QA	quality assurance
SERA	State Emergency Relief Administration
SRI	Statistical Research, Inc.
SU	stripping unit
SWCA	SWCA Environmental Consultants
UCB	University of California, Berkeley
UCLA	University of California, Los Angeles
UCSB	University of California, Santa Barbara
VCVM	variance/covariance matrix
WPA	Works Progress Administration

Introduction

John G. Douglass and Patrick B. Stanton

Introduction

This fourth volume of the Playa Vista Archaeological and Historical Project (PVAHP) data recovery report series focuses on the bioarchaeology of the Ballona region, which is located along Santa Monica Bay, in west Los Angeles County. This volume focuses on the physical remains of the prehistoric inhabitants of the Ballona region. Other volumes in this series consist of an introduction to the PVAHP and the paleoenvironment of the region (Volume 1), the methods and results of the archaeological work (Volume 2), discussions of prehistoric material culture and subsistence (Volume 3), and synthesis, ethnohistory, and mortuary analysis (Volume 5).

This volume is unique to the archaeology of the greater Los Angeles Basin in several ways. It focuses on the remains of 386 burial features recovered as part of the PVAHP. The vast majority of them (374 burial features) were identified at one prehistoric and early-historical-period archaeological site, CA-LAN-62/H, which is located within Gabrielino/Tongva territory. Small numbers of burials were also identified during the PVAHP at CA-LAN-54/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). The burials at LAN-62 were found within a tightly constrained burial area that dated primarily to the Protohistoric and Mission periods. Although several other dense burial areas like the one found at LAN-62 have been identified and excavated in the greater Los Angeles area over the past several decades (the Medea Creek site [LAN-243]; the Humaliwo, or Malibu, site [LAN-264]; the Irvine site [ORA-64], in Newport Beach; and the ARCO site [LAN-2682]), human remains have only been fully reported on from the Humaliwo site (Walker et al. 1996). Of these sites, only the ARCO and Irvine sites are within Gabrielino/Tongva territory; the other two sites are affiliated with the neighboring Chumash.

Therefore, the study of remains that is presented here offers unique insight into not only the Gabrielino/Tongva but also the study of indigenous burial areas in general. Although the human remains at the Humaliwo site have been documented as well as possible (the remains were analyzed and reported on more than 20 years after the excavations), the layout of the site and the relationships between features have not been documented in detail beyond synthetic articles (e.g., Gamble et al. 2001). This volume not only details the methods involved—as well as paleodemography, human variation, dentition, paleopathology, and trauma—but also offers important insight into chronology and feature-to-feature relationships between burials, to better understand the sequence of burials and their likely dates. In this volume, we present specific examples of feature-to-feature relationships, highlighting specific information; an attached electronic appendix presents all of the feature-to-feature relationships across the burial area, including both burial and nonburial features (see the Contents of this Bioarchaeology Volume section, below). Artifacts, macrobotanical and microbotanical remains, stratigraphy and soil morphology, chronometric data, and other relevant material classes and analyses are presented in other volumes in this series; chapters in Volume 5, this series, synthesize these diverse data, along with the data presented in this volume, to fully explain the significance and nature of the burial area at LAN-62, as well as other human remains found in the project area. Therefore, the research questions in this volume focus on biological issues, such as human variation, dentition, and paleopathology; chronological analysis using relative spatial relationships and chronostratigraphy; and descriptive discussions of mortuary observations. An in-depth discussion of demography and health in the Ballona is presented in Chapter 5, Volume 5, this series, in which differences in the various manifestations of demographic structure, disease, and violence between the PVAHP sample and other contemporaneous data are discussed. The mortuary analysis in Chapter 6, Volume 5, this series, which was guided by the research issues, presents rigorous analyses and interpretations of the mortuary behavior in the Ballona during the Millingstone through Mission period.

The PVAHP Context

The PVAHP is located on and around the Playa Vista development, a mixed-use community within the City of Los Angeles, in an area formerly containing the Ballona Lagoon, a drowned river valley located immediately to the east of Marina del Rey, in the western Los Angeles Basin (Figure 1). The southern boundary of these low wetlands is defined by Pleistocene terraces that are currently 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/Tongva, for more than 8,000 years, beginning approximately 8,200 years ago and continuing until the early 1800s.

Ballona Creek, occupying a remnant channel of the Los Angeles River, flows through these wetlands and drains about 230 km^2 (90 square miles) of the Los Angeles Basin. Prior to modern channelization, Ballona Creek flowed into the lagoon in the approximate location of the intersection of Lincoln and Culver Boulevards. Ballona Creek was improved in stages, and its course and banks remained 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). This area has been subject to archaeological investigations since the early twentieth century, and amateur collectors were the primary explorers during the first half of the century. The first professional study was by Nels Nelson in 1912, and his report was the first of many subsequent references to archaeology in the Ballona region. For additional information on early and modern researchers in the Ballona, see Chapter 2, this volume, as well as Volume 2, this series.

Statistical Research, Inc. (SRI), has been involved in archaeological research in the Playa Vista area for two decades (Altschul 1991; Altschul et al. 1991, 1992, 1994, 2003,

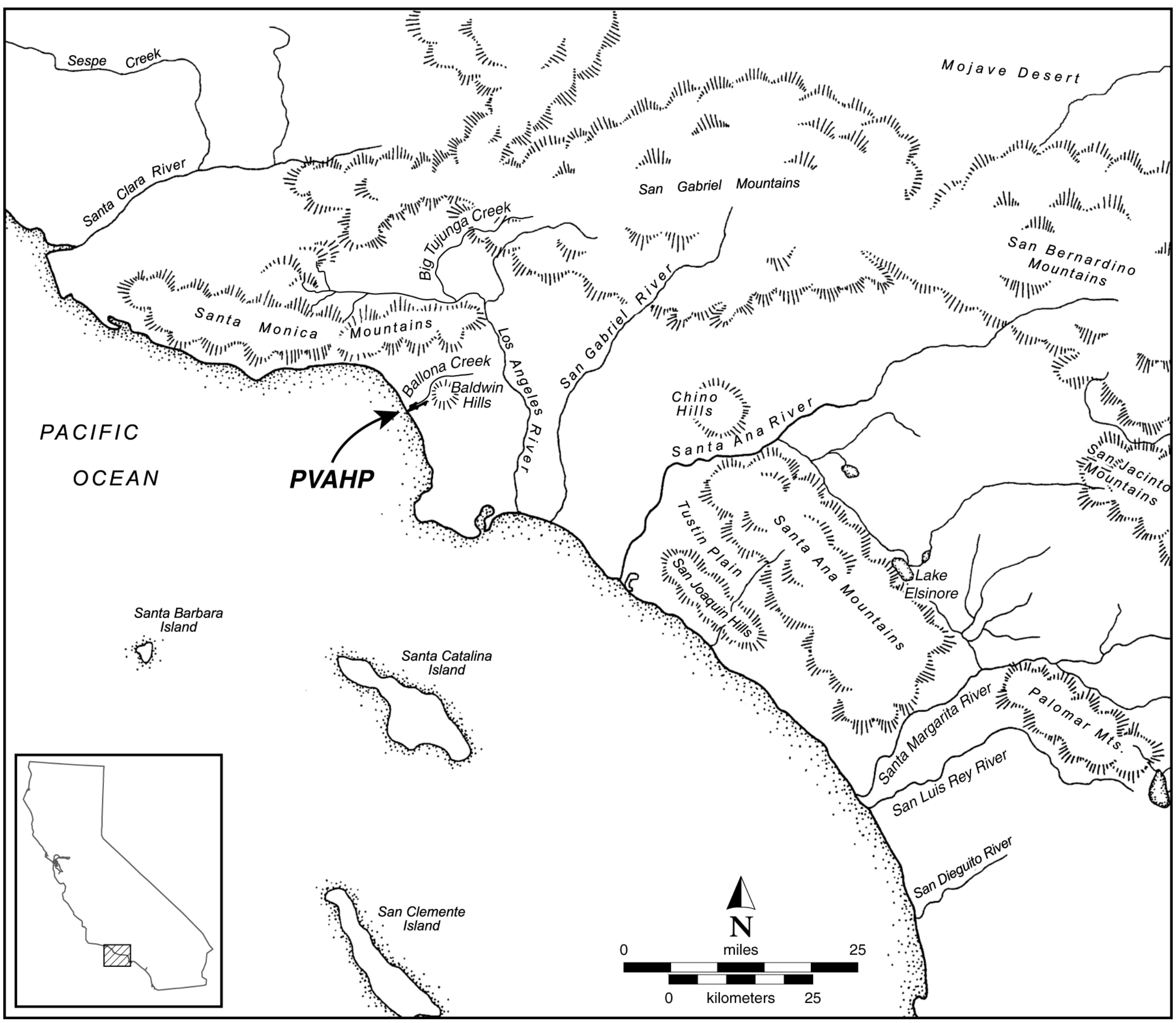

Figure 1. Map showing the location of the PVAHP area.

2005, 2007; Douglass et al. 2005; Grenda et al. 1994), and the PVAHP is the latest project involving excavations at several sites located in the Ballona Lagoon lowlands (Figure 2). SRI has also conducted archaeological research at several sites located on the Pleistocene terraces immediately south of the PVAHP (LAN-60, the Loyola and Marymount sites [LAN-61], the Del Rey Hills site [LAN-63], the Bluff site [LAN-64], and LAN-206A) (Altschul 1997; Douglass et al. 2005). SRI started archaeological research at the Playa Vista development in 1989, when the company was hired by Camp, Dresser, and McKee and PCR Services Corporation on behalf of its (then) owners, the Summa Corporation and Maguire-Thomas Partners–Playa Vista. Playa Capital Company, LLC, is the current master developer of the property.

Because of wetlands located within the Playa Vista development area, as well as the development of the Riparian Corridor draining into wetlands and recreated wetlands, permitting was required from the U.S. Army Corps of Engineers (Corps) under Section 404 of the Clean Water Act, which in turn requires the Corps to comply with the National Environmental Policy Act and Section 106 of the National Historic Preservation Act. In addition, the City of Los Angeles required compliance with the California Environmental Quality Act. 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 area, the phased development of the area, and the potential for buried cultural deposits, a Programmatic Agreement (PA) was created between the Corps, the California State Historic Preservation Officer, and the Advisory Council on Historic Preservation (PA 1991, extended in 2001 and 2011). Two organizations representing the Gabrielino/Tongva concurred in the PA, as did the developer, Maguire-Thomas Partners–Playa Vista. Subsequent to the PA, SRI conducted additional inventory, tested sites, and implemented data recovery at various locations across the PVAHP area.

The PVAHP is a phased archaeological study designed to comply with federal, state, and municipal regulations protecting cultural resources. 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 (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 history of the PVAHP, please refer to Volumes 1 and 2, this series, and the project research design (Altschul et al. 1991).

This volume presents the bioarchaeological analyses of human remains discovered during the data recovery investigations or subsequent archaeological monitoring conducted at five sites (LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768) that were recommended eligible for listing in the NRHP (Altschul 1991; Altschul et al. 1991, 1998, 1999, 2003; Denniston and Douglass 2007; Van Galder et al. 2006; Vargas and Altschul 2001; Vargas et al. 2005) (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 PVAHP 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 that portion of the original development was conveyed to the State of California in 2003.

Most Likely Descendant

When prehistoric human burials that are part of the PVAHP were identified, SRI followed appropriate regulations, including California Health and Safety Code §7050.5 and Public Resources Code §5097.98. The procedures in these regulations required the California Native American Heritage Commission (NAHC) to name a most likely descendant (MLD) for the project. When the first burial was identified in the PVAHP in October 2000, during archaeological and Native American monitoring of construction on the southern edge of LAN-193, the NAHC named Mr. Robert Dorame as the MLD for the PVAHP. Mr. Dorame has played an active role in the PVAHP as it relates to human remains for many years. Mr. Dorame has offered various recommendations concerning Native American monitoring and the handling of human remains, which evolved over time. Details of Mr. Dorame's recommendations are discussed in Chapter 3, this volume. When human remains have been identified on the Playa Vista property, Mr. Dorame has been notified, and in many cases, he either arrived in person or sent a designee to observe and bless the remains. In addition, Mr. Dorame personally supervised a group of Native Americans in the blessing and preparation of all human remains for reinterment at Playa Vista.

The MLD recommendations for the PVAHP, which have evolved through time, have both guided and limited SRI's research approach, methods used, and data collected and analyzed. For example, because of the MLD guidelines, no flotation or pollen analysis of certain soil associated with burials has occurred, resulting in a limited amount of information available on either micro- or macrobotanical remains from burials. The MLD also opposed the destructive analysis of human remains; so, there is no genetic information from DNA studies of burial remains. SRI strove to collect as much data as possible on the burial area and the associated remains while respecting the recommendations made by the MLD. Full details on MLD recommendations are discussed in Chapter 3, this volume.

Subsequent to the analysis of human remains and associated artifacts, all human remains and associated grave goods from LAN-54, LAN-62, LAN-193, and LAN-2768 were reburied in December 2008 at Playa Vista's Ballona Discovery

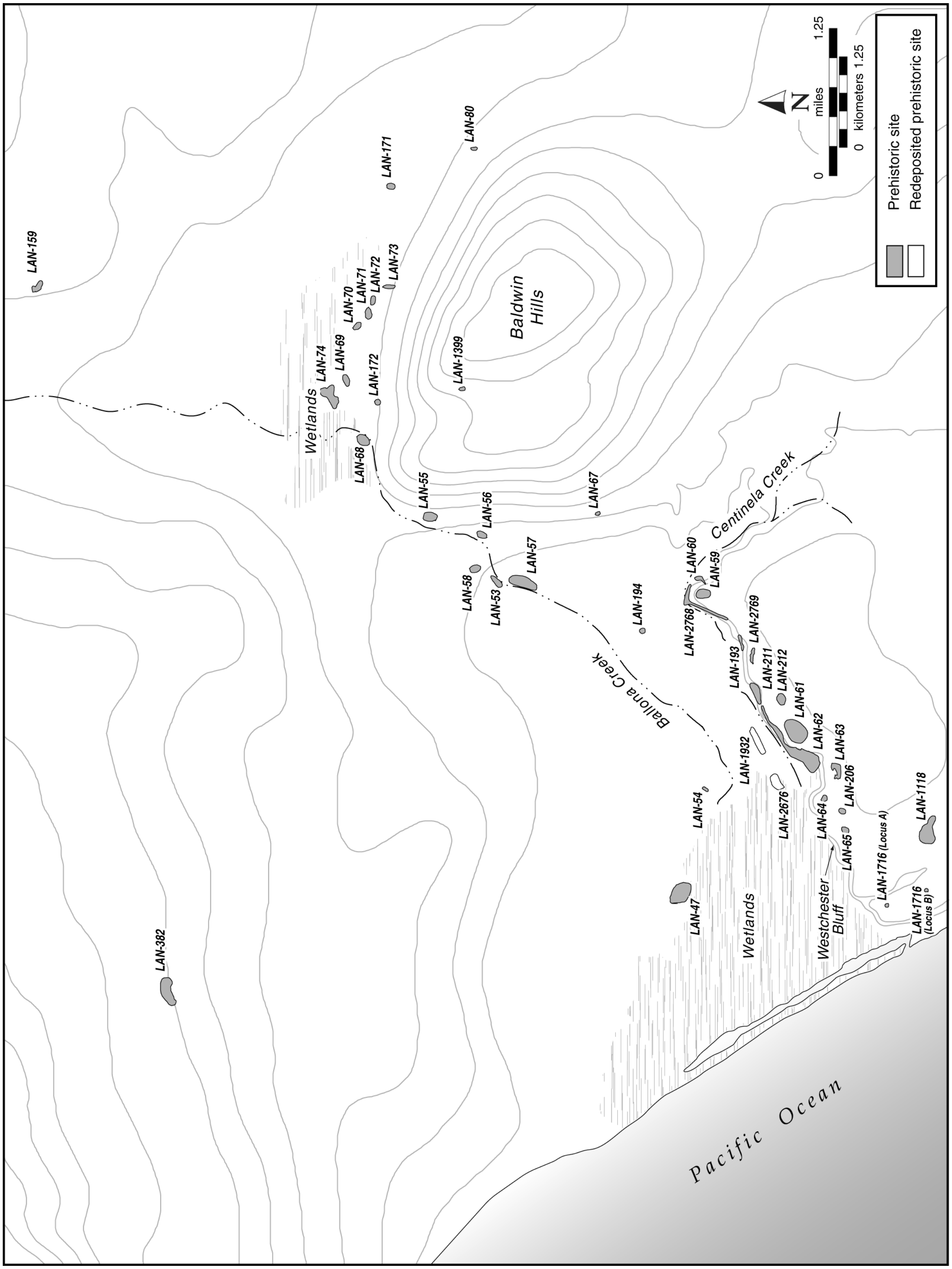

Figure 2. Map showing the locations of prehistoric archaeological sites in the Ballona region.

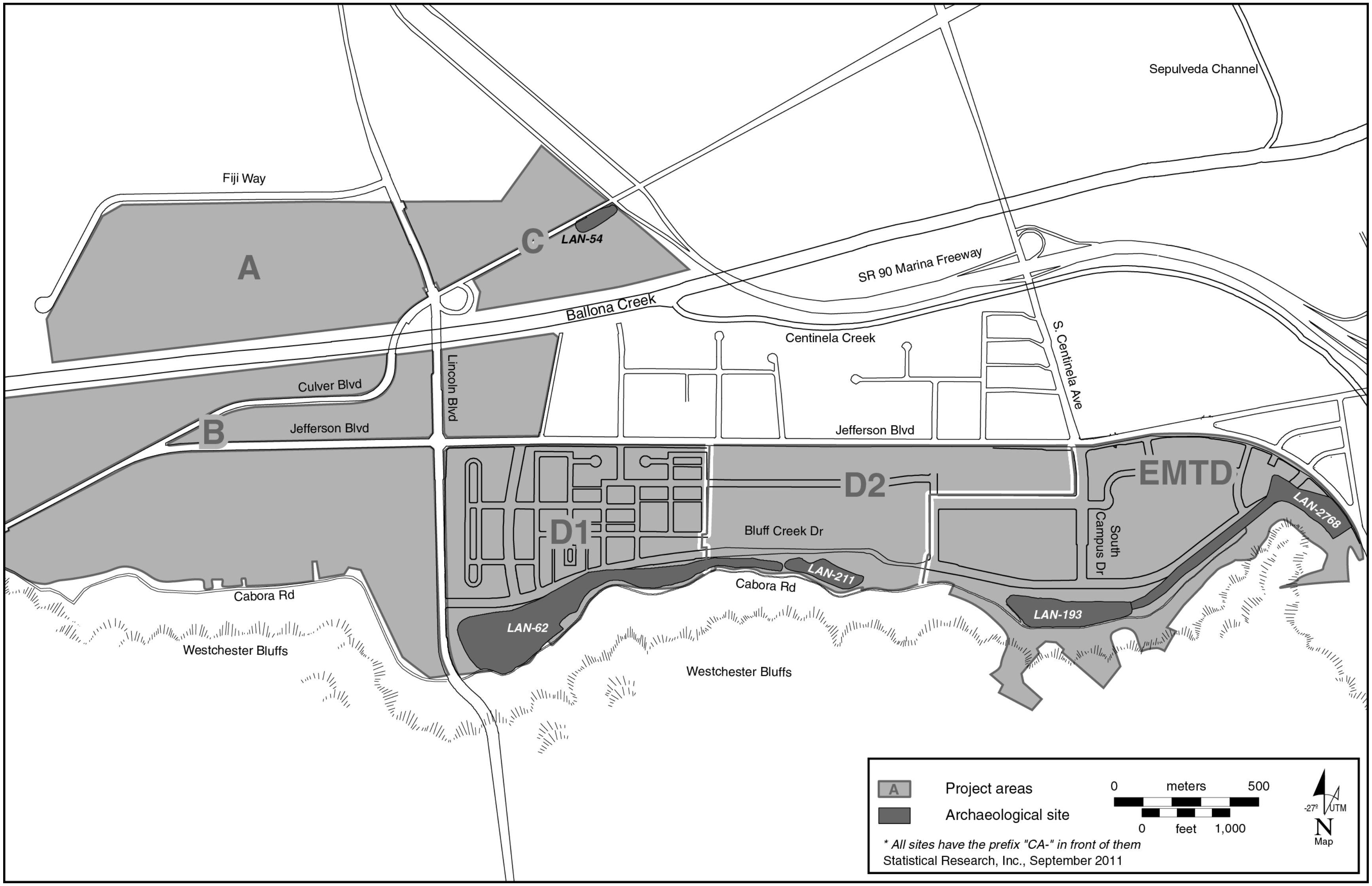

Figure 3. Map of the Playa Vista development, showing the locations of Areas A, B, C, and D and archaeological sites within the development.

Center near the LAN-62 burial area. Because of ongoing litigation between the landowner and other parties, human remains and associated grave goods from LAN-211 were not reinterred with the rest of the human remains and associated grave goods in 2008. The reinterment area was designed in consultation with Mr. Dorame, to permit the LAN-211 remains and grave goods to be reinterred in this same location at a later date, as the MLD has requested.

For additional information on how MLD concerns and recommendations were met in undertaking the excavation and analysis of burials as part of the PVAHP, the reader is referred to Chapter 3, this volume.

Brief History of Findings

Over the course of testing, excavation, and analysis of archaeological sites that are part of the PVAHP, SRI has gained significant understanding of the prehistoric and early-historical-period aboriginal, as well as Euroamerican, settlement in the Ballona Lagoon area. A rigorous dating program has yielded 200 radiocarbon dates on shell and carbonized seeds from the PVAHP sites (see Volume 2, this series, for details). The results revealed that most of the occupation of the Ballona area was concentrated between 5,000 and 200 years ago, whereas the earliest occupation dates to over 8,000 years ago. In all discussions of prehistoric adaptations in the Los Angeles Basin for the PVAHP, a cultural chronology identifying the Millingstone (8500–3000 cal B.P. [6550–1050 B.C.]), Intermediate (3000–1000 cal B.P. [1050 B.C.–A.D. 950]), Late (1000–408 cal. B.P. [A.D. 950–1542]), Protohistoric (408–179 cal B.P. [A.D. 1542–1771]), Mission (179–116 cal B.P. [A.D. 1771–1834]), and Historical (179–9 cal B.P. [A.D. 1771–1941]) periods is used (Figure 4). In the PVAHP, LAN-54 and LAN-193 have Millingstone and Intermediate period deposits, whereas LAN-2768 primarily contains evidence of an Intermediate period occupation with a minor Protohistoric-Mission-Rancho period component. Occupation at LAN-62 appears to have begun sometime during the early Millingstone period (8500–6000 cal B.P.), coinciding roughly with the establishment of the Ballona Lagoon (see Volume 1, this series, for details on the evolution of the Ballona Lagoon and Wetlands). Aboriginal occupation of LAN-62 culminated in the early nineteenth century, near the end of the Mission period. The formation of a formal burial area at LAN-62 during the Late and Protohistoric 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 dating between the Intermediate and Mission periods and is very likely associated with LAN-62. Detailed discussions on chronological indicators and dating results are presented in Volume 2, this series, and data on material culture and subsistence are presented in Volume 3, this series. In the discussion below, each site is described very briefly.

LAN-54

LAN-54 is located to the south and west of the intersection of the Marina Freeway (State Route 90) and Culver Boulevard; it is the only prehistoric site within the PVAHP that is near the prechannelized location of Ballona Creek. LAN-54 was originally within Area C of the Playa Vista development but was conveyed to the State of California in 2003. Data recovery in 2002 consisted of hand-excavation of control units, mechanical stripping of all intact site materials within the area of potential effects, and hand-excavation of identified features, including three human burials. Details on these burials are presented in a report by Dr. Phillip Walker of the Department of Anthropology at the University of California, Santa Barbara (UCSB), and his student Ken Maes (Appendix A.1, this volume). 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.

LAN-62

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). LAN-62 rests on an alluvial-fan deposit located at the base of the Ballona Escarpment, at the western end of the Playa Vista development. For management purposes, SRI divided LAN-62 into seven distinct loci (Loci A–G). The prehistoric occupation at LAN-62 was significantly denser in the southern portion of the site (most of which is designated Locus A). In contrast, the northern (Locus G), western (Loci E and F), and eastern (Loci C and D) portions of the site are characterized by sparse cultural deposits. Data recovery was not conducted at Locus B, because it is a highly disturbed area along the base of the bluffs northeast of Locus A. Locus B includes an area known as the former Fire Safety Training Area. It was subjected to extensive use during the Hughes era, and very little intact soil remains. It appears that much of the area was excavated and redeposited or altogether removed for fill to be used for runway construction or elsewhere on the property. Earth removal was monitored in Locus B, but the area was heavily contaminated and truncated by Hughes Aircraft Company activities; although cultural material was identified, no features were recorded. Locus A had a much denser concentration of cultural deposits relative to the other loci and also has a dense burial area dating primarily to the Protohistoric and Mission periods. Burials at LAN-62 have only been identified within Locus A, generally within the boundaries of the burial area. In total, 374 burial features were recovered from Locus A; all are detailed in this report.

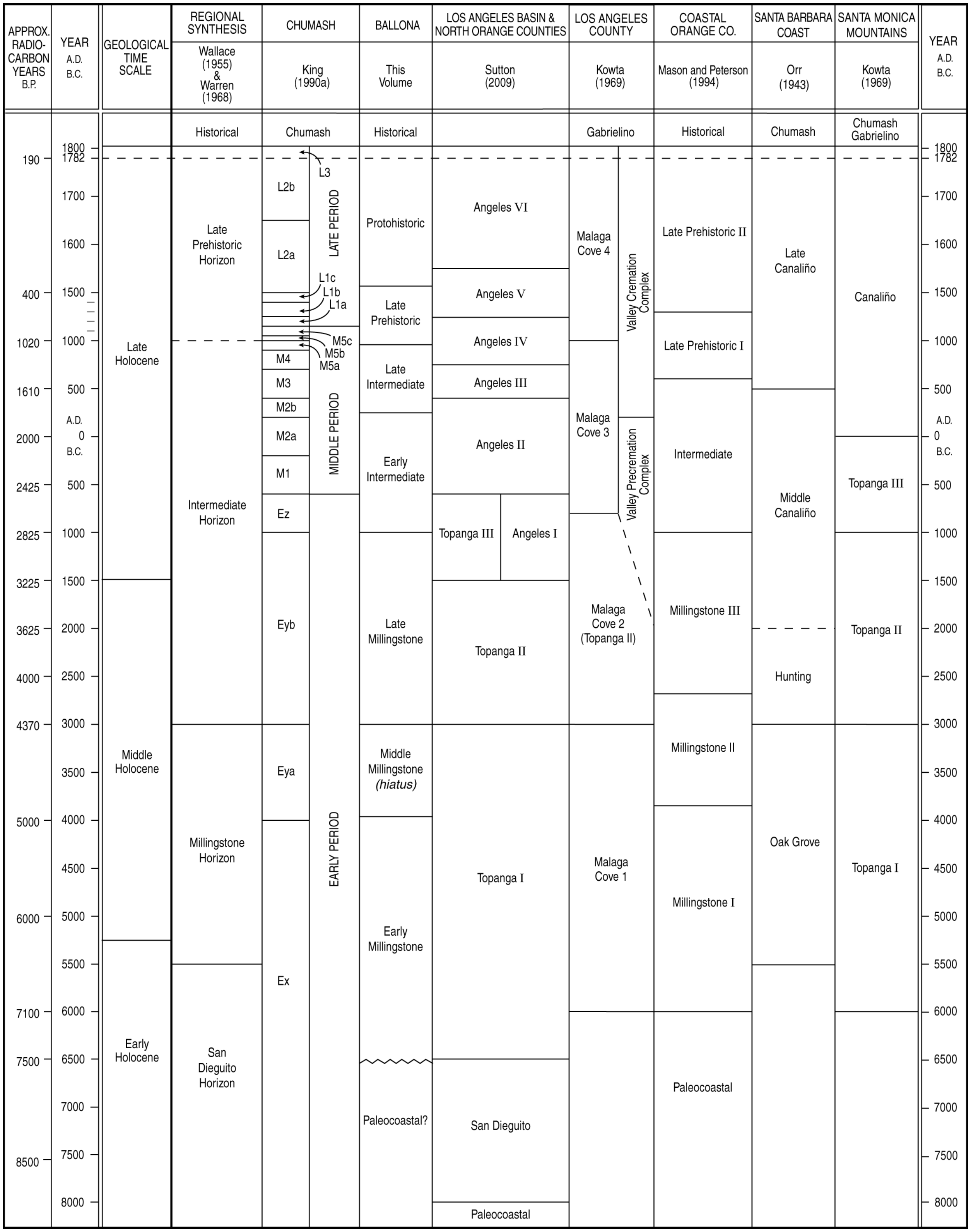

Figure 4. Chronology chart comparing the cultural history of the Ballona region with reconstructions of culture histories of other areas of southern California.

LAN-211

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. LAN-211 is a multicomponent site with predominantly Intermediate (3000–1000 cal B.P.) and Mission (A.D. 1771–1834) period components. The site was tested in 1999 and 2001 (Altschul 2003) and underwent data recovery in 2005 (Van Galder et al. 2006). During data recovery, three human burials were identified, along with isolated human remains. The three burials were found in different locations at the site, and they date to different periods: one dates to the Protohistoric through Mission period, another second dates to the Intermediate through Late period, and the third dates to the Intermediate period. All three burials are discussed within the body of this report.

LAN-193

LAN-193 is situated at the base of the Ballona Escarpment, sandwiched between the intersections of two large drainages south of Centinela Creek, within the area of Playa Vista previously known as the Entertainment, Media, and Technology District and now known as the Hercules Campus. Data recovery and subsequent monitoring at this site involved the excavation of 1-by-1-m excavation units, mechanical trenches, and mechanical-stripping units to identify features. Results of excavations at LAN-193 are presented in Volume 2, this series. LAN-193 has Millingstone and Intermediate period deposits, along with an early- to mid-twentieth-century refuse dump. Three burials have been identified at this site, all likely dating to the Intermediate period; each is reported on here. None of these burials was identified during data recovery. One was identified during monitoring of the creation of a temporary drainage ditch in 2000, and the other two were identified during monitoring of construction of the Riparian Corridor in 2005. Details on the two burials identified in the Riparian Corridor can be found in the body of this report; the report on the burial found in 2000 during construction of the temporary ditch was written by Dr. Phillip Walker of UCSB and his student Bonnie Yoshida (see Appendix A.2, this volume).

LAN-2768

LAN-2768 is located within the upper reaches of the historical-period channel of Centinela Creek, along the base of the Ballona Escarpment, in the area previously known as the EMTD and now known as the Hercules Campus. The Hercules 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), which were especially useful in light of the large area of the site. Archaeological investigations at LAN-2768 included the excavation of pothole trenches, linear trenches, excavation units (1 by 1 m), and stripping units. In addition, 97 features, including 3 burials, were excavated in the four loci of LAN-2768 during the data recovery and monitoring excavations. All three burials were identified and excavated in 2005, during monitoring of the construction of the Riparian Corridor and following data recovery at Locus A. In addition to these three burials, which all likely date to the Intermediate period, cremated human remains were also recovered from a mechanical-stripping unit excavated during data recovery in Locus A but only identified during postexcavation water screening of materials from the mechanical-stripping unit. The burials recovered during construction of the Riparian Corridor can be found in the body of this report; details on the cremated human remains are presented in a report written by Dr. Phillip Walker of UCSB and his student Ken Maes (see Appendix A.3, this volume). LAN-2768 consists of Intermediate period occupation deposits and a minor Protohistoric-Mission-Rancho period component.

Research Issues of the Bioarchaeological Study

As mentioned earlier in this chapter, the research issues identified and addressed in this bioarchaeological study are focused on determining the chronological order of the burials and the biological character of the PVAHP sample. Six major research issues have been identified and addressed in this volume and are briefly discussed below.

Chronology

Temporal placement of the human-burial features into a chronological framework is not only a necessary research issue but also fundamental to archaeological investigations. In particular, the relationships between burial features (feature-to-feature relationships) and burial and nonburial features are important to delineate, because ultimately, they are instrumental to reconstructing the sequence of burial events and features. The key research goals include establishing the chronological relationships between burials and identifying burials that date to the major cultural time periods through association with time-sensitive grave goods and chronostratigraphy.

Mortuary Analysis

Treatment of the dead is an important research avenue in this volume. Variation and trends in burial treatments (burial types, treatment, orientation, position, and direction of head facing) are often associated with cultural practices. Data gleaned from the PVAHP burials can be used to comment on the cultural and social characters of the Ballona populations over time, including the nature of society and changes in society. Mortuary analysis is also discussed in greater detail in Chapter 6, Volume 5, this series.

Preservation and Paleodemography

Taphonomic processes are an important factor to consider in the study of human remains, because the taphonomy directly affects the estimates of minimum number of individuals (MNI) and most likely number of individuals (MLNI). Taphonomy also can vary significantly from site to site within a given region. Our research goals include identifying the different taphonomic processes at play in the PVAHP and accounting for these processes when determining the MNI and MLNI counts for the project. Ultimately, we are interested in defining the paleodemography of the Ballona population and how it compares to other contemporaneous collections.

Human Variation

The PVAHP burial data are primarily from LAN-62 and have the potential to provide insight into biological variation in the prehistoric population. Our primary research question focused on human variation within the Ballona population. In addition, our analysis also focused on the potential for social or biological groups within the burial ground to be identified using biological features, mortuary behavior, and chronology.

Dentition and Diet

Diet can be reconstructed through analysis of the teeth and identification of indicators of particular diets of the consumer(s). Caries or cavities are well-known dental pathologies that have been attributed to the consumption of foods rich in carbohydrates and sugars and also general dental hygiene. For example, increased dental pathologies, particularly caries, have been associated with agricultural populations relative to hunter-gatherer populations (Turner 1979, among others). This is of particular relevance to the PVAHP given the presence of Mission period burials and habitation contexts. If domesticated Old and New World foods, such as corn, wheat, barley, and oats, were consumed on a regular basis and at higher rates than wild-plant foods, that should be reflected in the dental caries among Mission period burials. Other research issues relate to how dental data can shed light on the health status of individuals and their biological affiliation(s).

Paleopathology and Trauma

Much has been written about the high degree of disease and death during the Mission period in coastal California (Jackson 1983; Lambert 1994, 1997). The PVAHP provides an excellent opportunity to explore whether the Native Californian populations living away from the missions were exposed to European diseases and to assess the general rates of death attributed to natural vs. nonnatural causes. Our research questions also explored the presence of trauma from interpersonal violence, occupational risks, ritual practices, metabolic conditions, and inflammatory diseases.

Contents of this Bioarchaeology Volume

This PVAHP volume has three sections and a total of 10 chapters. Section 1, Background, provides a context to the study of human remains in southern California as well as the PVAHP, in three chapters. Section 2, Bioarchaeology and Mortuary Analysis, consists of two chapters that present the chronology and mortuary data for burials recovered in the PVAHP. Section 3, The People of the Ballona Wetlands, contains four chapters that discuss various bioarchaeological aspects of the population, including paleodemography, human variation, dentition, and paleopathology and trauma. Chapter 10 concludes the report and summarizes the research findings.

This volume also includes a glossary of terms and 17 appendixes (the appendixes are provided in electronic format). As mentioned above, Appendix A contains skeletal-remains reports for LAN-54, LAN-193, and LAN-2768 by Dr. Philip L. Walker and his students Ken Maes and Bonnie Yoshida. Appendix B presents a list of burial features and osteometric observations recorded for individuals recovered during the PVAHP. Nonmetrical age traits, nonmetrical sex traits, and pathological conditions recorded on the skeletal elements are provided in Appendixes C–E, respectively. Appendix F contains descriptions of dental traits for the recorded individuals, overall dental data is provided in Appendix G, and Appendix H contains frequency data for the direction, form, and degree of dental wear observed. Epigenetic traits for recovered remains are provided in Appendix E, Appendix J contains information on taphonomy, and Appendix K presents the burned-bone data. Mortuary observations and burial-feature descriptions appear in Appendixes L and M, respectively, and Appendix N presents the results of the archaeoparasitological analysis. A feature-relationship empirical diagram is provided in Appendix O, followed by dental-trait frequencies in Appendix P and the results of the logistic-regression analysis in Appendix Q.

Context of Study

Patrick B. Stanton, John G. Douglass, and Tamara L. Leher

Introduction

To help gain a better understanding of the burial population at LAN-62 and other sites in the Ballona, we need to place them in the appropriate context. This chapter, composed of several sections, presents the historical and archaeological context for the burial population of the PVAHP. First, we offer general archaeological and ethnographic/ethnohistoric perspectives on burial practices in southern California. Here, we document and discuss various sources of information related to aboriginal burial practices. Second, we provide details on early avocational and professional investigations at archaeological sites in the general Ballona region that have contained human burials. Next, we detail modern research (not conducted as part of SRI's work for the PVAHP) related to human burials at six archaeological sites within the Ballona: the Admiralty site (LAN-47), the Loyola and Marymount sites (LAN-61), LAN-62, the Del Rey Hills site (LAN-63), the Bluff site (LAN-64), and LAN-206A. The subsequent section presents summaries of major archaeological sites with burials (organized by region) in other areas of southern California. As shown in Figure 5, the archaeological sites with burials discussed in this chapter fall into two broad areas: the North Coast and Interior, located generally within the western portion of the Los Angeles Basin and areas to the north and west, and the South Coast and Interior, generally located in the southern portion of the Los Angeles Basin. As illustrated in Figure 5, during the early Historical period, sites in the North Coast and Interior were within both Chumash and Gabrielino/Tongva territories, and the South Coast and Interior comprised Gabrielino/Tongva and Luiseño territories; it is unclear how these cultural boundaries were configured prior to the early Historical period. Given the great variability in the data presentation for these previous investigations—some reports offer little information, whereas others are very detailed—we provide succinct summaries of these sites based on available data. Of note is that the main site in the PVAHP with burials, LAN-62, is most comparable to the burial areas described for the Humaliwo (or Malibu) site (LAN-264), the Medea Creek site (LAN-243), and the ARCO site (LAN-2682). In the final section of this chapter, we offer general thoughts and conclusions relevant to placing the PVAHP bioarchaeological research in historical context.

As discussed in Volume 1, this series, and Chapter 1, this volume, we use the Ballona Lagoon chronology in this volume. This chronology includes the following time periods: Millingstone period (6500–1000 B.C.), Intermediate period (1000 B.C.–A.D. 1000), Late period (A.D. 1000–1532), Protohistoric period (A.D. 1532–1771), and Mission (or early Historical) period (A.D. 1771–1834). In our discussion in this chapter, we have used this chronology to discuss sites outside the Ballona Lagoon area, so that one site is comparable to another. Farther north, in Chumash territory, a different cultural chronology is traditionally used (divided into Early, Middle, and Late periods), but for comparison, we have converted the Chumash chronology into the one used for the Ballona for discussion of specific sites. In some cases, we have presented both chronologies in making particular points that are important in regard to specific cultural phenomena (e.g., changes in social hierarchy).

Ethnographic/ Ethnohistoric and Archaeological Perspectives on Prehistoric Burial Practices in Southern California

Human burials provide a unique, and otherwise archaeologically elusive, insight into the cultural practices, ritual behavior, and worldview of a group. So, study of human burials is invaluable for anthropological research. The documentation and perspectives on aboriginal burial practices in southern California have varied across time and space. Various views

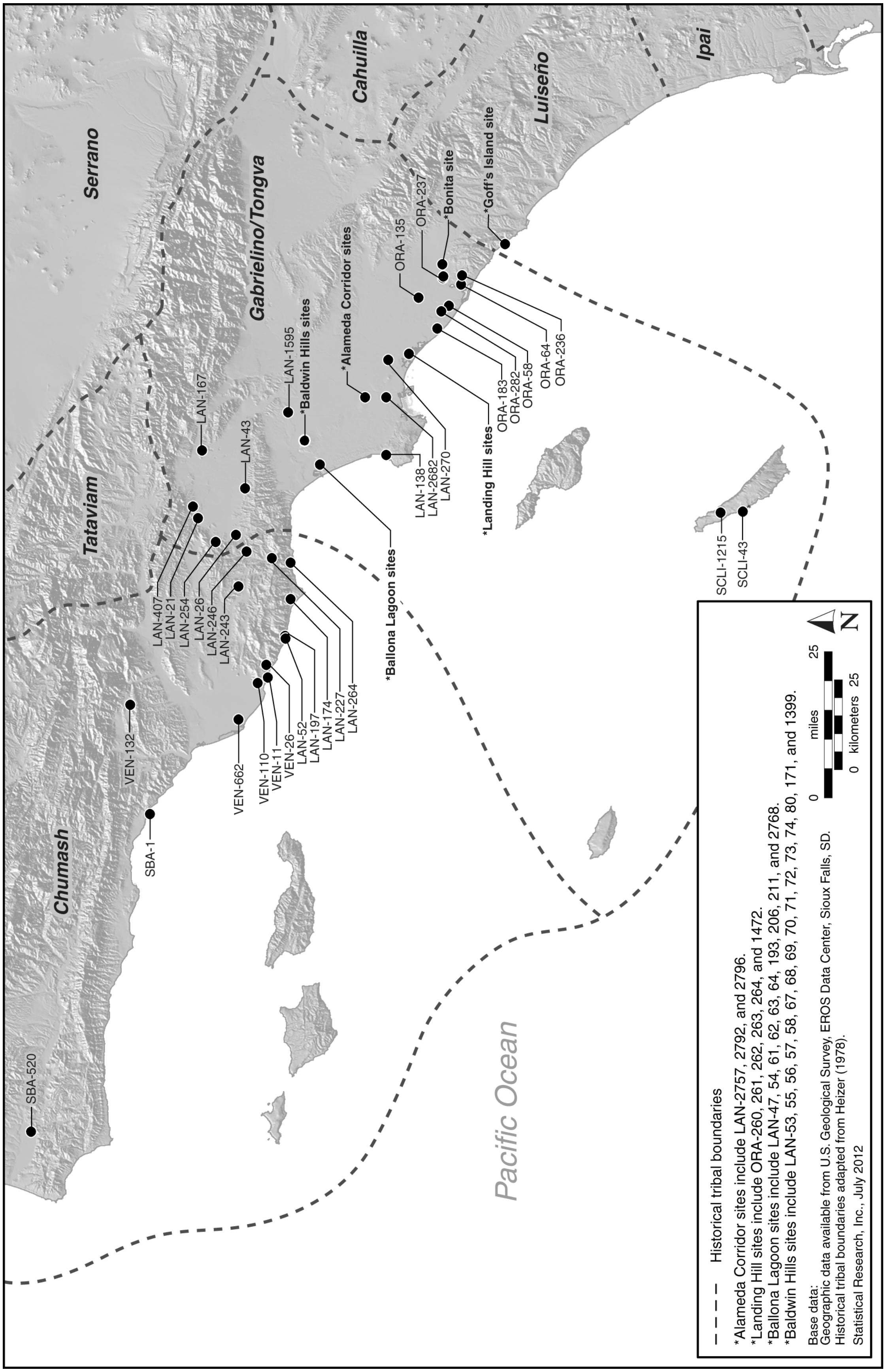

Figure 5. Map showing the locations of the archaeological sites along the Southern California Bight that are discussed in the text.

on burial practices have included both ethnographic/ethnohistoric as well as archaeological perspectives.

Archaeologically, prehistoric burial practices prior to the early Historical period have been important topics for researchers. Early archaeological syntheses of burial practices described by Wallace (1955) and Warren (1968) argued that there were differences by time period. Wallace (1955), for example, argued that early Millingstone period burials were either primary or secondary, whereas Intermediate period burials included cremations and greater diversity in burial practices. He also suggested that, by the Late period, flexed burials were common in the northern portion of southern California, whereas cremations were more common in the southern portion of the state. Like Wallace, Warren (1968), in his synthesis of regional chronology, also suggested that burial practices changed from time period to time period. For example, cremations, he argued, were related to the intrusion of Takic groups to the coast (what elsewhere has been called the Takic expansion) from the desert. Gamble and Russell (2002:118) have also argued this, noting that cremations are characteristic of Takic groups, such as the Gabrielino/Tongva. They used Moratto (1984:161–162) to delineate Takic elements in the archaeological record, which included pottery, triangular arrow points, and cremations.

Recent research on burial practices among southern California groups has involved examination of the treatment of the body itself: was the deceased interred or cremated, and what may be the reasons for the differences? Cremation as a burial technique of prehistoric peoples has traditionally been tied to the arrival of Takic groups in the anthropological literature; cremation is seen as a "desert" trait, along with ceramics and triangular projectile points. Sutton (2009) has argued that sometime between ca. 3500 and 1500 cal B.P., there was an initial entry of the Takic groups (proto-Gabrielino/Cupan branch) into the region. That is different from Kroeber's (1925) original hypothesis that Takic groups arrived much more recently, in ca. A.D. 500. These Takic groups replaced the existing late Millingstone period groups along the coast. Scholars have correlated particular signatures in the archaeological record to reflect this major change. First, the entering Takic groups were biologically distinct from the preceding populations, as reflected in both osteometric and DNA data (for a full discussion, see Sutton [2009]), providing empirical evidence that there was a population replacement. Second, some scholars have argued that there were significant and relatively sudden population increases during the early Intermediate period in localized areas, such as in the Ballona (Altschul et al. 2005:291, 295; Altschul et al. 2007:35; Grenda and Altschul 2002:128;), which could suggest the arrival of new incoming groups. Also, at about that time, larger sites with a greater diversity of artifacts appeared, but they seem to have been occupied on a seasonal basis. Third, economic change from a heavy emphasis on marine resources (especially shellfish) to an increased emphasis on terrestrial resources has been proposed for the Ballona for this time period (Van Galder et al. 2007). At the same time, fishing became more important during the transition from the late Millingstone period into the subsequent early Intermediate period. Lastly, changes in mortuary patterns have been noted along the coast. Flexed burials under cairns disappeared, although they continued in the inland areas. Unlike what has been commonly proposed, cremation was practiced during the Intermediate period and was not strictly a Takic marker. Large mourning features with cremated human bone appeared in ca. 2600 B.P. (during the early Intermediate period).

Three archaeological sites in the Ballona, LAN-63, LAN-64, and LAN-206A, located on the bluff top immediately to the west of the Lincoln Gap, provided our best data on Intermediate period settlement and burial practices (Douglass et al. 2005). Analysis of the midden materials indicated a highly diverse set of activities at these sites and more permanent settlement. The distribution of these activities is also noteworthy. These sites are adjacent to two large, natural depressions that were used for a variety of purposes by the prehistoric occupants. The eastern depression was used as a community trash dump and was also surrounded by hundreds of thermal features. Three special features consisting of large numbers of milling implements, many of which had been intentionally broken and smeared with ocher, were located on the western flank of the eastern depression. Interspersed among the milling stones in these three features was cremated human bone. Inhumations also were found in several locations throughout the community represented by the three sites. Often, these burials were found in small clusters, suggesting the presence of burial areas for specific social groups or families. The western depression, which held water for various lengths of time, was used primarily as a plant-resource-procurement area, and processing took place on the higher ground, where hearths also abounded. In short, use of space at these bluff-top sites was highly structured, socially controlled, and segregated into communal refuse areas, resource-procurement and -processing areas, ritual spaces, and burial areas (for details, see Douglass et al. [2005]).

Thermal features at LAN-63, with purposefully broken artifacts and some with cremated human remains, were similar to features found at Landing Hill (including ORA-263) (Cleland et al. 2007; Hull et al. 2013). Burial Feature 29 at ORA-263 contained a large amount of fragmentary cremated human bone and broken ground stone fragments. This feature, approximately 23 m^2, contained ground stone that had been purposefully broken and left in place by the inhabitants of the site. In total, 135 pieces of ground stone were recovered, nearly all within a roughly 3-by-5-m area. The majority of the bowls and mortars recovered appeared to have been intentionally broken or "killed," similar to what was observed on the bluff tops in the Ballona area. This main concentration of cremated human bone also contained an exceptionally dense number of beads (primarily stone beads, although some shell beads were also present) and ornaments. This deposit represents an Intermediate period (ca. 2300–1900 cal B.P. cluster) cremation feature intrusive into a Millingstone period midden deposit. It appeared that the cremation feature had been used for a few-hundred to perhaps 1,500 years (ca. 2300–800 cal B.P.), according to radiocarbon dating of human teeth. Based on similarities found in ethnographic and ethnohistoric documents, Cleland et al. (2007:114–115) argued that the cremation feature at ORA-263 may represent a mourning-type-activity area as described for the historical period.

Finally, Gamble and Russell (2002:123) studied 13 prehistoric archaeological sites from the Gabrielino/Tongva region and argued that there was evidence of both cremations and inhumations at sites dating to the late Holocene but no evidence of cremations from the middle Holocene. The earliest cremations among the Gabrielino/Tongva, they argued, dated to between 600 and 200 B.C. and were from the Encino Village site (LAN-43). Among the Gabrielino/Tongva, inhumations appear to have been placed either individually or in relatively small groups, whereas among the Chumash to the north, larger burial areas appear to have been more common (Gamble and Russell 2002:123). In their report, they documented six large burial areas, but in the Gabrielino/Tongva area, evidence of large burial areas was much more scant (not including the findings of the PVAHP).

There are several sources of ethnohistoric data on aboriginal burial practices in southern California (for detailed information, see Hull et al. [2011]). Padre Boscana, a Franciscan missionary at Mission San Juan Capistrano, detailed in his book *Chinigchinich* (Boscana 2005 [1846]) the cremation of recently passed Juaneño and Luiseño, as well as their personal items, such as their bows and arrows, skins, feathers, and beads. Johnson (2006) identified additional passages from Boscana's description of these burial customs that had not been published previously, including information on the function and ownership of grave goods. For additional information on this, see Volume 5, this series. This type of ceremony has been argued to have been related to one performed by many southern California groups called the Mourning Ceremony. A second source was Hugo Reid, a mid-nineteenth-century author of letters detailing the Gabrielino/Tongva, married to a woman from the Gabrielino/Tongva village of Comicrabit (likely near present-day Santa Monica), who detailed that the Gabrielino/Tongva waited several days to bury a member of the community, generally waiting until the body showed signs of decay. That delay may have been related to ensuring that the person was actually dead.

A third and richer source of early Historical period information on Gabrielino/Tongva burial practices are mission records. As noted by Earle (2003:8), the Mission San Gabriel priest Father Zalvidea, between 1806 and 1819, had Gabrielino/Tongva informants report on the burial practices of different villages in the Los Angeles Basin. Research on Mission period burial practices in southern California, through the use of the Early California Population Project (ECPP) database housed at the Huntington Library (http://www.huntington.org/Information/ECPPmain.htm), also has suggested that both inhumation and cremation were practiced by the Gabrielino/Tongva. However, only a few instances of cremations were noted, indicating that most burials were inhumations. For example, on July 23, 1785, a Gabrielino/Tongva informant notified Antonio Cruzado at Mission San Gabriel that a recently baptized neophyte with a Spanish name of Maria Josepha (San Gabriel Baptismal No. 01154, Death No. 00385), from the village of Comicrabit, died at that village and was cremated by the Native Californian (and nonbaptized) inhabitants of that village. The officiates of the burial were recorded as gentiles from the village of Comicrabit. The record states, in part, "*havia muerto y la havian quemado los Gentiles* [she has died and the Gentiles have burned her]." Cremation has also been documented at a variety of other villages in the Mission San Gabriel area, including Jutucabit and Jaysobit; based on these cases, it appears that multiple individuals may have been cremated simultaneously. Some have argued that the distance from the location where someone died to their home village was an important variable in cremating a body; the farther the distance to the home village, the more likely it was that the person would be cremated. However, that was certainly not always the case; for example, Mission San Gabriel records related to the cremation of three individuals at the Gabrielino/Tongva *ranchería* of Jutucubit in October of 1784 indicated that they were all from that village and died there.

Outside the Gabrielino/Tongva territory, other evidence of mortuary practices and ritual includes ethnohistoric documentation of practices by groups to the east and the south. Two early ethnographic studies of the Cahuilla and Serrano desert groups have detailed burial practices or ceremonies related to recently departed members (Benedict 1924; Strong 1929). Benedict detailed the Serrano living at Morongo Indian Reservation in Banning Pass, California, in her important 1924 *American Anthropologist* article. Each year, the Serrano and other local groups came together to hold ceremonies involving dances and other observances, culminating in a Mourning Ceremony (Benedict 1924:374). After a week of dances, ceremonies, and other activities, the Mourning Ceremony would begin more than 1 hour before sunrise with the distribution of a meal to the heads of families of invited groups. Life-sized effigies of deceased family members were brought out, and family or group members of the deceased would dance with the images (Benedict 1924:378). At the conclusion of the dancing and singing, the dancers would put the life-sized images of deceased family and group members on a pile of wood and burn them. Money and calico would be thrown to the guests by members of the deceased family. Other objects of value would be thrown into the fire, although most were tossed to the group (Benedict 1924:378). Benedict noted that there were very few old Serrano baskets in the Morongo community, because baskets were generally destroyed at the deaths of the individuals who owned them (Benedict 1924:387). Strings of beads would be distributed to members of the community, although beads were also buried, in as large numbers as possible, with the dead (Benedict 1924:379, 389). With these activities concluded, the Mourning Ceremony was complete for the year.

Strong (1929) documented the nearby Palm Springs Cahuilla and their rituals and treatment related to deceased members of the community. Strong (1929:84) discussed several ceremonies for the dead. Among the Cahuilla, burning of the body and house of the deceased was common, in prehistory and into the early 1920s. Strong indicated that in times of draught or food scarcity, the Cahuilla would burn the house and body of the deceased quickly, before the news of the death traveled. A year after death, an image-burning ceremony was conducted, much like that described by Benedict (1924) for the neighboring Serrano. The life-size images were made of reed matting and covered with deer hide. Men were represented with bows and arrows, and images of women had baskets decorated with eagle feathers (Strong 1929:85). After the burning of the images, gifts (including money and beads) were distributed to the group prior to the conclusion of the ceremonies (Strong 1929:85, 130). Burning of the deceased occurred shortly after death in a ceremony called *teutni'l* (Strong 1929:121). Gift and wealth items, such as shell beads, were distributed to the lineage of the deceased by all those hearing of the death. By the 1920s, although interment had replaced cremation, the destruction of the deceased's property and house continued. Approximately 1 month after the cremation of a body, family and clan members of the deceased would gather and drag bolts of calico around the dance house to "wipe out the tracks of the dead" (Strong 1929:122). Afterward, any gifts, food, cloth, basketry, and other items collected by the assembled clan members would be destroyed, as would be any remaining personal items of the dead. Ceremonies for the dead of the mountain Cahuilla (Strong 1929:180) and Cupeño (Strong 1929:264–268) were identical or very similar to those of the Desert and Pass Cahuilla.

Early documentation of Diegueño/Kumeyaay burial and related ceremonial practices was noted by Waterman (1910). Cremation, according to Waterman (1910:305), was regularly practiced by the Diegueño prior to the arrival of the mission system. When a person died, the deceased's body, clothes, and all belongings were burned in a large fire (Waterman 1910:278–279, 305). Once the body had been cremated, the ashes were collected, placed in a small jar, and either buried or placed in a hidden location (Waterman 1910:306). A Mourning Ceremony, in which additional possessions of the deceased were burned or otherwise destroyed, occurred 1 year after the individual passed. At that ceremony, items of wealth, including beads, baskets, and calico, would be either given away as gifts or burned in a fire, to mark the passing of the individual.

As evident in this discussion, burial practices for Native Californian communities during the prehistoric and early historical periods varied, with a few common underlying themes. During prehistoric times, it was common for there to be both individual burials and loci with small numbers of burials, as well as cremations (both isolated as well as intermingled with other cremated remains). In the case of ORA-263, it is possible that burial Feature 29 was an ossuary used for perhaps a millennium by the inhabitants of Landing Hill. The high diversity of burial practices during the early historical period is apparent based on historical documents in the form of both mission records and ethnological studies of southern California groups. At the same time, however, there are underlying similarities; for example, several different cultural groups in southern California all practiced variations of a Mourning Ceremony. Archaeological research has potentially identified the foundations of the Mourning Ceremony associated with the Intermediate period at sites like those excavated by Walker (1951) and at more-recent excavations at LAN-63 (Douglass et al. 2005) and ORA-263 (Cleland et al. 2007). Finally, among the Gabrielino/Tongva, burials during prehistory were generally placed either individually or in small groups, and in the Chumash territory to the north, large burial areas were part of village organization.

Prehistoric Burials in the Ballona Lagoon Area: Early Professional and Avocational Investigations

The discovery of human burials in the greater Ballona Lagoon area is not altogether surprising, because the area provided an ideal locale for long-term occupation, with rich and varied resources, and a strategic location for trade with islanders and also with groups to the north, south, and east. The earliest-dated site in the Ballona is LAN-64 (Hull and Douglass 2005), located on the bluff top, which yielded numerous radiocarbon dates between 8200 and 7000 cal B.P. In this section, we briefly discuss early professional and avocational investigations of burials in the Ballona Lagoon area.

By the early twentieth century, early investigators, both professional and avocational, had begun investigating human remains in the area. Until the latter half of the twentieth century, archaeological work in the Ballona was undertaken primarily by amateur collectors. P. M. Palmer (1906), a Redondo Beach dentist, was the first investigator to explore the numerous prehistoric sites in the region and write about his discoveries (Wallace 1984). In his "Report on Researches," published after he excavated in the Redondo Beach area, Palmer noted, "a number of lesser villages that were situated at points of vantage, for about seven miles, along the coastline in this part of the southern California mainland" (Palmer 1906:24). Based on that, it appears that he might have been aware of sites in the Ballona.

Six years later, Nels Nelson (1912) made the first professional archaeological overview of sites in the Ballona, during a brief visit to southern California. Funded by the American Museum of Natural History's Department of Anthropology, Nelson undertook a survey of prehistoric "campsites" and "refuse heaps" from Topanga Canyon to the southern limits of San Diego Bay. Reaching the Ballona, Nelson surveyed at the base of the bluff in the westernmost portion of the PVAHP area, in the vicinity of Area B. He found no sites in that area, which corresponds to SRI's survey results (Altschul et al. 1991). Additionally, he reported on "Site No. 4," as a "refuse heap situated at the mouth of a small ravine opening north on Centinela Creek about 3 miles northeast of Port Ballona." Port Ballona was located at the inlet of Ballona Lagoon, near the modern town of Playa del Rey. Nelson's description of Site No. 4, limited as it was, may correspond to the recorded location of LAN-62, LAN-193, or LAN-2768, all located along the base of the bluff. Nelson did not personally observe the sites but, rather, based his report on the observations of a hunter living halfway between the archaeological site and Port Ballona. Nelson recorded the presence of a large accumulation of material, including human-skeletal remains and other assorted artifacts. Nelson's 1912 report is the first known published professional reference to archaeological sites in the Ballona.

Subsequently, the discovery of deeply buried human-skeletal remains by construction workers for the Haverty Company in 1924 at Angeles Mesa (LAN-171, the Haverty site), at the base of the Baldwin Hills (Stock 1924), provided fuel for the debate over "Early Man" in southern California. The *Los Angeles Times* ran articles daily after the initial discovery and during large-scale excavations of the remains. Skeletal remains of at least eight individuals—three males, three females, and two individuals of indeterminate sex—were uncovered in close association at this site at depths between 5.8 and 7.0 m (approximately 19 and 23 feet) (Brooks et al. 1990). Bone-awl fragments, a quartzite core tool, and some freshwater gastropods were found near the skeletons in the marshy area at the base of the Baldwin Hills. The depth of the finds and the partial mineralization of some of the bones suggested to Stock (1924) that the remains might have been Paleoindian; a subsequent amino-acid racemization age estimate of no more than 11,000 ^{14}C years B.P. made some 60 years later refuted that conclusion (Taylor et al. 1985:137). A dozen years after the find at Angeles Mesa, in 1936, another discovery of a possible "Early Man" site was identified at LAN-172, located approximately 2 miles to the west. That site also contained human remains in a similar stratigraphic relationship, this time in context with mammoth bones (Lopatin 1940).

Several articles in the *Los Angeles Times* have reported on findings of other human remains or burials in the Ballona area, as well. In an article entitled "Del Rey Gives up a Skeleton," the newspaper reported that a coffin containing a clothed body was found "at the foot of the big hill just north of Playa del Rey" (*Los Angeles Times [LAT]*, 17 September 1904:A7). Although that location is unknown, it is possible that the "big hill" may have been a large hill prominent on the bluff just northeast of the Lincoln Gap. The hill was removed in the 1920s during the widening and construction of what is now Lincoln Boulevard. The coffin appeared to be Euroamerican in nature, with still-intact German silver handles. After the coffin's discovery, it was reburied in the same approximate location as where it was found. The same article also documented that two other burials had been uncovered approximately 1/2 mile beyond the discovery of the coffin, on "the new automobile boulevard between Playa del Rey and Los Angeles" (*LAT*, 17 September 1904:A7). The article reported that it was possible that the remains were prehistoric Native American. The road may be either Jefferson Boulevard or Culver Boulevard. If it is Culver Boulevard, the burials may have been in the vicinity of LAN-54. That said, these locations are merely speculative.

On May 21, 1916, the *Los Angeles Times* also reported on the excavation of a prehistoric burial in Ocean Park, at the base of Fraser Pier, during the construction of the "Great American Racing Derby" (*LAT*, 21 May 1916:IV12). De Moss Bowers, an archaeologist famous for his excavations along both Santa Monica Bay and the Channel Islands during that period, was living in Santa Monica at the time and examined the bones. He reported to the newspaper that the remains were evidence that prehistoric peoples practiced dentistry, stating that the skull had fillings made of a mixture of asphaltum and pulverized stone. The article also illustrated a large collection of bone awls that Bowers argued were used in prehistoric dentistry. Today, bone awls are known to be used for a variety of tasks, primarily related to basketmaking and hide working; dentistry is not a common explanation for these artifact types.

In addition, the *Los Angeles Times* reported on April 1, 1931, that evidence of a Native American burial area had been recently uncovered near the intersection of Jefferson Street and Centinela Boulevard, in what was then called Mesmer City (*LAT*, 1 April 1931:A9). Professor M. S. Moore of Polytechnic High School (likely in Long Beach) argued that ground stone artifacts found near the base of the bluffs near that intersection were "worthy of the attention of museum scientists." After the initial find of artifacts by one of his former students, Melvin Redhead, Professor Moore spent an additional day excavating the area where the ground stone artifacts were found and identified similar artifacts, including pestles, as well as several human skulls and other human bone. He argued in the article, "I daresay deeper and more extensive excavation will bring to light many valuable human remains" (*LAT*, 1 April 1931:A9). He went on to argue that the human remains were prehistoric, because only ground stone artifacts were found, rather than more-modern materials, such as metal objects. Based on the locational information, it is likely that the human remains and artifacts were recovered at or near LAN-2768, at the base of the bluff, just east or southeast of the intersection of Jefferson Boulevard and Centinela Avenue.

Prehistoric Burials in the Ballona Lagoon Area: Modern Archaeological Investigations

By the late 1930s and early 1940s, modern professional archaeologists in the Ballona began systematically recording and investigating prehistoric sites, both on top of and below the bluffs. Below, we discuss archaeological sites recorded during this period that have been known to contain human remains.

LAN-47 (The Admiralty Site)

The Admiralty site, LAN-47, is located approximately 2 km east of the ocean, in Marina del Rey. In 1961, archaeologists from the University of California, Los Angeles (UCLA), conducted salvage excavations at the Admiralty site when Basin F of the marina was being constructed. The archaeological work was mainly done by a team of volunteers, under the direction of Keith Johnson, as the marina and buildings were being built around them. UCLA archaeologists revisited the site in 1965 and again in 1969 to conduct additional salvage work as new buildings and utility lines were constructed (Levine 1969). Levine (1969:1) reported that "a half dozen human skeletons, stone bowls, projectile points, and stone tools and some rather unusual antler harpoons" were recovered from the bulkhead of Basin F in 1961, and in 1965, two disturbed burials were removed by UCLA archaeologists where the basement for the National Surety Bank was being excavated, at 4519 Admiralty Way. Several other burials were uncovered by "pot-hunters, amateur archaeologists, and workmen" in 1965 but were not documented scientifically (Levine 1969:1). "All of these burials were discovered amongst discarded bones of fish, broken shells, and utensils" (Levine 1969:2). Although these salvage excavations were conducted under tremendous pressure and time constraints, the work is important, because it documented human burials, cultural deposits, and artifacts, and it demonstrated the significance and stratigraphic integrity of the site. Furthermore, a conclusion was drawn that the human burials from the site were most likely Gabrielino/Tongva dating to the Late period (Levine 1969:3). Unfortunately, no funding was obtained for the 1960s salvage excavations and artifact analysis, and no archaeological report was completed to provide details on the findings of that work.

Following these excavations, no archaeological work was conducted at the Admiralty site until the late 1980s, when development of the 16-acre Channel Gateway project area was proposed. Based on a pedestrian survey, Stickel (1988:9) concluded that the potential for significant archaeological remains on the property was high. Test excavations conducted by Dillon et al. (1988) confirmed that the Admiralty site did indeed extend into the Channel Gateway project area.

In 1989, SRI was selected to conduct test excavations and subsequently to mitigate adverse effects to the northern part of the Admiralty site that would be caused by proposed construction activity (Altschul et al. 1992). During SRI's extensive data recovery work, which totaled 80 m^2 in area and 67 m^3 in volume, no features were identified in the investigated portion of the site. In addition, although human burials previously had been encountered within the site boundaries, only four isolated fragments of human bone were recovered during SRI's excavations. These data confirmed the potential for human remains along the northern edge of the Admiralty site but suggested that at most, only isolated burials might be found in the future.

Analysis of diagnostic artifacts and radiocarbon dates led Altschul et al. (1992:7–8) to conclude that temporary, seasonal prehistoric camps were established at the Admiralty site during the Late period, ca. A.D. 1050–1150. No evidence of an early-historical-period occupation associated with the purported Gabrielino/Tongva village of Sa'angna was found at any of the excavations. Analysis of artifacts and food remains indicated that subsistence focused on the locally available estuarine resources (e.g., diverse species of shellfish, fish, small mammals, and wild seeds and berries) that existed during the latter stages of the infilling of the adjacent Ballona Lagoon. To facilitate the gathering/hunting and processing of plant and animal food resources, a variety of lithic tools were used, as represented by lithic technologies ranging from finely controlled bifacial and microlith technologies made from imported, fine-grained chert and chalcedony to expedient flake tools made from coarser-grained, locally available basalt and quartzite cobbles. A wide variety of shell beads were also recovered from the site, but no evidence of local manufacture was identified.

LAN-61 (The Loyola and Marymount Sites)

LAN-61 is located on the campus of Loyola Marymount University, on the bluffs overlooking the Ballona Wetlands (Van Horn 1985:1, 3). Testing and data recovery excavations at LAN-61 by Archaeological Associates in the mid-1980s produced significant results (Van Horn and Murray 1985). During the testing phase, Van Horn and his colleagues used three different archaeological methods: (1) transit-controlled surface collection and mapping of the entire site, (2) auger sampling using 145 8-inch auger holes, and (3) hand-excavation and analysis of 23 1-by-1-m test units. They recovered thousands of artifacts from the combined investigations and described the site as consisting of fine sandy loam overlying a compact and hard, sterile, reddish sand substrate with a significant amount of rodent disturbance. The total area of the LAN-61 deposit was found to exceed 15,000 m^2 in area and approximately 1 m in depth. They also identified three different loci at the site: LAN-61A, LAN-61B, and LAN-61C.

Van Horn and his colleagues argued that although the three loci appeared similar, LAN-61A and LAN-61B appeared to be of different ages, based on the presence of stemmed projectile points at LAN-61A and Canaliño-style points at LAN-61B. Because stemmed points are an older variety than Canaliño-style points, they argued that LAN-61A was slightly older than LAN-61B. The overall absence of typical Late period artifacts, such as shell beads or Desert Side-notched projectile points, from all three loci strongly suggested that the site had been abandoned prior to A.D. 1000. Obsidian-hydration analysis was conducted at the UCLA Obsidian Hydration Laboratory on a sample of 21 obsidian flakes obtained from these excavations. Using a 220 years/µm index derived from work in nearby Malibu, the results indicated that the obsidian was in use in 1429 B.P. (or A.D. 554), which was consistent with the interpretations based on the projectile-point styles.

Based on these results, Van Horn recommended that data recovery be conducted at LAN-61. These excavations began in late 1984 by Archaeological Associates under the direction of Van Horn. Drawing on experience with mechanical excavations at the nearby LAN-59 in 1983, Van Horn used a combination of mechanical and manual methods to excavate samples of all three loci at LAN-61. Van Horn dubbed LAN-61A the Marymount site and referred to LAN-61B as the Loyola site. His goal was to excavate 10 percent of the total site area (approximately 1,500 m^2)—approximately 9 percent mechanically and 1 percent by hand. Nine units of varying sizes, with a total area of 90 m^2 and total volume of 57.4 m^3, were excavated by hand at LAN-61A; 11 units, with a total area of 55 m^2 and a total volume of 40.7 m^3, were excavated at LAN-61B. In addition, 13 mechanical trenches were excavated at LAN-61 (7 trenches at LAN-61A, 5 at LAN-61B, and 1 at LAN-61C), totaling 1,362.52 m^2 in area and 952 m^3 in volume.

These data recovery excavations resulted in the identification of 32 features (13 at LAN-61A and 19 at LAN-61B; none were found at LAN-61C). Feature types included hearths, artifact scatters, a burial, caches, earth ovens, and features of unknown use. Many of the features were associated with subsistence and production activities at the site. Only a single burial (Feature 9 at LAN-61A) was described by Van Horn and his associates in their report. However, in addition to formal features, there were four distinct "clusters" of human bone at LAN-61A (with a total of 191 human elements) and two distinct "clusters" of human bone at LAN-61B (with a total of 65 human elements). Although the authors suggested that there were two distinct clusters of human bone at LAN-61B, both were located in Trench B, only 0.3 m apart from one another. In both clusters, nearly all the bone consisted of unburned human-cranial fragments. It is quite possible that these two clusters actually represented a single burial. Unlike LAN-61B, where almost all the human bone was unburned, at LAN-61A, nearly all the human bone was burned. It is likely that the bone clusters from LAN-61A represented individual cremations, which should be considered individual features, although they were not reported as such.

The single reported burial feature, Feature 9, is of interest, partly because it is similar to a mortuary feature found at nearby LAN-63 (Feature 587) (Douglass et al. 2005), which dates to roughly the same period as LAN-61 (Intermediate period). Feature 9 consisted of a concentration of burned objects and a peripheral scatter of artifacts, cobbles, and human bone. The entire feature measured approximately 2.9 by 2.0 m. Artifacts consisted of a compact, oval-shaped pile of ground stone and cobble fragments, all exhibiting fire alteration. Fragments of some ground stone artifacts (including a metate and a bowl) could be partially refitted, indicating that whole artifacts had been broken and tossed into a fire. A similar feature found at LAN-63, though much larger and more diverse than Feature 9, was hypothesized to have functioned in a manner similar to features associated with the historical-period Mourning Ceremony documented for the Cahuilla, Serrano, Gabrielino/Tongva, Luiseño, and other southern Native Californian tribes (see Hull et al. 2006).

Subsistence analyses at LAN-61 suggested that whereas fish and birds in the lagoon were sought for food, shellfish played a relatively small role in the subsistence practices of the site's occupants. This is in stark contrast to nearby LAN-63, where shellfish played a large role in the prehistoric diet. Shellfish remains were very sparse throughout LAN-61. Fish remains suggested that the site's inhabitants focused on marine life gathered from near-shore and shallow-lagoon habitats. The complete absence of artifacts made from marine shell is notable. The focus on near-shore and lagoon resources and the absence of artifacts made from shell are typical of early prehistoric sites in the Ballona. It appears that more-distant habitats were exploited only during the Mission period (as well as possibly the Late period), when large numbers of shell artifacts also were used (Van Galder et al. 2007). The abundance of ground stone and terrestrial-faunal remains suggested that plants and animals from the nearby coastal prairie contributed important portions of the diet. Deer and rabbit were prominent in the terrestrial-faunal collection.

Besides subsistence, everyday activities at the site included the manufacture of tar-lined baskets (based on the presence of hundreds of tarring pebbles and clumps of asphaltum) and numerous bone-point tips. Van Horn and Murray (1985) argued that based on the lack of site structure and the undeveloped midden, LAN-61 was occupied on a short-term, intermittent basis during the fall and winter months rather than year-round. The presence of steatite artifacts, such as bowls and *comales* (flat cooking vessels), in all portions of the site suggested that trade with Catalina Island was important to the residents of the site.

In total, 10 radiocarbon and 19 obsidian-hydration samples were collected and analyzed as part of the data recovery investigations. Generally, the corrected (but uncalibrated) radiocarbon dates for LAN-61 ranged from 580 ± 60 to 4710 ± 80 B.P., and the majority dated to the Intermediate period (3000–1000 B.P.). The obsidian-hydration dates fell within a range of 2000–900 B.P., and the majority were in the 1400–1300 B.P. date range. Generally, the obsidian-hydration results indicated an occupation approximately 1,000 years later than the radiocarbon dates. It is not clear whether that discrepancy was because the radiocarbon dates were not calibrated or because of an error in the hydration index used for the obsidian dates. Obviously, this is an important issue for future research at the site.

It is important to note that whereas most of the data focused on by Van Horn et al. pointed primarily to an Intermediate period occupation for LAN-61, there was some evidence of a Mission period (A.D. 1771–1832) component to the site. In total, 10 glass trade beads (1 red and black, the others clear in color) were recovered from three different trenches (Trenches F, G, and I) at LAN-61A (Van Horn and Murray 1985:147–148). Perhaps because of Van Horn and Murray's focus on the Intermediate and Late periods, rather than later occupations, these glass trade beads were not brought up again in the report, including in their later discussions of the chronology and dating of different portions of the site. John Johnson (personal communication 2012) found it curious that there would be numerous clear- glass beads at the site, given that they were generally rare during the Mission period, and he questioned whether they may actually date to the subsequent Historical period. Because the beads were described in Van Horn and Murray's report only in brief detail, this remains unclear.

More-recent work conducted between 2007 and 2012 at LAN-61 has been reported by Van Galder and Douglass (2013), including limited archaeological testing and data recovery, as well as monitoring. Based on the data collected, SRI generally agrees with Van Horn and Murray's (1985) interpretation of LAN-61 as a seasonal habitation site exhibiting a focus on lithic production and dating to the Intermediate period. SRI's work does offer additional evidence to support a possible Mission period component at LAN-61, although it is ephemeral. Van Horn and Murray (1985) documented the presence of 10 glass trade beads, which date to the early historical period, in addition to at least one feature that contained *comales*, an artifact type diagnostic of the Mission period. SRI's work identified domesticated barley and wheat in the same context as wild plants; that combination has been documented at other Mission period sites in the Ballona. Unfortunately, the seeds were in mixed contexts, and therefore, it is unclear whether there is a discrete Mission period stratigraphic layer within the site or simply scattered evidence of Mission period use of the site. In addition, other types of diagnostic artifacts, such as Cottonwood and Canaliño projectile point types, were used from the Late period through the Mission period; Van Horn and Murray argued that these points were not used after A.D. 1000. Other sites in the Ballona dating to the Protohistoric and Mission periods have contained both of these point types.

LAN-62 (The Peck Site)

The Hughes Aircraft site, LAN-62, is at the base of a bluff on the southeastern side of the tidal flat that borders Ballona Creek, approximately 0.5 miles south of the intersection of Lincoln and Jefferson Boulevards. Based on the artifact inventory, the site was originally dated to the Intermediate and Late periods, with documented burials and cremations (Altschul 1991; Gamble and Russell 2002; Peck 1947). LAN-62 has been subjected to fieldwork by numerous professionals and amateurs, alike, over the last century. A detailed summary of this work is presented in Volume 2, this series. In an effort to minimize redundancy, only information pertaining to mortuary practices prior to SRI's investigations are detailed here.

Stuart L. Peck, an amateur archaeologist and dentist by profession, excavated three 10–15-foot-long and approximately 10-foot-deep trenches in the southern embankment of the site between 1945 and 1946 (Peck 1947:2). Where those trenches were dug within the boundaries of LAN-62 is unclear, but we suspect that they were in Locus B. Peck (1947:8) reported that several burials were discovered in 1942 when Hughes Aircraft Company removed approximately 8–12 feet of sediment to a hardpan layer from LAN-62 during a project to lengthen the airfield. No information was available on these burials. Two burials, however, were discovered about 0.3 m above the hardpan by Peck. The first burial was fully flexed, lying on the right side, with the head to the east, and without any associated artifacts, and the second burial, located in the same vicinity as the first, was oriented to either the west or the northwest (Peck 1947:9). Because of a trench collapse, no further information could be gathered.

Cremated human-skeletal remains were also found throughout the deposits by Peck (1947:8) at LAN-62, and at least one concentration of cremated remains was noted in the southern portion of the site, in association with large amounts of charcoal. With the exception of some burned shell beads, no artifacts were recovered from the cremation area (Peck 1947:8), but numerous artifacts were recovered in other areas of the excavation conducted by Peck, including ground stone artifacts (e.g., fragmented and complete metates, shaped chlorite schist rocks, pestles, five varieties of manos, fragmented and complete mortars, and fragmented and complete steatite and granitic stone bowls), flaked stone artifacts (e.g., chopper, blades, projectile points, and debitage), "broken beach stones," tarring pebbles, moonstones, red and yellow ocher, shell beads, a bone awl, bone tubes, a barbell-shaped ground-slate object, and a teardrop-shaped ground-slate object (Peck 1947:2–8). Peck also noted that two of the mortars and a steatite bowl had been ritually "killed" (Peck 1947:4–5).

In 1948, a survey conducted by Luhrs and Ariss of the Archaeological Survey Association of Southern California (ASA) revealed burned human and animal bone, shell, and ground stone artifacts in the lower stratum; the site was recorded as LA-1, LA-2, and LA-3 (see Los Angeles County Museum of Natural History site-record cards for LA-1, LA-2, and LA-3, especially sketch maps). Additionally, Rozaire and Belous (1950) wrote that starting in ca. 1939, Oscar Shulene, a collector, "potted" about 15 inhumations at LAN-62, all of which were recorded as having been interred in a flexed position on their sides. Peck photographed some of Shulene's excavation locations, and they appear to have been in Locus B. In addition, beginning in 1947, William Deane, a contractor working for Hughes Aircraft Company, began collecting from LAN-62 and recovered numerous artifacts and human remains, of which Marlys Thiel (1953) provided photographic documentation and commentary in 1953. In regard to the human remains, Thiel (1953) wrote:

> Four skulls were found altogether. Only one of the skulls had signs of being burned and that was only on one side of its head. The burials were flexed. One of the burials was upside down. The heads were not facing in any particular direction. These were found under three feet of dirt. Nothing was found with the burials. Artifacts were found in this site but they were not near the burials. All four of these skulls are adult. . . . The one that is so called cremated is missing its teeth and jaw.

As a result, it is clear that LAN-62 had a series of avocational and professional investigations that revealed human remains. Peck's work in the mid-1940s suggested that there was a burial area within the site, perhaps dating to two different time periods, but until the recovery of a formal burial area within Locus A of the site by SRI in 2003 and 2004, it was unclear to what extent burials may have been present. Although it is not completely clear, it is possible that all the avocational work was undertaken in Locus B, which was subsequently largely removed by Hughes Aircraft Company during work related to construction of the runway to the north. A detailed discussion of the burial area at LAN-62 is the focus of much of the subsequent chapters in this volume.

In addition to early archaeologists in the 1940s and 1950s, there have been several more-recent investigations conducted at LAN-62 by professional archaeologists. In 1983, Chester King and Clay Singer conducted test excavations at LAN-62 but did not encounter intact cultural deposits, because of the thick fill and alluvial materials overlying the site (King and Singer 1983). David Van Horn and his company, Archaeological Associates, conducted test-level excavations at LAN-62 on two different occasions in the 1980s, with some success. In 1983, Van Horn et al. used a combination of mechanically excavated trenches and hand-excavated test units in an attempt to delineate the site's boundaries. Despite the presence of thick alluvial and fill materials, they were able to identify intact deposits on the site's eastern edge. In that initial testing phase, Van Horn et al. (1983) labeled the intact buried deposit along the base of the escarpment LAN-62A. They estimated the deposit to be approximately 1 m deep, with 75 percent of the deposit having been removed via construction-related activities.

A second deposit identified as LAN-62B was located southwest of LAN-62A but was only investigated through the use of one mechanically excavated trench and one hand-excavated test unit. There, Van Horn et al. (1983) identified midden approximately 1.2 m thick below the alluvium and fill capping the site. Later investigations by Van Horn and his colleagues in 1987 were more successful in identifying the site's horizontal boundaries and in showing that a portion of the site lay below the water table (Freeman et al. 1987). A combination of mechanical and hand-excavation identified cultural deposits buried under 2.4–3.2 m of alluvium and modern fill. Determinations as to the vertical extent of the site were not made, because of the difficulties of working in the thick sediments overlying the site.

Once again, Van Horn and Archaeological Associates returned to the site in 1988, in order to excavate a number of mechanical trenches (Archaeological Associates 1988). Alluvial and fill materials overlying the site appeared to be even thicker on that visit, and the trenching program was only minimally successful at locating an archaeological midden. Several of the trenches did encounter intact deposits, but most were not able to penetrate the midden enough to characterize it fully. Van Horn and his colleagues did not identify any human remains during the course of their work. SRI attempted to compile maps from the various Van Horn and Archaeological Associates testing phases, but problems with scale inherent to their maps made that task difficult. During the excavations at LAN-62 Locus A (Vargas et al. 2005), however, many of their excavation units and trenches were located and mapped, allowing us to compile a clear picture of Van Horn and Archaeological Associates' work at the site.

LAN-63 (Del Rey Hills Site), LAN-64 (Bluff Site), and LAN-206A

LAN-63 and LAN-64 are located on the bluffs overlooking the Ballona Wetlands, immediately west of Lincoln Boulevard. These two sites, along with LAN-206A (a component of the main LAN-206 site), were located on land developed for the West Bluffs project. Both LAN-63 and LAN-64 were originally explored by William Deane, a collector who worked at a number of sites in the area. The sites were first recorded in 1936 by Malcolm Farmer as Playa del Rey Sites 5–7 (see Stoll et al. 2003:Figure 23), and in 1950, all three were formally recorded by UCLA students Rozaire and Belous. These sites underwent two rounds of data recovery, in the 1980s by Archaeological Associates (Van Horn 1987) and in the 2000s by SRI (Douglass et al. 2005). During the first round of data recovery by Van Horn and his colleagues, no human remains were reportedly identified. During the subsequent round of data recovery and controlled grading of the sites by SRI, in total, 15 burials and several instances of isolated human remains were identified (5 burials at LAN-63, 9 burials at LAN-64, and 1 burial at LAN-206A). All burials appeared to date to the Intermediate period, ca. 2200–1900 cal. B.P. The distributions of burial features differed from site to site. At LAN-63, burials were located generally along the periphery of the site, on either the northern or the southern edge, and the majority (6 of 9) of the burials at LAN-64 were located in an approximately 10-m-diameter area on the western edge of the site. The other three burials at LAN-64 were located on the periphery of the site. A partial skull was recorded at LAN-206A, but no postcranial remains were identified.

Of the burials for which a position could be determined with some certainty, all were buried in a flexed or semi-flexed position (Yoshida et al. 2005). Two burials, both at LAN-63, were suggestive of secondary burials because of the considerable disarticulation of the remains. Of the burials that had good preservation, heads were generally oriented to the north or west. Only 2 of the 15 burials had discernable pits. There were few clearly associated grave goods with burials, and they included ground stone, flaked stone, stone beads, faunal bone, and shell. In many cases, it was unclear which artifacts were grave goods and which were from surrounding midden.

In addition to formal burials, a single feature at LAN-63 contained cremated human bone from a minimum of two individuals (Hull et al. 2013). This large feature, designated Feature 587, contained numerous examples of purposefully broken ground stone, flaked stone, large-sea-mammal bone, whole shell, and faunal bone in addition to the cremated human bone. The burned human remains from Feature 587 included both adult and subadult remains, and it is likely that at least one male and one female were present in the feature. The color of the burned bone evidenced that some of the remains had been burned in a high-temperature fire that produced white calcined bone, whereas other bone in the deposit was brown to black from having been burned in a low-intensity, low-oxygen fire. The largest proportion of bone, by both weight and count, was uniformly black, indicating a low-oxygen reducing atmosphere. This feature was discussed earlier in the description of LAN-61 excavations and is likely a mourning feature.

In sum, then, there are three separate patterns at LAN-63 and LAN-64 involving Intermediate period burials. At LAN-63, inhumations were dispersed along the periphery of the site, whereas cremations were concentrated in a large mourning feature. At LAN-64, most of the burials were clustered within several meters of one another on the western side of the site, and several others were also found on the site periphery. It was unclear whether the clustered burials were related genetically to one another or contemporary to one another. The social signature of the presence of both inhumations and cremations is unclear, although a diversity of burial practices was followed during this time period.

Comparative Site Descriptions: North Coast and Interior Sites

This section presents detailed descriptions of comparable sites in southern California in portions of Los Angeles, Santa Barbara, and Ventura Counties. Although many sites have been recorded in this region of California in the past several decades, only the larger and better-reported sites with substantial burial populations are presented here in detail.

LAN-21 (The Cairn Site at Chatsworth)

The Cairn site at Chatsworth, LAN-21, was located at the foot of the Santa Susana Pass, at the northern edge of the San Fernando Valley floor, and was excavated first in 1939 by Edwin Francis Walker (1951:81) and later by Glassow (1969) and Tartaglia (1980). This site likely was occupied and used during the Intermediate period and consisted of two rock-cairn groups (Cairn Groups A and B) that were located 19.8 m apart. Cairn Group A measured 8.5 m by 4.6 m and consisted of several smaller cairns of broken artifacts and large stones located around a larger (5-by-1-m), centrally located cairn composed exclusively of artifacts broken into hundreds of smaller fragments. Cairn Group B measured 10.1 m by 7.3 m and consisted of several clusters of large stones and broken artifacts without a centrally located larger cairn (Walker 1951:96). Cremated human remains were found centrally located in the soils associated with Cairn Group A, and unburned long bones and skulls were recovered from the base of the cairns in Cairn Group B (Walker 1951:96).

Although several types of artifacts (e.g., manos, metates, bowls, mortars, and hammerstones) were represented in both cairn groups, there were differences in the composition of the two groups. Cairn Group A was characterized by "small pestles, very large round bowls of coarse sandstone, two discoidal stones, small flaked knives or projectile points, sandstone metates, beads, *comales*, and incised slabs of soapstone" (Walker 1951:99). The distinguishing characteristics of Cairn Group B, on the other hand, included the presence of flowerpot-form bowls made of fine sandstone and incised with one to two rim grooves for shell beads, very long stone pestles, and large spear or atlatl dart points (Walker 1951:99).

Walker (1951:96) hypothesized that the cairns were likely associated with the Mourning Ceremony. He further suggested that the differences between the two cairns may represent two time periods and possibly two different groups of people.

Tartaglia's (1980) later report of the site was the result of several seasons of archaeological-field-school excavations at the site through the Archaeological Research Center at California State University, Northridge. The purpose of the field schools was to delineate the vertical and horizontal boundaries of the site and to relocate, if possible, the original excavations by Walker in 1939 (reported in 1951). Tartaglia's (1980:120) field-school work was able to relocate the approximate locations of Walker's (1951) excavations. Small numbers of artifacts as well as fragmentary human remains were identified during Tartaglia's (1980:Table 34) excavations. The analysis of faunal remains showed a nonrandom distribution, which suggested that feasting or consumption of food had been undertaken in specific areas of the site. Human remains showed a similar pattern of distribution, with clustering in the center of the site (Tartaglia 1980:309–310). Although radiocarbon dates were not presented in his report, Tartaglia argued, based on obsidian-hydration data (Tartaglia 1980:Table 35), that the site had been occupied during the Intermediate period, from approximately 600 B.C. to A.D. 500.

In his conclusions, Tartaglia (1980:321–334) suggested that LAN-21 was a Mourning Ceremony site with specific characteristics. For example, he suggested (1980:323) that human cremations had not taken place at the site but elsewhere, based on the lack of heavily ash-stained soil as well as the lack of ash, fire-affected rock, and charcoal within the cairns themselves. Tartaglia (1980:323–324) noted that the presence of cremated human remains within cairns of purposefully broken ground stone was not characteristic of ethnohistoric accounts of the Mourning Ceremony. In ethnohistoric accounts, human remains were not present in cairns of purposefully destroyed household items, although effigies of deceased family members were burned. Finally, he also noted (1980:324) that the large cairns recorded by Walker (1951) were not described in ethnohistoric accounts as having been used in the Mourning Ceremony.

LAN-26 (The Sheldon Reservoir Site)

The Sheldon Reservoir site, LAN-26, was located in Pasadena, on Arroyo Boulevard, three blocks south of Devil's Gate Dam and on the eastern side of Arroyo Seco. This burial area was first excavated in 1938 by Edwin Francis Walker and likely dates to the Late period. In 1938, a single burial was uncovered by a tractor-drawn scraper. The *Los Angeles Times* described the burial as a female, flexed with the knees "drawn up under the chin" and accompanied by "pieces of worked stone, possible arrow chips, charcoal chunks, and other articles" (*LAT* 22 October 1938:A3). The burial was found near the location of an isolated mortar that had been discovered 2 days prior (*LAT* 22 October 1938:10).

An obsidian-hydration rim measurement from unsourced obsidian recovered from the site suggested a date of A.D. 916 for the site. Based on the artifacts recovered from the site, King et al. (1974) dated the site occupation to between A.D. 1000 and 1769. Two levels excavated at the site yielded 2 cremations and 53 inhumations. The upper level contained the 2 cremations and 14 of the inhumations, and according to Walker (1951:73), they were likely later than those found in the lower level, judging from the better preservation. No remains of children were recovered. Furthermore, near the burials in the upper level were a variety of large, broken stone tools—metates, mortars, and pestles—indicating that the aboriginal custom of "killing" artifacts as part of the funeral rites had been practiced by this group (Walker 1951:73). The 2 cremations were deposited in such a manner that 1 of them was completely surrounded by a circle of five small boulders, and the other was bounded by a crescent of seven boulders on its western side (Walker 1951:73). Walker (1951:73) further commented that the burials in the upper level were all flexed and had been bundled but that "there was no regularity of burial, possibly because the position of the body might not be discernible when placed in the grave in a large bundle, sometimes the face being downward."

The lower level contained the remaining inhumations. Those individuals were interred in groups of three to six and were likewise flexed, although Walker (1951:73) suspected that they had not been bundled. A few of the burials had been interred with Late period projectile points beside or above them (Walker 1951:73, 79). Because of poor preservation, the orientations of only 29 individuals could be discerned: 15 were oriented to the north, 8 were oriented toward the south, 5 were oriented toward the east, and 1 was oriented toward the west (Walker 1951:73). Located approximately 10 feet north of the burial area were approximately 10 cairns composed of 35–200 stones each and broken stone artifacts (e.g., metates, pestles, bowls, scrapers, and projectile points); many of them were fire affected (Walker 1951:79). The cairns were possibly associated with the Mourning Ceremony, and according to Walker (1951:79), the placement of the cairns so close to the burial area was unusual; the Sheldon Reservoir site might represent the first recorded instance of that relationship.

LAN-43 (The Encino Village Site)

The Encino Village site, LAN-43, was located on the southeastern corner of the intersection of Ventura and Balboa Boulevards, in Encino, on the floor of the San Fernando Valley and at the northern base of the Santa Monica Mountains, near the boundaries of the Fernandeño (a subgroup of the Gabrielino/Tongva) and Chumash territories (Mason 1986:9; Wheeler 2004:81; Whitney-Desautels 1986:3). The site was first excavated in 1984 by Scientific Resource Surveys, Inc., under the supervision of Nancy Whitney-Desautels and Roger D. Mason (Mason 1986:9). The Encino Village site had two distinct burial areas; one contained 21 inhumations, and the second contained approximately 13 cremations (Mason 1986:13; Wheeler 2004:81; Whitney-Desautels 1986:Figure 1). Additionally, 11 canid inhumations, 1 canid cremation, and 1 red-tailed-hawk inhumation were also recovered from the site (Langenwalter 1986:63; Mason 1986:13). Based on radiocarbon dating of features and human bone, the site was primarily dated to between the Late and Mission periods, and there were a few radiocarbon dates from the Millingstone and Intermediate periods. The direct radiocarbon dating of human bone suggested three temporal clusters: the late Intermediate/early Late period transition, the Protohistoric period, and the Mission period (Taylor et al. 1986).

An osteological analysis of the remains from the 21 inhumations was conducted by Richard Cerreto, under the supervision of Judy Suchey (Mason 1986:14). Nine of those inhumations were the focus of a study on paleopathology for this population (Cerreto 1986). Cerreto found that each of the individuals, all aged between 18 and 35+ years, exhibited some observable evidence of degenerative joint disease, most frequently in the form of minor osteophytosis, and osteoarthritis and intervertebral disk herniation occurred rarely (Cerreto 1986). The individual associated with Feature 15 exhibited a healed fracture of the right fifth metacarpal and an "irregular circular lesion with a concave surface" that might have been "the result of muscle or tendon injury" on the posterior (popliteal) surface of the distal end of the right femur (Cerreto 1986:50). Similar lesions were noted on the right femora of the individuals from Features 107 and 121; the lesions were convex and concave in representation, respectively (Cerreto 1986:56).

Little evidence of infectious disease was evident in this population. Periostitis was observed on the neck of the left femur of the individual associated with Feature 51 as well as on the buccal surface near the gonion on the right side of the mandible of the individual associated with Features 65/74 (skeletal elements associated with this individual were found in both features) (Cerreto 1986:50). A large enthesophytic growth, possibly associated with the lateral pterygoid muscle, was also observed on the left mandibular condyle of this same individual (Cerreto 1986:Figure 3C). Squatting facets were observed on the distal end of the left tibia of this individual as well as on the distal end of the right tibia of the individual from Feature 15 (Cerreto 1986:Figures 1D and 3A).The right humerus of the individual from Feature 75 exhibited a curious lesion on the medial epicondyle. The lesion appeared to be either a large enthesophytic growth or a healed antemortem fracture, possibly an avulsion fracture (Cerreto 1986:56, Figure 4A–B). Finally, a small auditory exostosis was observed in the right external auditory meatus of the latter individual (Cerreto 1986:Figure 4C).

LAN-52 (Arroyo Sequit)

Arroyo Sequit, LAN-52, was the location of an important early-historical-period Chumash village known as Lisiqishi. The site extends across both sides of the Pacific Coast Highway, approximately 1.5 km east of the Los Angeles–Ventura County line. It is situated on a marine terrace wedged between the beach and the hills that forms the seaward base of the Santa Monica Mountains. Arroyo Sequit Creek marks the western boundary of the site, and Willow Creek marks the eastern boundary. The site has been subjected to numerous excavations and collections during the past century. The first large-scale excavation was undertaken by the Museum of the American Indian, Heye Foundation's Littleton expedition of 1941–1942 in conjunction with Sanger, during which 140 burials were removed from a burial area at the western end of the site. Unfortunately, that research has only been briefly described, and some unusual artifacts reputedly collected from these excavations have been illustrated (Burnett 1944; Curtis 1959:125). No map of the excavations was ever produced, and the precise location of the burial area is unknown.

In 1951, the ASA, a local organization of professional and avocational archaeologists, was next to investigate the site. An archaeological-field-methods class from UCLA followed in 1954, when they excavated 21 5-by-5-foot units. Both the ASA and UCLA excavations again focused on the western portion of the site. Following a brief report by Meighan (1954) on the UCLA investigations, Curtis (1959) produced a detailed report on both investigations together, along with additional information gathered from private collections and institutional sources. The California Department of Parks and Recreation (DPR) sponsored additional investigations in other portions of the midden in 1960 and 1962 (Curtis 1963) as well as in recent times (see below). Students from the UCLA Archaeological Survey also returned to the site after the DPR investigations. James Toney directed the excavation of two units in December 1966 and January 1967 on the northern side of the highway (Accession No. 562) (Sampson 1987). Joseph Chartkoff also rerecorded the site and collected artifacts from the surface in 1966. Finally, Thomas King of the UCLA Archaeological Survey directed excavations at the western end of the midden in the spring of 1970. The precise locations of the units are unknown, and it is unclear whether the excavations were related to Chartkoff's work. Brief letter reports by Leonard (1967) and King (1970) were the only indications that both excavations had been undertaken. King mentioned the discovery of lenses of packed clay representing one probable and two possible houses and the recovery of scattered infant bone, small rock features with asphaltum, beads, tarring pebbles, bone tools, fishhooks, projectile points, and flake tools. In the spring of 1971, volunteers from the UCLA Archaeological Survey undertook the excavation of several additional test units in the same area as King's excavations the preceding year and may have been related to his study. The results of those investigations were not reported (Ciolek-Torrello and Vargas 2003).

Harry B. Allen and Iliff Anderson were the first to describe Arroyo Sequit, after a brief visit to the site in May 1938 as part of a class study. They provided few details, but within 1 year, Sanger and O. T. Littleton began their excavations of the burial area for the Heye Foundation. The elaborately inlaid stone and bone artifacts recovered during those excavations (Burnett 1944) brought considerable attention to the site. The Los Angeles County Museum followed that work, making a considerable collection of artifacts from the site. The Museum of Anthropology, University of California, Berkeley (UCB), made a smaller collection of surface artifacts (Meighan 1954). ASA tested the burial area and the adjacent midden between 1951 and 1952. Their work resulted in the collection of hundreds of artifacts and a number of skeletal remains. Despite these many investigations, little was known about the site or its extent.

In the first investigation of the site sponsored by DPR, who had recently acquired the area, Meighan returned to Arroyo Sequit in April and May 1954 to carry out systematic excavations. In his brief report, Meighan (1954) noted that they recovered an almost-complete adult burial, several partially articulated burials, and hundreds of isolated bones, along with an intact hearth with a large whale bone. The artifact collection included 22 distinct types of shell beads made from 9 different species, shell fishhooks, bone fish gorges, small projectile points, many fragments of steatite bowls and *comales*, asphaltum, and a decorated shell object.

Noting the paucity of detailed reports on Arroyo Sequit, Curtis (1959) undertook the task of synthesizing the results of the ASA and UCLA excavations. As part of that study, Curtis also examined Arthur Sanger's collections at the Los Angeles County Museum and the Southwest Museum as well as other private collections. Curtis (1959:129) identified the age of the settlement as dating to the Late to early Historical periods (ca. A.D. 500 through approximately 1830), based on the presence of shell fishhooks, mortars and pestles, steatite bowls and other artifacts, shell ornaments, and glass trade beads. The apparent lack of stratigraphy and the homogenous nature of the artifact assemblage also suggested a short duration of occupation. Others, however, suggested that portions of Arroyo Sequit had been occupied in the Intermediate period (Leonard 1971:119), and Chartkoff and Chartkoff (1966) indicated the presence of a Millingstone component.

Curtis returned to Arroyo Sequit under the sponsorship of DPR in 1960, when she excavated near the terrace edge in the eastern portion of the site. In 1962, Curtis (1963) returned to the site once again, this time under the auspices of the Central California Archeological Foundation, and excavated higher on the terrace to the east of the 1960 excavations. Besides large numbers of artifacts, Curtis encountered a house floor, three fragmentary burials, hearths, and other rock features in that portion of the site.

Curtis (1963:83–84) observed that the burials recovered from the eastern side of the midden were markedly different from those found in the western burial area by earlier investigators. Sanger had reported 52 burials in one portion of the western burial area. They were all flexed burials oriented to the east; many were covered with large piles of rocks, whereas others were tightly wedged in small wooden boxes, with the remains (including asphaltum plugs used to seal the wood) found scattered about. It was from those burials that Sanger claimed to have recovered the highly controversial inlaid steatite and serpentine pipes, daggers, effigies, bowls, "tarantulas," and other artifacts that adorned the pages of Burnett's (1944) report and the storerooms of several museums. From the same vicinity, ASA later reported as many as 20 mixed burials in one 3-by-3-foot unit that also contained hundreds of *Olivella* (hereafter referred to as "olivella") disk beads, trade beads, and midden refuse (significantly, ASA found no evidence of the elaborate artifacts reported by Sanger). By contrast, the burials found during Curtis's later excavations were individual isolated burials that did not fit the pattern of a "mass-grave, reburial" pattern (Curtis 1963:84). Artifact associations were meager, and trade beads, piles of rock, wood, and asphaltum were lacking.

Curtis (1963:97–100) concluded that Arroyo Sequit did not represent a single large village that covered the entire site area. Rather, the site was horizontally stratified, with the earliest occupation in the eastern end of the site, where she undertook her investigations in 1960 and 1962. There, Curtis observed that occupation had continued for a considerable length of time—enough for 2 m of midden to accumulate. A shell lens within that deep deposit was found separating relatively different cultural complexes (Curtis 1963:100). Above the shell lens, Curtis found a small, bifacially flaked lithic industry associated with worked bone and shell, as well as polished stone. Below the lens, she found an assemblage dominated by crude cobble core tools similar to those that are the hallmark of the Topanga complex. Historical-period artifacts were notable by their absence from that area of the site, suggesting to Curtis that the eastern end of the site had not been occupied during the historical period. By contrast, her 1959 report of early investigations in the western part of the site suggested that this portion of the site consisted of a shallow, homogenous midden deposit representing an occupation that extended back from the historical period to the early centuries A.D.

More recently, DPR conducted several small-scale investigations at Arroyo Sequit (Hines 1996; Sampson 1987; Wheeler 1996). Among other activities in February 1987, Michael Sampson submitted two radiocarbon samples from materials collected during Curtis's 1962 investigations and obtained the first absolute dates for the site. The first sample dated to 1340 ± 100 B.P. (late Intermediate period), and the second sample dated to 470 ± 75 B.P. (the Late/Protohistoric period transition). These dates did not support Curtis's interpretation that this portion of the site dated primarily to the Intermediate period, although the samples came from the upper levels of the excavations in that area. In November 1996, Hines (1997) carried out a small-scale testing program to evaluate the nature of the cultural deposit in an arroyo eroding the southwestern boundary of Arroyo Sequit. Hines observed three strata. The two uppermost were interpreted as subsoil deposited during highway construction. The lowest stratum consisted of a dark grayish brown, loose sandy silt midden with many fragmented shells.

Finally, SRI conducted archaeological test investigations on the peripheries of Arroyo Sequit for DPR in 2003 (Ciolek-Torrello and Vargas 2003). They also found intact cultural deposits that contained abundant shell and vertebrate-faunal remains, along with numerous shell beads and small numbers of worked-stone and worked-bone artifacts. The recovered beads confirmed previous indications of an occupation that extended from sometime in the Intermediate period to the end of the Late period, with the main occupation in the latter part of the Late period. No evidence of a Millingstone occupation was found, however. Four radiocarbon dates obtained from shell samples collected during the excavations indicated that the upper levels of the deposit, which appeared to date to the Late period, based on the associated shell beads, actually dated to the early Intermediate period (2800–2400 B.P.) (Ciolek-Torrello, personal communication 2009).

LAN-167 (Big Tujunga Site)

The Big Tujunga site, LAN-167, was located in the San Fernando Valley, at the confluence of the Big Tujunga and Little Tujunga dry washes, approximately 1 km south of the San Gabriel Mountains (Wheeler 2004:87). This site consists of two loci, Big Tujunga and Stone Bowl. The Big Tujunga site and the Gabrielino/Tongva village of Tujunga, as recorded at both Missions San Gabriel and San Fernando Rey, may be one and the same (Wheeler 2004:87). The Big Tujunga locus was located at the southern end of the site, and the Stone Bowl locus was at the northern end of the site. Though initially excavated by Edwin Francis Walker in 1945 (Walker 1951:102), LAN-167 was the focus of several subsequent excavations, including those conducted under the auspices of the ASA by Jay Ruby from 1963 to 1964 (Ruby 1966). This site likely dates to the Intermediate period.

Walker's excavations revealed that the site extended 38 feet north–south, was 10–14 feet wide and below 6–32 inches of overburden, and contained "many hundred fire-stained fragments of stone bowls, mortars, pestles, and manos," as well as ceremonial stone knives, steatite pipes, deer-bone awls and gaming pieces, projectile points, stone and olivella-shell beads, abalone shells, 4 stone gorgets, 3 hammerstones, 2 bone harpoon barbs, steatite fishing weights, and approximately 40 decorated ceramic sherds (Walker 1951:112). The ceramic sherds were identified as Sacaton Red-on-buff, which was dated to A.D. 900–1150 (Ruby and Blackburn 1964:209; Walker 1951:112) (Sacaton Red-on-buff is currently dated to A.D. 950–1150 [Richard Ciolek-Torrello, personal communication 2009]). Further excavation by Ruby revealed additional pottery types, Colorado Buff Ware (A.D. 1150 onward) and Hopi Polychrome (A.D. 1500–1700), which helped to further expand the range of occupation at this site (Ruby 1966:111–112). Additionally, Walker (1951:112) identified possible grave markers that he described as burned whale bone but that were later determined to be fossilized bone from a mammoth or mastodon (Ruby 1966:111). The presence of imported ceramics is interesting, partly because they are relatively rare in coastal southern California. In addition, local ceramic production did not begin until very late (ca. A.D. 1700) along the coast and in near-inland locations.

The skeletal remains of up to 15 individuals were recovered from the northern portion of the site and were represented by fragments of crania, long bones, and other skeletal elements; at least 1 of the individuals was almost complete (Walker 1951:112). In the central and southeastern portions of the site, 26 "killed" steatite bowls containing human remains were found, although no evidence of burning was noted on the bowls during excavation; at least 1 bowl was covered by an abalone shell (Walker 1951:112, Plate XLIV). Two additional burials were later identified by Ruby at the southern end of the site, in association with a hearth and a "pavement of unmodified stone" (Becker 1999:18).

Because of the breadth of artifact types, Walker concluded that the site had been used for several centuries and that the northern end of the site, which was characterized by larger projectile points, ceramics, and reburied human remains, was older than the southern end, which was characterized by smaller projectile points and cremated remains (Walker 1951:115–116). Walker concluded that although the site was associated with the Mourning Ceremony, it had not been the actual scene of the event but, rather, a redeposition of the remnants of the ceremony, based on the lack of ash, charcoal, and burned soil associated with the site (Becker 1999:17–18; Walker 1951:112). "Presumably, therefore, it was a sacred site to which such fragments of offerings as survived the ceremonial fire were removed, together with the reburial from a cemetery of a portion of the skeletal material of the restricted number of individuals for whom the anniversary rite was conducted" (Walker 1951:113–114).

LAN-171 (The Haverty Site)

The Haverty site, LAN-171, was located in West Los Angeles, between La Brea and Crenshaw Boulevard, south of Rodeo Road and north of Santa Barbara Avenue. It was situated in the Ballona Creek area, northeast of the Baldwin Hills (Brooks et al. 1990:Figure 1). The site was discovered in 1924 after the Thomas Haverty Company encountered human remains while cutting a trench for an extension of the Los Angeles sewer system. Chester Stock, then chairman of the Department of Paleontology at UCB, was allowed to conduct excavations to remove the remains and evaluate the site (Stock 1924:2). Although radiocarbon dates obtained from bone indicated that the individuals dated to between the terminal Pleistocene and middle Holocene, more-recent investigators have questioned those results and suggested further research (Brooks et al. 1990:60, 79). Nonetheless, the site likely contains a Millingstone period component.

The collection of human remains associated with the Haverty site consisted of at least eight individuals: three females, three males, and two individuals of indeterminate sex between 13 and 40+ years of age (Brooks et al. 1990:Table 1).

The remains were well preserved, and at least one individual had been interred flexed in a sitting position (Brooks et al. 1990:79). Stock (1924:3) noted that some degree of bone fossilization had taken place. Furthermore, there did not appear to have been any disturbance of the soils above the remains, leading Stock (1924:24) to believe that the location of the remains was the result of "miring under bog or marsh conditions." Brooks et al. (1990:79) suggested that because of the range of ages and sexes, these individuals had been deliberately interred at this locale.

No major pathological conditions or trauma was evident on any of the skeletal remains, although slight to moderate osteophytic lipping was observed on the lumbar vertebrae of all the adults, and Individual 2 (female, 40+ years) exhibited some moderate osteoarthritic activity associated with the cervical spine (Brooks et al. 1990:72–73). Finally, when compared to the remains collected from Humaliwo site, the individuals in the Haverty collection were, on average, 6.7 cm taller, although analysis of robusticity between the two collections revealed that both groups were similarly robust (Brooks et al. 1990:74, 80).

A small number of artifacts were recovered from the site, including a quartzite scraper and a partially mineralized awl fragment (Brooks et al. 1990:66). Other lithic artifacts noted included a "quartzite boulder, regarded as an implement" (Stock 1924:24). There was mention of camel remains nearby, in the area designated Locality 6 (Brooks et al. 1990:63).

LAN-174 (Zuma Creek)

Zuma Creek, LAN-174, was located approximately 2 km northwest of Dume Point, on top of a bluff near the western edge of the Dume Point Mesa (Peck 1955:1). Dume Point is approximately 29 km west of Santa Monica, along the coast, near Los Angeles County Survey Marker R. E. 2177 (Peck 1955:7). The site was excavated first from 1947 to 1948 by Stuart Peck and again in the spring and summer of 1957 by a UCLA field school and Robert Ascher (Littlewood 1960; Peck 1955). Material sources included obsidian from the desert, possibly Coso. Based on artifact typology and burial customs, the site was occupied during the terminal Early period (what is called, in the Ballona area, the early Millingstone period, approximately 3000 B.C.).

At minimum, six inhumations with scattered single bones and bone fragments were identified at the site during Peck's initial excavation, and an additional five burials were recovered in the spring and summer of 1957 (Littlewood 1960:136; Peck 1955:65). Although Peck was very detailed in his description of the burials removed during his excavations, the remains were poorly preserved, and very little information was available. From the available information, males and females were represented in fairly equal numbers: a single male and two females were identified. Two individuals were adult, and one was described as "adolescent" (Peck 1955:65–75). No demographic information was available for the other three individuals. Furthermore, burial treatment associated with these individuals ran the gamut of configurations: one extended, one semiflexed, one fully flexed, two reburials, and one flexed in an indeterminate manner (preservation was lacking for this individual). Two of the individuals were oriented to the south, and a third was oriented to the north (Peck 1955:65–75).

All six burials recovered in 1957 were interred in an extended position; one of the burials (a child of approximately 8 years old) was oriented north–south (Littlewood 1960:136). With the exception of the child, these individuals were all adults, including four young adults and one middle-aged adult, among whom both sexes were fairly evenly represented, with three males and two females (Littlewood 1960:147).

Few mortuary offerings were observed with these individuals. In burial Feature 2-9 (a young-adult female), a ring of stones including two manos (one intact and one fragmentary) was placed around the head, an abalone shell was located approximately 1 foot away from the left elbow, and a possible scraper was found 6 inches above the chest (Peck 1955:66). Other mortuary offerings consisted of an asphaltum-plugged abalone shell (burial Feature 3-10), three leaf-shaped projectile points (burial Feature 13-21), and olivella-shell beads (burial Feature 13-21) (Peck 1955:72–73). Unfortunately, no additional information on these projectile points and olivella-shell beads was available. Peck suggested that the disturbed burials/reburials were similar to burial features associated with the Mourning Ceremony, but he also noted that they were "definitely without evidence of the sacrificial offerings of artifacts which are characteristic of that ceremony" (Peck 1955:70).

Although few mortuary offerings were found at LAN-174, numerous artifacts unrelated to mortuary activities were recovered. These included ground stone artifacts (e.g., manos, metates, "miniature manos," a steatite bowl, a sandstone dish, and possible mortars), flaked stone (e.g., flakes, choppers, hand-picks, scraper planes, disk scrapers, knives, and projectile points), expedient-use stones (e.g., abraders, pebble hammers, hammerstones, red ocher, and "pebbles of white agate and chalcedony moonstones"), red-ocher-decorated stones, charcoal-lined stone, worked-bone awls, and olivella-shell beads (Peck 1955).

LAN-197 (Trancas Canyon)

The Trancas Canyon site, LAN-197, was located on a knoll on the west bank of Trancas Creek, overlooking the coast 15 km west of Malibu Beach. This site was first excavated in 1968 as a salvage operation by the UCLA Archaeological Survey and the Malibu Archaeological Society (Thomas and Beaton 1968:163). Radiocarbon dates obtained from abalone shell indicated that the site had been in use from 430 to 310 B.C. and that the burial area had been in use from approximately 400 B.C. to A.D. 500 (Martz 1984:110). Thus, the site likely dates to the Intermediate period. In her dissertation, Patricia Martz indicated that the occupants of

Trancas Canyon may have been contemporaneous to and "ultimately absorbed" by the Chumash, even though it is "chronologically and geographically where a pre-Chumash site would be" (Martz 1984:115).

The site suffered a number of disturbances, including bioturbation from rodent burrowing, construction of a flood-control channel, planning during construction of a parking lot, erosion, and vandalism (Martz 1984:111). At minimum, 106 burials (no cremations) were identified at the site, and an estimated 10 percent of the burials had been lost as a result of the aforementioned disturbances (Martz 1984:111; Thomas and Beaton 1968:165). The burials were organized in a relatively moderate, diffuse manner in an area measuring approximately 22.5 m (east–west) by 12.0 m (north–south), with the density decreasing away from the center of the burial area (Thomas and Beaton 1968:Map 1). Martz (1984:111) noted that there were fewer infants represented than would be expected in a population from the time period. The majority of burials were in an extended position. There were very few reburials, and a there was a paucity of associated artifacts or grave goods (Martz 1984:111). A number of burials could be characterized as dating to the Late period (Martz 1984:111). As a result of poor preservation and the absence of a physical anthropologist during excavations, only 21 burials were identifiable as to sex: 8 females and 13 males (Martz 1984:124). Of the 92 individuals for which age could be identified, 62 were adults, 6 were "adolescent," 15 were children, and 9 were infants (Martz 1984:125). There was a tendency, according to Martz (1984:132), for adult burials to be located toward the western portion of the site and child and adolescent burials to be located toward the eastern portion of the site.

Slightly over 60 percent of the burials lacked any mortuary accompaniments or artifact associations (Thomas and Beaton 1968:170). Noteworthy burials included an older-adult male buried with a pipe and an adolescent buried with a bone tube and an abalone shell over the face. The pipe and bone tube were considered ritual artifacts by Martz (1984:117). Only one burial included beads, that of a 7–8-year-old child whose burial included abalone shells over the knees, a string of *Olivella biplicata*–shell beads, and red ocher (Martz 1984:117). Other features noted included cairns constructed of rock and broken artifacts. Cairns were associated with the burials of nine adults and one adolescent (Martz 1984:137).

The vast majority (approximately 97 percent) of the inhumations recovered from the site had been interred in an extended position; considerably fewer burials had been interred in semiflexed or fully flexed positions (Thomas and Beaton 1968:Table A). Additionally, in regard to position, 70 percent of the burials had been interred supine, 24 percent had been interred prone, and a scant 6 percent had been interred on there right sides; none had been positioned on the left side (Thomas and Beaton 1968:Table B). Finally, 87 percent of the burials were clustered at approximately 200° (roughly due south) and toward the ocean (Thomas and Beaton 1968:167).

LAN-227 (Century Ranch Site)

The Century Ranch site, LAN-227, was located on a terrace between Las Virgenes Creek and Stokes Canyon, in Century Ranch, in the Santa Monica Mountains of Los Angeles County. It was first excavated from 1960 to 1961 by Chester King, Thomas Blackburn, and Ernest Chandonet (King et al. 1968:13, 22). Although no absolute- or relative-dating methods were used, the investigators believed that the site had likely been occupied during the Late through historical periods. King (1990a:43) stated that the burial area dated to the Late period (L2b in his Chumash chronology, or A.D. 1650–1782).

At minimum, 22 burials, 3 of which appeared to be secondary, and an additional 5–7 possible individuals identified from scattered human remains were recovered during excavation of the site (Brooks 1968:144; King et al. 1968:25). In terms of demographics, the burial population was fairly balanced, with a near 1:1 male-to-female ratio among identified individuals and with all age groups represented (Table 1). Furthermore, with few exceptions, mortuary observations revealed a predilection toward tightly flexed inhumations oriented to the west, with the heads facing either north or south, and buried on the left or right side or in a prone position (see Table 1). The map of the burial area (King et al. 1968:Figure 2) indicated that many of the individuals had been interred either simultaneously or within a short period of time of one another, in a rather dense concentration approximately 19 feet (approximately east–west) by 9 feet (approximately north–south). Finally, mortuary accompaniments were generally rare and mundane (i.e., utilitarian flaked stone, red- or yellow-ocher fragments, or worked-bone artifacts), although some burials exhibited more-abundant artifact concentrations. Seven black-abalone shells were piled next to the cranium of the primary inhumation in burial Feature 6, an asphaltum-plugged black-abalone shell was found over the abdomen of the primary inhumation in burial Feature 12, and asphaltum-covered basket fragments were recovered from several burials (burial Features 7, 9, 12, 17–19, and 21) (King et al. 1968:26–29). Shell beads were also exceedingly rare, and only burial Feature 8 contained shell beads in any large amount—a necklace made of 675 olivella-shell beads was around the neck of the primary inhumation (King et al. 1968:26). A mortar was found inverted over the cranium of the same individual (King et al. 1968:26). Burial Feature 19 was of special note, because it consisted of the redeposited human cremations of an adult and a "juvenile," as well as some mammal bone, all of which had been placed in an asphaltum-coated basket that had been placed upon the feet of the individuals in burial Features 17 and 18 (King et al. 1968:28).

An analysis of the skeletal elements revealed that the most-common pathological condition was osteophytosis in the spine and appendicular skeleton. One individual exhibited diaphyseal swelling of the right clavicle and both tibial shafts (Brooks 1968:145). In addition to the burials, 11 rock clusters were also recovered from the site (King et al. 1968:29–30).

Table 1. Demographic and Mortuary Information from LAN-227 Burials

Feature No.	Sex	Age	Treatment	Orientation	Direction of Head Facing	Position
1	male	37–41 years	tightly flexed	west	north	left side
2	indeterminate	<6 months	indeterminate	east	indeterminate	indeterminate
3	indeterminate	>35 years	indeterminate	indeterminate	indeterminate	indeterminate
4	indeterminate	>25 years	indeterminate	indeterminate	indeterminate	indeterminate
5	male	47–49 years	tightly flexed	west	south	right side
6	female	>40 years	tightly flexed	northwest	north	prone
7	indeterminate	~2 years	tightly flexed	west	down	prone
8	indeterminate	~2 years	tightly flexed	west	indeterminate	indeterminate
8[a]	indeterminate	child (3+ years)	indeterminate	indeterminate	indeterminate	indeterminate
9	indeterminate	8–10 years	tightly flexed	west	south	right side
9[a]	indeterminate	2–3 years	indeterminate	indeterminate	indeterminate	indeterminate
9[a]	indeterminate	25 years	indeterminate	indeterminate	indeterminate	indeterminate
10	female	39–42 years	tightly flexed	west	south	prone
10[a]	indeterminate	~6 months	indeterminate	indeterminate	indeterminate	indeterminate
11	male	>50 years	tightly flexed	west	south	prone
12	indeterminate	1–1 1/2 years	tightly flexed	northwest	northeast	left side
13	indeterminate	<1 year	flexed	east	indeterminate	right side
14	female	43–46 years	tightly flexed	west	down	prone
15	male	>50 years	tightly flexed	west	indeterminate	right side
16	male	6–7 years	tightly flexed	west	north	left side
17	male	37–39 years	tightly flexed	west	north	prone
18	female	45–50 years	tightly flexed	west	south	right side
19	indeterminate	child	indeterminate	indeterminate	indeterminate	indeterminate
19	indeterminate	adult	indeterminate	indeterminate	indeterminate	indeterminate
20	female	45–50 years	tightly flexed	west	south	supine
21	female	~46 years	tightly flexed	west	south	right side
22	female	12–13 years	tightly flexed	west	north	left side

[a] Individual identified from scattered skeletal elements.

A number of nonmortuary-related artifacts were also recovered. These cultural materials consisted of pottery (e.g., Cibola White Ware and Tizon Brown Ware), ground stone (e.g., manos, pestles, a serpentine bead, a talc schist bead, chlorite beads, metates, a talc schist pendant, chlorite schist pendants, *comales*, steatite pipes, discoidals, cogged stone, a digging-stick weight, a doughnut stone, and mortars), flaked stone (e.g., choppers, blades, drills, cores, scrapers, knives, and projectile points), expedient-use stone (e.g., hammerstones, tarring pebbles, a steatite shaft straightener, a rubbing stone, a grooved sandstone cobble, and ocher), shell beads of unknown type, and awl fragments (King et al. 1968).

LAN-243 (Medea Creek)

The Medea Creek site, LAN-243, consisted of an inland Chumash burial area located approximately 300 m north of an associated village (King 1982:1, 44). It was located in the Santa Monica Mountains, along the west bank of Medea Creek (a tributary of Malibu Creek), approximately 19 km from the Humaliwo site (King 1982:37–38; Martz 1984:301). According to analysis by King (1982:197; see also King 1969), the burial area served the local region as well as the nearby village and was probably under the influence of the larger village at Humaliwo (Martz 1984:381). King (1982:35) indicated that the site had been used continuously as a burial area from approximately A.D. 1450 (near the end of the Late period) through the early Mission period and that its use ceased between A.D. 1785 and 1800.

The site was first excavated as part of an emergency salvage operation in 1966 by the UCLA Archaeological Survey project, under the supervision of Linda King and Linda Hasten (King 1982:38–40). There was no physical anthropologist on site, and vandalism was a significant problem, because the site was not secured during nonworking hours. Disturbances included plowing, bioturbation, and the Chumash practice of disturbing one burial in the process of interring another individual. Salvage excavations of the nearby Medea Creek Village were conducted in 1969 by the UCLA field class, with Clay Singer and Dr. James Hill (King 1982:44–46). Patricia Martz later used that data set as part of her dissertation research (Martz 1984).

The burial area consisted of an estimated 397 primary and secondary interments clustered in an oval-shaped area measuring 20.1 m (east–west) by 9.5 m (north–south) (King 1982:36). Within that concentration of the burials, there were numerous discontinuities and clusters that, according to King (1982:52), might have indicated family plots. Furthermore, King (1982:64) felt that the burial area associated with the site conformed to descriptions of historical-period burial areas on the Channel Islands. The abrupt boundary of the burial area indicated some form of fence or enclosure, and preserved redwood in the burial area was suggestive of pole markers, whereas whale-bone planks that had been painted red were found in some surface features and might have been used as grave markers (King 1982:64).

Burials consisted of primary interments, reburials, and cremations and were generally poorly preserved, partly because of the disturbances mentioned above (Martz 1984:309). Martz indicated that 68 percent of the burial-area population were primary interments; 29 percent were reburials, 10 percent of which appeared to have been "defleshed" prior to burial; at least 3 percent, or 13 burials, showed evidence of burning, 8 of which appeared to have been cremated and redeposited; and 3 showed evidence of trauma in the form of burning and mutilation (King 1982:147; Martz 1984:309). Most of the cremated individuals had been only partially cremated (Martz 1984:375). King (1982:53–54) indicated that "most reburials were found in areas of dense use and were probably originally from primary burials which had been cut through and then redeposited around and/or over a primary burial." Some reburials, however, were found on sterile sediment or in locations where there was no apparent source of disturbance (King 1982:53–54).

In regard to burned bone, artifacts, and flora, King (1982:55) identified four potential behaviors: (1) cremations, (2) partial charring of articulated burials or grave pits (preinterment grave-pit burning), (3) burning of the cut-up bodies of victims of violence, and (4) generalized burning of wood, seeds, and artifacts, perhaps originally on the surface of the burial area or in the graves. One adult burial feature, burial Feature 380, had been "slightly charred in such a way that a net that was wrapped around the waist and between the legs was carbonized and very well preserved" (King 1982:55). Burned floral material and the occasional thermally affected artifact associated with several burials and throughout the matrix potentially indicated that ceremonial fires, both in the burial pit and on the surface, were a common occurrence in the burial area (King 1982:57). Burial Features 20, 133, and 330 were the three burials to have been partially mutilated and burned. The descriptions of these three burials are very important to the discussion of partial cremations and cut marks and are presented below.

> **Burial Feature 20:** This burial consists of two sections of a torso plus a cluster of disarticulated bones (one femur, ribs, small skull fragments, and miscellaneous pieces). A projectile point was observed embedded in a thoracic vertebra. Charring appears on the outer surfaces of the skull fragments, the end of the broken femur, and on the processes on the back of the vertebrae. This pattern of burning indicated that the body was burned after it was cut, but with the flesh still on. The burial appears to represent a partial cremation that took place at another location, as there was no evidence of fire in the burial pit itself [King 1982:147–148].
>
> **Burial Feature 133**: This is a body cut in two at the chest: only the lower part is present in articulation. The lower body is sprawled on its back with the right femur, cut above the knee and missing the distal end, drawn up toward the right shoulder; the left leg is extended and missing below the knee. This is a highly deviant position at the site, and it is the only adult body in the cemetery oriented directly east. At the left rib cage was a cluster of burned bone fragments, including ribs, clavicle, and skull. These appear to be the missing bones from the upper part of the body heaped together. A burned tibia and fibula were beside the left femur: these appear to be the cut lower leg in its approximate proper location. A radius and ulna were placed where the right leg would have been if it had been extended: this could be a part of one of the missing arms [King 1982:149–150].
>
> **Burial Feature 330**: There were two projectile points in the neck region and one in the upper back. A large distinctive crack on the right side of the head may have been the result of a blow, although there is no depression fracture. The body was cut in two at the waist (between the third and fourth lumbar vertebrae), the legs were removed above the knees, and the hands and feet cut off at the joints. The chest was opened and the ribs dislodged from articulated position. The body was burned enough to char where the bones were exposed by cuts—the ends of the femora, the cut vertebrae, and the ends of the ribs. Parts of the skull and the iliac crest were also burned in places where the bone was near the surface of the skin [King 1982:151].

In an analysis of status of the individuals recovered from the burial area at Medea Creek, King made several astute observations. First, although there was a lack of discrimination between males and females regarding the types of mortuary accompaniments, there were marked inequalities in wealth items between juveniles and adults (King 1982:66–67). The few artifacts of shamanistic/ceremonial importance were recovered with male individuals, whereas basket impressions in asphaltum were common in female burials (King 1982:70). Furthermore, although the burials at Medea Creek did follow a pattern in which "wealthier" individuals were buried deeper than "less-wealthy" individuals, King (1982:93) observed that children tended to be more differentiated than adults and males tended to be buried deeper than females (King 1982:96). In regard to orientation and placement, children were more frequently placed on their right sides than were adults, and infants were curled in containers, with less display of orientation (King 1982:96). King (1982:94) suggested that the latter observation had more to do with "the mechanics of fitting an infant into a basket, bowl, or mortar, which was buried without orientation," whereas "a larger body was wrapped in a mat and could be oriented." On occasion, containers contained disarticulated adult remains, such as the articulated hand from Feature 14 (King 1982:59).

About half the interred individuals (55 percent; n = 117) were oriented to the west, with no preference in the direction of head facing, regardless of status (Martz 1984:309, 320). Males were more consistently oriented to the south (King 1982:73). Additionally, and likewise regardless of status, 78 percent (n = 158) were buried on their sides, 78 percent (n = 160) were tightly flexed, and only one individual was in an extended position (Martz 1984:320). When comparing the Trancas Canyon, Simo'mo (VEN-26), prehistoric Humaliwo, and Medea Creek sites, one finds a progression in the positions of the burials: the earliest, at Trancas Canyon, were identified primarily in extended positions; burials were semiflexed at Simo'mo; and they were tightly flexed at the prehistoric Humaliwo and Medea Creek sites. Also, 61 percent of the Trancas Canyon burials were in a dorsal position, 89 percent of the Simo'mo burials were in a ventral position, 78 percent of the Medea Creek burials were in a ventral position, and 51 percent of the prehistoric Humaliwo burials were in a ventral position (Martz 1984:389).

The demography of the burial area included 231 individuals (63 percent) that could be identified as adults, 36 "adolescents," 70 children, and 30 infants (Martz 1984:255). Sex was estimated for 72 adults: 57 percent (n = 41) were considered male, and 43 percent (n = 31) were considered female (Martz 1984:321) (however, for additional details, see King [1982]). Like Simo'mo, Trancas Canyon, and the prehistoric Humaliwo burial areas, there was an "under-representation" of subadults that could be attributed to poor preservation of the more-delicate skeletal elements but was more likely the result of cultural practices in which burial areas were reserved for those with ascribed status or those who had been initiated into the society, which would not have happened until an individual was of appropriate age; thus, uninitiated subadults would have been buried elsewhere (Martz 1984). Of the infants present in the burial area, 50 percent were buried with an adult (Martz 1984:354).

King (1982:79) also found that the western portion of the site contained the majority of the children identified at the Medea Creek site. Two possible reasons for that pattern were suggested: (1) a kinship group that used the eastern end of the burial area did not bury many of its small children in primary context and (2) infants and small children tended to be preferentially buried to the west (King 1982:83).

The evidence from the Medea Creek burial area has been used by several investigators to argue that Chumash society was ranked with distinct classes, as suggested by some ethnohistoric reports. King (1982:99) maintained that at Medea Creek, "the pattern of distribution of grave goods suggests status differentiation, but that wealth correlates with neither adult status nor maleness" and that "the Medea Creek population represents a nonegalitarian society wherein status was expressed to a greater degree within the subadult population than within the population over 22 years of age." King conjectured that perhaps adult status was conveyed more through commemorative mortuary activities. Although no potential Mourning Ceremony features were identified, such features might have been located at the surface and dispersed through subsequent disturbances. King (1982:190) argued further that because some burials of children had higher-status artifacts, status was likely inherited among that group of people. Finally, King (1982:188) concluded that although the society appeared to have been differentially ranked, the lack of a separate burial area for higher-status individuals indicated that the society was not highly stratified.

Interestingly, the Medea Creek subadults were recovered with more artifacts associated with wealth and prestige than were those from such sites as Simo'mo and Humaliwo, where subadults were buried with few, if any, artifacts. Martz (1984:392) argued that this evidence suggested an important change indicating a transition in the culture's treatment and view of subadults and in the "appropriate way to express these feelings for the children of the upper class." Martz (1984:392–393) concluded that it indicated a narrowing of elites, which supports ethnographic references to a noble class and emphasis placed on heredity and lineage rather than "initiation and participation as a ritual, political, or economic specialist." These arguments by King and Martz were based on the assumption that the variability in the distribution of mortuary goods they observed at Medea Creek represented contemporary burial practices. They failed to demonstrate, however, whether those differences could have been due to temporal differences, considering that Chumash society undoubtedly changed dramatically during the historical period after the arrival of the Spanish.

Of the nearly 400 burials examined at the site, few individuals exhibited any trauma. Only 1.3 percent of the burials presented evidence consistent with violence: burial Features 20, 73, 133, and 330 (King 1982:147–152; Martz 1984:376). Furthermore, only 2 adult females exhibited trauma: perimortem femoral fractures wrapped in asphaltum and fibers, as though in casts (Martz 1984:376).

A small house pit with historical-period artifacts that dated the time of use to ca. A.D. 1850–1880 was located between Medea Creek and the burial area (Martz 1984:304). Although Martz argued that the house pit dated to that time period, John Johnson (1997) has argued elsewhere that it seems almost certain that no Chumash were living at Medea Creek between 1850 and 1880; therefore, he believed that it was possible that the pit structure dated to earlier than 1850. Artifacts recovered with the pit house included porcelain and glass fragments, scrap iron, leather, and square-cut nails, along with items created by Native Californians and domestic refuse (King 1982:43; Martz 1984:304). Rock features with large stone artifacts and whale bone were "scattered across the central and western portions" of the burial area (Martz 1984:302). Features associated with burials included cairns or mortars that had been placed over the bodies or parts of the bodies, "killed" artifacts, caches, canoe parts, burned offerings, and rock or whale-bone markers (Martz 1984:321).

Over 28,000 artifacts were collected from Medea Creek. They consisted of numerous shell beads; worked-shell ornaments, containers, and fishhooks; worked-bone tools, musical instruments, markers, and pendants; stone beads; flaked stone tools; mortars, pestles, metates, bowls, pipes, charmstones, incised stone, and large modified stone slabs; crystals; wooden canoe planks; asphaltum; cordage; and soaproot brushes (King 1982:268–270; Martz 1984:302). Artifacts were recovered with 60 percent of the burial-area population (Martz 1984:323). Four individuals were painted with red ocher (Martz 1984:321). Less than 500 historical-period glass beads were recovered, primarily with inhumations. Eighty percent of those beads were associated with only two individuals, and the rest were distributed among 15 individuals (Martz 1984:323–324). Martz (1984:322) suggested that the historical-period artifacts seemed to represent a single "trading event with Spanish explorers."

LAN-246 (The Mulholland Site)

The Mulholland site, LAN-246, was a large habitation site located in the Santa Monica Mountains, approximately 16 km from the coast, 45 m above and 2.5 km south of the San Fernando Valley (Wheeler 2004:90). LAN-246 was first excavated by Alex Apostolides in 1963 (Galdikas-Brindamour 1970). Radiocarbon dates obtained from charcoal and human bone indicated that the site had been occupied between A.D. 1240 and 1440 (that is, during the Late period). Galdikas-Brindamour (1970) argued that the inhabitants were either a subgroup of the Gabrielino/Tongva or Chumash because of the proximity of this site to the cultural boundary separating the two groups. She also argued that the artifact assemblage, soil, midden, and inferred social complexity were indicative of a "multi-activity, sedentary village" with a year-round resident population, although no distinct house floors or house remains were identified (Galdikas-Brindamour 1970:157). Modern looting at the site was a significant problem and very likely affected the artifact and burial recovery.

Excavation by Apostolides resulted in the discovery of 23 human burials (Galdikas-Brindamour 1970:Table 1). The full extent of the burial area, however, is unknown because of the damage from looting. Wheeler (2004:90) also noted that a Native American Graves Protection and Repatriation Act inventory of fragmentary human remains from the site resulted in the identification of an additional 19 individuals.

The majority of the burials were interred in a tightly flexed position, and a few individuals were interred in a loosely flexed position (Table 2). Head orientation and body placement were less distinctive. Burials were interred with the heads oriented in a variety of directions (see Table 2). There were relatively even numbers of burials associated with the sexes—eight males and seven females—and individuals ranged in age from infant to over 35 years of age (see Table 2). Associated mortuary offerings appeared to have been unevenly distributed. Some burials were found with numerous artifacts, whereas artifacts were completely absent from others. Galdikas-Brindamour (1970) saw that as indicative of rank within the social organization of the group.

Several burial features were noteworthy. Burial Features 2 and 7 (a 35+-year-old male and a 17–19-year-old female, respectively) contained some of the greatest concentrations of associated mortuary offerings at the site. Burial Feature 2 was associated with a steatite spool and pendant, a serrated projectile point, a limonite disk, perforated shell with asphaltum, basalt flakes, chert flakes, a pecking pebble, a broken mano, numerous shell beads made from California mussel and olivella shells, and a collection of keyhole Limpet shells, one with a red zigzag design (Galdikas-Brindamour 1970:Table 1). Burial Feature 7 was associated with approximately 1,000 olivella-shell and California mussel–shell beads as well as an abalone-shell bead, all recovered from the chest cavity of the individual (Galdikas-Brindamour 1970:Table 1). Other artifacts consisted of a serpentine bead and pipe fragment, a mortar fragment, a smoothed pebble, a basalt scraper, a possible awl fragment, and unmodified shell and bone fragments (Galdikas-Brindamour 1970:Table 1). In regard to artifacts, other burial features exhibited similar artifact types but in smaller quantities.

Burial Feature 12, a 25+-year-old male, exhibited evidence of possible trephination, as well as dismembered leg bones (Galdikas-Brindamour 1970:Table 1). The cranium was examined by Dr. Thomas Noguchi, then the chief medical examiner-coroner for Los Angeles County. In a personal communication with Galdikas-Brindamour, he indicated that the individual had lived for 6 months after a trephination had been performed (Galdikas-Brindamour 1970:136). Sussman (1965:338) described the trephination as "a shallow, round hole in the right parietal bone near the sagittal suture line, measuring 1.7 cm in diameter and about 0.5 cm in depth" and indicated that a similar defect had been observed by William Harrison on a skeleton from Santa Barbara. Subsequent to these analyses, Dr. Phillip Walker evaluated the same skull and determined that the hole was the result of blunt-force trauma and had caused the death of the individual (John Johnson, personal communication 2012). Burial Features 13 and 17 (a 30+-year-old male and an adult male respectively) were both missing their hands and feet (see Table 2). Although Galdikas-Brindamour did not indicate whether any

Table 2. Burial Information from LAN-246 Associated with 1963 Fieldwork by Apostolides

Feature No.	Sex	Age	Treatment	Orientation of Head	Observations
1	unknown	preteen	tightly flexed	not noted	
2	male	35+ years	tightly flexed	east	
3	unknown	15 years	loosely flexed	northwest	
4	female	19–21 years	tightly flexed	east	
5	female	9? years	not noted	not noted	
6	male	22–27 years	loosely flexed	west	
7	female	17–19 years	loosely flexed	northeast	
8	male	30+ years	not noted	not noted	
9	female	18–20 years	tightly flexed	east	
10	female	35+ years	tightly flexed	east	
11	male	25+ years	tightly flexed	northeast	projectile point facing inward between ribs
12	male	25+ years	tightly flexed	not noted	skull trephined; dismembered leg bones
13	male	30+ years	tightly flexed	east	hands and feet missing
14	female	30+ years	tightly flexed	not noted	
15	female	35+ years	loosely flexed	south	
16	male	17–20 years	tightly flexed	northeast	
16	unknown	adult	not noted	not noted	
17	male	adult	tightly flexed	east	hands and feet missing
18	unknown	adolescent	not noted	not noted	
18	unknown	infant	not noted	not noted	
19	unknown	child	tightly flexed	northeast	lipping on lumbar vertebrae
20	unknown	infant	not noted	not noted	cremated and placed inside flowerpot mortar
22	unknown	adolescent	tightly flexed	not noted	

Note: From Galdikas-Brindamour (1970).

cut marks were evident on these remains, she did remark that the cutting of the hands and feet was a form of warfare mutilation practiced by the Chumash (Galdikas-Brindamour 1970:136). Burial Feature 11 was recovered with evidence of trauma in the form of an inward-facing projectile point between the ribs that was suggestive of soft-tissue-exclusive arrow trauma (see Table 2).

Burial Feature 20, an infant of indeterminate sex, had been cremated and was recovered from inside a "flowerpot" mortar (Galdikas-Brindamour 1970:132). Such mortars, also known as flat-rim mortars, have been described as having a "flat rim, flat base, and straight sides" (Meighan 2000:64). Meighan (2000:64) indicated that flat-rim mortars would have been reserved for special purposes because of their greater size and the time it took to manufacture the vessels.

In addition to the artifacts associated with these burials, a number of other artifacts were recovered from non-burial contexts at LAN-246. Ground stone artifacts included over 100 manos and metates (Galdikas-Brindamour 1970:137), pestles, and pestle fragments; slate pendants; and a "large amount of shaped slate blanks" (Galdikas-Brindamour 1970:140). There were 30 steatite *comales* and vessel fragments recovered, and the "presence of mortars and basket-hopper mortars" was noted (Galdikas-Brindamour 1970:137). One of the mortars had been "killed," and a steatite olla fragment had been partially reworked into a *comal* at the time of deposition (Galdikas-Brindamour 1970:137).

The recovered flaked stone artifacts included 50 choppers and 45 cores. There were approximately 100 projectile points collected, including 8 large stemmed, 5 large triangular, 13 small convex-based, 1 small lozenge-shaped, and 42 concave-based points. "Many hundreds of utilized and unutilized flakes" were also recovered (Galdikas-Brindamour 1970:139).

Other lithics collected included 6 tarring pebbles, approximately 60 angular hammerstones, approximately 30 lumps of "pigment" (hematite and limonite), and 20 quartz crystals (Galdikas-Brindamour 1970:140). Asphaltum was found at the site, covering quartz crystals and shell, as tarring pebbles, and in large lumps; asphaltum had also been used to mend a mortar (Galdikas-Brindamour 1970:137).

These lithic artifacts were made from materials including chert from the Santa Monica Mountains; fuchsite, chlorite, and serpentine possibly from Bouquet Canyon; fused shale from Grimes Canyon; obsidian potentially from Mono Lake; and steatite from Catalina Island. The recovery of specific nonlocal artifacts suggested trade—for example, the recovery of quartz crystals, some with adhering asphaltum, which were not locally available.

The recovered worked-shell artifacts included over 800 shell beads that were mostly made from olivella, although some were made from clam and California mussel. The recovered worked-bone artifacts included 20 bone awls and approximately 80 worked-bone artifacts, including the distal end of a cougar humerus with a circumferential groove around the proximal end. Faunal remains of over 25 species were recovered, along with shellfish remains.

Overall, it is clear, based on the descriptions of the artifacts by Galdikas-Brindamour (1970), that artifacts from different time periods at the site have been mixed together. For example, as described previously in this chapter, *comales* are diagnostic artifacts for the Mission period, although the radiocarbon dates for the site suggested an earlier time period. Details on other diagnostic artifact types, such as shell beads, would be helpful to further determine specific time periods during which the site was occupied for different site components.

LAN-254 (Dayton Canyon Site)

The Dayton Canyon site, LAN-254, is located in Dayton Canyon, in the foothills of the Simi Hills, in the western San Fernando Valley, near the border between Los Angeles and Ventura County. The site was tested and underwent data recovery by RMW Paleo Associates in the early 2000s. SWCA Environmental Consultants (SWCA), which acquired RMW Paleo Associates in 2001, continued work at the site. Data recovery at the site consisted of geophysical survey methods, manual archaeological excavation, and subsequent monitoring of the controlled demolition of the site (SWCA 2008). The site was located near the traditional cultural boundary between the Chumash and the Gabrielino/Tongva.

The Dayton Canyon site consists of a prehistoric residential base that was repeatedly occupied between the Millingstone and Intermediate periods. Radiocarbon dates for the site have spanned from roughly 3360 cal B.C. to cal A.D. 350, with no discernable hiatus in site occupation. Excavations of the site have produced evidence of a significant residential locus, a large prehistoric Native Californian burial area, and a separate midden area. The majority of the cultural features identified have consisted of fire-affected-rock piles within a dense midden. The 120 thermal rock features discovered at the site represented a number of different aboriginal daily activities associated with cooking, food preparation, and food production. The range of artifacts include milling-stone implements, flaked stone tools and debitage, battered stone, vertebrate- and invertebrate-faunal remains, bone tools, and funerary items. Human remains from 33 individuals were recovered from 39 features and 2 point-provenienced collections. Although the majority of the features containing human remains were either complete or partial burial features, isolated human remains have also been identified in several features.

The burial area at the Dayton Canyon site is important, partly because it offers one of the largest burial data sets for the San Fernando Valley area. That said, the poor preservation of many of the burials and the extensive bioturbation by rodent burrowing and plant roots have offered significant challenges to analysis. For example, the demographic profile of the burial population was impeded by the fragmentary nature of diagnostic skeletal features. Of the 33 identified individuals, 29 were adults, 1 was either a subadult or a young adult, and 2 were adolescents; sex could only be estimated for 8 adults. Possibly because of the condition of preservation, skeletal lesions associated with infectious disease, traumatic injury, or osteoarthritis were not identified. In total, 119 teeth from 19 features provided perhaps the best overall assessment of health of the skeletal population. Enamel hypoplasia, which generally indicates poor nutrition or disease in childhood, was identified in 2 individuals. For the 2 individuals for which dental attrition could be measured, there was a high degree of wear, suggesting an abrasive. Dental caries were also identified, suggesting a diet high in carbohydrates. Additionally, the stature of the skeletal population from the Dayton Canyon site was more diminutive than that of many other early Santa Barbara Channel populations, suggesting nutritional deficiencies or separate genetic affinities of the coast and inland groups, because other San Fernando Valley skeletal populations have also exhibited smaller stature.

Again, because of the fragmentary nature of the remains, many mortuary practices could not be observed. Burial position, for example, could only be determined for 14 burials. Of those with identified burial positions, all but 1 were flexed. Most of the flexed burials were resting on their right sides, and the rest were on their left sides or were indeterminate. Orientation appeared to be random, although the majority were facing northwest. Interestingly, there was no evidence of cremation at the Dayton Canyon site, although cremation was a generally common practice across southern California during the Intermediate period. Stable-isotope ratios of nitrogen and carbon in bone collagen were used as relative indicators of the dietary importance of marine vs. terrestrial resources for the Dayton Canyon population. Results from the site were sparse, because data from only one feature (Feature 131) had useful isotopic data. That individual, a female, did not consume succulent plants or animals that fed on C_4 grasses or succulents, but rather, this individual's terrestrial diet was based on C_3 plants or animals that fed on C_3 plants.

In addition to isotope data, the mortuary behavior presented in Feature 131 was unique, because it was both (1) the only burial not identified as flexed and (2) one of two burials containing burial goods indicative of a special or important social status within the prehistoric community. Finally, mitochondrial-DNA analysis was conducted on 47 dental and bone samples representing 17 individuals from the Dayton Canyon skeletal population. Of the samples submitted, DNA was successfully extracted from 16 samples representing 13 individuals. Only 7 individuals were assigned to specific haplogroups: 2 assigned to Haplogroup A, 3 assigned to

Haplogroup B, 1 assigned to Haplogroup C, and 1 assigned to Haplogroup X. None was assigned to Haplogroup D. As discussed by SWCA, the presence of Haplogroup A generally suggested that the prehistoric population at Dayton Canyon had some affinity with the Chumash, although Haplogroup A is not exclusively connected with the Chumash (John Johnson, personal communication 2012). Haplogroup B is generally associated with northern Uto-Aztecan populations, whereas Haplogroup C is found in both Chumash and northern Uto-Aztecan populations.

All told, the Dayton Canyon skeletal population revealed important information on the prehistory of the San Fernando Valley and had implications for Chumash and Gabrielino/Tongva cultural interaction. Although the preservation of skeletal remains was poor, the SWCA researchers and their colleagues were able to extract interesting information about particular individuals and groups, using varied data and analyses.

LAN-264 (Humaliwo or Malibu Site)

The Humaliwo, or Malibu, site, LAN-264, was located on the east bank of Malibu Creek, bordering Malibu Lagoon, along the northern boundary of Santa Monica Bay. It consists of a prehistoric and historical-period burial area, as well as a domestic area (Martz 1984:226). Like the villages of Simo'mo and Medea Creek, the occupants of Humaliwo spoke the Ventureño language (Martz 1984:226). Although the site is within a few kilometers of the southwestern cultural boundary between the Chumash and the Uto-Aztecan-speaking Gabrielino/Tongva, it is considered a major Chumash village, according to ethnographic and historical accounts (Martz 1984:226). Although the site was first recorded in 1959 by R. S. Watson, the first scientific excavations were not conducted until 1964. The prehistoric burial area was excavated by the UCLA Archaeological Survey and a number of UCLA field classes between 1971 and 1974 (Gamble 1995:1; Martz 1984:228). Disturbances to the site have included construction of the Pacific Coast Highway, water lines, and brick walls, as well as the Chumash practice of disturbing earlier burials when interring later individuals (Martz 1984:227, 228).

The dating of the artifacts and samples recovered from the site indicated a long history at LAN-264. Based on radiocarbon dating, the site was occupied between 5000 B.C. and A.D. 1000 (Martz 1984:228). Furthermore, obsidian-hydration testing of samples from the prehistoric burial area and domestic deposits indicated that the site was used between A.D. 740 and 1000 (during the late Intermediate period) for the prehistoric burial area and between A.D. 564 and 718 (during the Intermediate period) for the "living area" in the domestic area (Meighan 1978:159, 161 [as cited in Martz 1984:228]). Radiocarbon dates obtained for the prehistoric burial area provided a time of use during the ninth century A.D. Taken together, these data suggest that the prehistoric burial area was used primarily in the late Intermediate period. Historical-period artifacts and shell-bead types indicated that the historical-period burial area was in use during the Mission period, between 1785 and 1820, although baptismal records indicated that the burial area was used very little after 1805 (Bickford 1983:63, 69; Gibson 1975:110–118; King 1974:90–91, 1990a:323 [as cited in Martz 1984:228]). Johnson (1999) has argued, however, that according to Mission San Fernando Rey records, baptisms of individuals from Humaliwo continued as late as 1816, suggesting that perhaps the burial area was used after 1805.

The Middle period (Intermediate period in the Ballona region to the south) burial area at Humaliwo came into use after the burial area at Simo'mo had been abandoned. It continued to be used for 200–300 years and was abandoned 500 years before contact with the Spanish (Martz 1984:230, 290). Black sandy midden was present within the area of the Intermediate period burial area, which was located in the southwestern portion of the site (Martz 1984:228). Approximately 114 burials and 514 associated artifacts were recovered from the Intermediate period burial area, although Martz noted that "0–100 beads of a single type and chipping waste of a single material were counted as one artifact" (Martz 1984:229). Of the burials recovered, 89 percent (n = 68) were primary interments, and 2 were cremations. Both of the cremations were reburials, having been burned elsewhere and then buried within the burial area (Martz 1984:239). As was the case with Simo'mo and Medea Creek, a majority (83 percent; n = 43) of the burials were oriented toward the west (Martz 1984:239). Furthermore, although there were no extended burials in the Intermediate period burial area, the majority of burials were in a tightly flexed position, and 75 percent of the individuals identified as children were in a semiflexed position (Martz 1984:239, 276). Martz (1984) did not suggest a particular reason for the difference in flexure between adults and children.

There was also a noticeable difference between sites in the positions of burials. Martz noted that 61 percent of burials at Trancas Canyon were in a dorsal position, compared to 11 percent for Simo'mo and none for prehistoric Humaliwo. Furthermore, 89 percent of the burials at Simo'mo were in a ventral position, compared to 51 percent at the Intermediate period burial area at Humaliwo, and 49 percent of the burials were placed on their sides (Martz 1984:297). Martz (1984) also noted the progression from extended burials at Trancas Canyon to semiflexed burials at Simo'mo to primarily flexed burials at the Intermediate period burial area at Humaliwo.

Age could be determined for 109 of the 114 burials identified within the Intermediate period burial area. The majority, 62 individuals, were identified as adults, of which sex could be determined for 37, resulting in the identification of 54 percent as male and 46 percent as female; the rest of the population were identified as 5 "adolescent," 26 children, and 16 infants (Martz 1984:240, 269). Two burial features were double burials and each contained both a male and a female (Martz 1984:277). When compared to other sites, such as

Simo'mo and Medea Creek, which had low representations of subadults within the burial areas, the Intermediate period burial area at Humaliwo had what Martz considered a predictable number of younger individuals. She provided three possible explanations for that pattern: (1) better preservation and improved excavation techniques, (2) a higher mortality rate in the subadult group, and (3) a comparable mortality rate but different cultural practices in regard to burying subadults and adults (Martz 1984:297).

There was evidence of trauma identified in two burials from the Intermediate period burial area, an adult male and a child. The adult male had suffered a wound to the upper spine caused by a spear or knife, and the child showed evidence of a possible fracture to the skull (Martz 1984:287). There were five burials that were recovered with red ocher in association with the individuals, and only one of them was suggested to have been painted with the red ocher, a practice that appeared to have been more common at Trancas Canyon and Simo'mo (Martz 1984:240). Martz did note in her review of the Humaliwo Intermediate period burial area that the sparse representation of burials painted with red ocher may have been more attributable to poor recording and documentation by students of the field school than to the absence of that practice (Martz 1984:240).

Martz (1984:291) noted that overall, when the Intermediate period burial area at Humaliwo was compared to Simo'mo, there was a decrease in the variety and number of artifacts and grave features and a decrease in elaboration, both artistically and technologically. Material sources included steatite from Catalina Island and obsidian from Coso and Casa Diablo (Leonard 1971:126; Martz 1984:292; Meighan 1978:159 [as cited in Martz 1984:290–291]). King (1996:14) noted that schist material from the Sierra Pelona schist formation, serpentine from the Franciscan formation, burned shale from the Oak Ridge formation, and fluorite that likely had been collected from Catalina Island were also recovered. Steatite that was found at the site was very similar to the type found on Catalina Island (Gamble et al. 1996:12). Macrobotanical remains included redwood that could have been used for canoe construction (Gamble et al. 1996:13). The amount of faunal material collected from Humaliwo was quite large, and Gamble (1995:17) noted that the collection was in a state of excellent preservation; it included fish, large and small terrestrial mammals, marine mammals, and birds. According to Martz (1984:290), the assemblage from the prehistoric burial area indicated that the occupants had a focus on "marine resources and trade with other ecological zones, including Catalina."

Features identified within the Intermediate period burial area included rock cairns, some of which incorporated broken mortar fragments placed over parts of the body (Martz 1984:240, 248). Artifacts were associated with 68 percent of the burials in the Intermediate period burial area (Martz 1984:241). They included, but were not limited to, debitage, including obsidian; at least 12 cores; 3 abalone pendants; "money bead necklaces"; stone effigies; "very large" harpoon barbs; ear spools; and labrettes (Gamble 1995:17; King 1996:16; Martz 1984:292; Walker et al. 1996:111–122). The ear spools and labrettes were indicative of trade with the Colorado River and central California regions (Gamble 1995:17). At minimum, 62 effigies were identified, mostly in association with female burials (Gamble et al. 1996:11, 12, 13). Most of the effigies represented fish or probable fish; a whale effigy and 2 pelican stone effigies were also represented (Gamble et al. 1996:11). The effigies were made from a variety of materials, including siltstone, steatite (including talc schist and chlorite schist), and sandstone; 43 had been painted with red ocher (Gamble et al. 1996:12). Faunal bone and shells were also recovered from the Intermediate period burial area (Walker et al. 1996:111–122).

King's (1996:3) analysis of beads from the Intermediate period burial area indicated the presence of stone and bone beads, shell beads of *Olivella biplicata* and mussel, and ornaments of giant keyhole limpet (*Megathura crenulata*) and abalone. Olivella wall beads were the most common shell-bead type present at the prehistoric burial area, and mussel disk beads were the second-most-common type (King 1996). *Olivella dama* beads with the spires and bases ground off and barrel-shaped profiles were also recovered and may be indicative of increased trade (King 1996:12). King (1996:14) noted that the majority of stone beads recovered from the Intermediate period burials were made from talc schists, chlorite, or burned shale, all of which are softer than the shell material. Beads made from steatite, a green translucent fluorite, and serpentine, a harder material, were also recovered. Some of the green fluorite beads were recovered with shell-bead inserts (King 1996:14). At least one burned bird-bone tube was recovered (from burial Feature 18) (King 1996:14). Two ring ornaments made from *Fissurella volcano* were recovered from burial Feature 48 (King 1996:16).

The Mission period burial area at Humaliwo was at the northeastern end of the site, about 58 m to the north of the Intermediate period burial area. That burial area measured approximately 10 by 10 m, roughly the same size as the main concentration of burials at LAN-62. Malibu Creek empties into an estuary approximately 130 m to the west of the Mission period burial area (Martz 1984:394). The Mission period burial area was first excavated in 1972 by the UCLA Archaeological Survey, including students and community volunteers (Martz 1984:394). Of special note is the fact that crewmembers camped at the site to prevent vandalism (Martz 1984:396). Disturbances in the area of the Mission period burial area were the same as those identified within the Intermediate period burial area. Furthermore, the Chumash practice of using discrete family plots within the burial area, as seen at Medea Creek and Simo'mo, was also observed there. Additionally, Gamble et al. (2001:201) conducted a special analysis of the burial area at Humaliwo and found that the regular spacing of burials, approximately 35 cm from each other, indicated a strong preference for closely packing burials in a defined space, a practice that persisted from the late Middle period throughout the life of the burial area.

Martz (1984:398, 409) noted that 82 percent of the burials had been disturbed in some manner. There did not appear to be any evidence of a historical-period occupation area at the site, however, which Martz (1984:394) suggested may have been because highway and building construction had destroyed portions of the site. Mission records indicated that the first baptisms of neophytes from Humaliwo occurred in 1785 (Martz 1984:398). Martz (1984:398) pointed out that church customs would have prohibited neophytes from being buried within the burial area of the village and that they would instead have been buried in consecrated ground at the missions. Clearly, however, that was not always the case, because mission records documented numerous neophytes who died away from the mission and were buried in native burial areas. Ethnographic records also indicated that sometime around 1801 or 1802, an adobe was built within 1 mile of Humaliwo (Martz 1984:398). The last baptisms from Humaliwo were recorded as having taken place in 1816, after which the burial area may have been abandoned (Martz 1984:398) because of a lack of natives still residing in the area.

Within the Mission period burial area, 59 features and approximately 139 burials were identified. Over 15,000 glass beads, 51 other objects identified as being of European origin, 255 artifacts identified as being of "native manufacture," and over 30,000 shell beads were recovered from these features and burials (Martz 1984:396). Features included artifact caches, asphaltum impressions, and rock features, some of which incorporated whale bone (Martz 1984:394). Overall, the preservation of human remains in the Mission period burial area was poorer than within the Intermediate period burial area. Of the approximately 139 burials, 69 percent were considered primary burials, and the remainder were reburials; there were no cremations or evidence of violent trauma (Martz 1984:398, 452). Burial orientation was difficult to determine because of the poor preservation and disturbances. For those that could be observed, however, the majority (88 percent; n = 28) were buried on their sides; 84 percent (n = 26) were in a tightly flexed position (there were no extended burials), and 55 percent (n = 18) were oriented in a westerly direction (west, southwest, or northwest). These patterns were much like those in other Chumash burial areas (Martz 1984:409).

The overall demography of the population included 100 individuals (74 percent) identified as adults, 5 "adolescents," 20 children, and 11 infants (Martz 1984:436). Sex was estimated for 28 adults, using pelvic traits; 68 percent were identified as male, and 32 percent were identified as female. Based on cranial and postcranial traits, the probable sex of 24 adults was determined; 71 percent were considered probable males, and 29 percent were considered probable females (Martz 1984:410–411; Suchey et al. 1972:50 [as cited in Martz 1984:410–411]). Overall, males outnumbered women by 19 to 9 (Martz 1984:470). Bickford (1982:43) attributed that pattern to assimilation of a greater proportion of women and easier adaptation to the mission system. Women's roles in the mission system were much more similar to their roles in the village. For men, however, the transition to mission life and the shift from hunting and fishing to agriculture and animal husbandry would have been much more difficult. In addition, men's roles in leadership and ceremonial functions would have been greatly diminished. Walker et al. (1996:16) disagreed with those conclusions, stating that their analysis of the remains from the historical-period burial area found no significant difference in the numbers of males and females: 36 males and 34 females were identified from the burials.

There are several important trends associated with the Mission period Humaliwo burial area. As in the case of Trancas Canyon, Simo'mo, and Medea Creek, Martz (1984:428) noted that the data indicated that there was an underrepresentation of subadults. There was a reduced presence of ritual associations when compared to Medea Creek (Martz 1984:457). The number of children that had wealth-associated artifacts was greater, however, apparently following the trend that Martz identified at Late and historical-period sites such as Medea Creek. Martz (1984:461) suggested that this evidence indicated an emphasis on wealth and a "consolidation of the political elite," as was observed at Medea Creek. Martz (1984:461) identified an increasing trend in burials with artifacts, indicating higher political status and wealth; only 1 percent of the burials at Trancas Canyon had indications of "political identities with wealth," compared to 19 percent at Medea Creek, 35 percent at Simo'mo, 40 percent in the Intermediate period burial area at Humaliwo, and 68 percent of the burials in the Mission period burial area at Humaliwo.

Artifacts of note included canoe parts, "killed artifacts," caches, and whale and stone markers (Martz 1984:410). Artifacts that Martz noted as having ritual significance included a whistle, quartz crystals, and a painted stone, all of which were associated with adult burials, of which only one was a female (Martz 1984:412). Eight-four percent of all of the burials were recovered with associated artifacts (Martz 1984:412). Historical-period artifacts recovered during excavations at LAN-264 included over 15,000 glass beads and nearly 50 metal and ceramic artifacts of European origin, consisting of personal effects (e.g., shoe buckles, 1 concho, buttons, and 1 Saint Francis medal), household items (e.g., cups, nails, 1 drawer or chest handle, and ceramic artifacts), weaponry (e.g., 1 sword blade, knives, 1 pistol butt, and flintlock-rifle parts), and equestrian gear (e.g., *higos*, 1 headstall plate, 1 spur heel, and 1 rowel) (Bickford 1982:8–31; Martz 1984:397, 398, 411–412). It is clear that neophytes were buried in the burial area, as were Native Californians who had been incorporated into the rancho economy of the area.

Although European materials and goods were introduced to the Chumash, they maintained continuity with their traditional lifeways. Artifacts were altered and incorporated into traditional tools. For example, Bickford (1982:24) described a "leaf shaped blade made of copper [that] still bears traces of the asphaltum used to glue it to a bone or wood haft." Similarly, a metal spike or nail was found hafted to a deer bone with asphaltum; it might have been used as an awl or a drill (Bickford 1982:30). A pistol butt had also been modified: the tines, which ran up either side of the artifact, were "broken off to approximately half their original length and bent outwards" (Bickford 1982:19). The pistol butt also had traces of asphaltum around and inside a nail or screw hole, indicating that it had been plugged with asphaltum and potentially used as a receptacle (Bickford 1982:21). Furthermore, fetal remains were found inside an apothecary jar, also known as an *albarelo* (Bickford 1982:30). That association is clearly reminiscent of burials in which infants were placed inside some receptacles, such as the infant cremation found inside a flowerpot mortar recovered from LAN-246 (Galdikas-Brindamour 1970:132). King (1982:59) also commented on the occasional use of soapstone pots, mortars, and baskets as containers for small infants and reburials. Finally, a red-ocher-stained Saint Francis medal was recovered from the burial area (Bickford 1982:14).

Bickford (1982:60–61) hypothesized that the types of European artifacts recovered from the burial area suggested the emergence of "new masculine roles as paid hands working for the Spanish ranchers." Furthermore, the association of red ocher with a Christian effigy, as well as the use of an apothecary jar in a mortuary context, clearly demonstrated that, at some level, religious syncretism might have been occurring. Religious syncretism is a merger of religious beliefs that results in a reconciliation of often disparate or contradictory beliefs, a process that has resulted in the conversion of a multitude of cultures and the creation of several new religions throughout time and across the globe (Briggs 1951; Grayson 1992; Nutini 1976; Peel 1968; Watanabe 1990).

A brass pendant was recovered from burial Feature 95, and a pendant "made from a flat piece of green glass, asphaltum and blue glass cane beads" was recovered from burial Feature 157 (King 1996:47). Impressions of fabric were also recovered from the Mission period burial area, and that, in association with the other historical-period artifacts, supported ethnographic information indicating that individuals from villages in the area, working as cowhands, farm laborers, and builders, had been seen "dressed in shoes, sombreros, and blankets" (Englehardt 1927:5 [as cited in Martz 1984:398]). Walker et al. (1996:3) and Gamble et al. (2001:188–189) have noted that ethnographic literature has documented Chumash cultivation of crops and participation in the rancho economy.

Worked-shell artifacts from the Mission period burial area included over 30,000 shell beads, including shell-bead necklaces, some of which had been tinted with red ocher (Martz 1984:410). Bead types included *Olivella biplicata* rough disk, a *Haliotis rufescens* disk, a clam cylinder, a mussel (*Mytilus californianus*) cylinder, a mussel tube, a columella tube, a giant-rock-scallop (*Hinnites multirugosus*) tube, black-serpentine stone beads, and glass cane beads (King 1996:22, 23, 25). *Olivella biplicata* rough disk beads and *Haliotis rufescens* disk beads were the most common types of shell beads (King 1996:23). Some large columella beads were manufactured from *Kelletia kelleti* shells; there were 6 tube beads of *Kelletia kelleti* columella recovered from two Mission period burials (King 1996:30). The clam cylinder, clam tube, and clam disk beads were made from Pismo clam (*Tivela stultorum*) shells (King 1996:33). At least 7 bone-tube beads of rodent long bones were recovered from a single burial, burial Feature 95 (King 1996:35). The numerous glass beads were grouped into three categories by King (1996:35, 36): cane, wire wound, and pressed. Of those, cane beads were the most common, because they were the most economical to produce.

Other artifacts recovered from the Mission period burial area included, but were not limited to, glass trade beads, debitage of obsidian and chert, small bifaces, red stones, cores, large cobbles, and red ocher (Walker et al. 1996:99–110). Asphaltum was also noted within the historical-period burial area at Humaliwo, including plugs and caulking for canoes (Gamble et al. 1996:13). Some of the asphaltum was identified with red ocher on it (Gamble et al. 1996:13). Large and small pieces of canoes were associated with at least three burials, all of which also had significant numbers of beads (Gamble et al. 1996:14). One of those burials (burial Feature 56) was of particular note, consisting of a male of approximately 19 years of age who was referred to as "canoe man," because he was buried with a large portion of a plank canoe, caulking, canoe plugs, and pieces of redwood (Gamble et al. 1996:14).

Changes in health and disease were observed between the Intermediate and Mission period burials. Walker et al. (1996) indicated that there was an overall reduction in body size, more so for males than females. Little change was observed in cranial size between the two burial-area populations, however (Walker et al. 1996:16, 17). Four individuals from the Intermediate period and two from the Mission period exhibited cribra orbitalia, a disease associated with iron deficiency (Walker et al. 1996:23). Periosteal lesions, which can be caused by any number of factors, including trauma and infection, were observed on many of the skeletons at Humaliwo; however, actual rates for these lesions were difficult to develop because of the problems associated with poor preservation and significant disturbances (Walker et al. 1996:24). Despite the problems encountered, Walker et al. (1996:24) were able to determine that a number of the cases of periosteal lesions were representative of systemic infections. Intermediate period periosteal lesions were encountered on multiple limb bones, whereas the Mission period evidenced those lesions "almost exclusively on the tibia." Furthermore, the frequency of periosteal lesions was higher among the Intermediate period population. Walker et al. (1996:38) noted that frequencies of that disease may actually have been higher, but individuals afflicted with it died before the lesions developed on the bone.

Arthritis was also observed in both populations; instances involved the knees much more commonly during the Intermediate period, and males were affected more often than females. By contrast, during the Mission period, males and females appear to have been affected equally (Walker et al. 1996:29).

Evidence of trauma was observed on the skeletal remains of both populations buried at Humaliwo. Walker et al. (1996:25, 27) found that it was rare to find fractures in the Mission period burials, whereas they were quite common in the Intermediate period burials—19 cranial fractures were observed in 13 individuals from the Intermediate period burial area. It is also noteworthy to mention that men were more likely to have cranial injuries and injuries to the hands or feet, as well as cases of multiple fractures. By contrast, women were more likely to suffer fractures to the ribs or bones of the arm (Walker et al. 1996:27). The reduction in cranial injuries was attributed to changes in warfare resulting from the introduction of the bow and arrow during the late Intermediate period (Lambert 1994 [as cited in Walker et al. 1996:39]).

When comparing the Intermediate and Mission period burials, it was also observed that the former suffered antemortem tooth loss at a rate that was four times higher than that of the latter and that there was also a general reduction in tooth size over time (Walker et al. 1996:17, 18). Also of note regarding teeth was a general increase in the amount of anterior tooth wear in women over time from the Intermediate period through the Mission period (Walker et al. 1996:21). Anterior tooth wear is relevant in regard to the use of teeth as tools, such as in basketmaking and net making (Walker et al. 1996:21).

LAN-407 (Porter Ranch Site)

The Porter Ranch site, LAN-407, is located in the San Fernando Valley, about 4 km north of Mission San Fernando Rey and just outside the northwestern corner of the city of San Fernando. First excavated in 1936 by Edwin Francis Walker, it is a ceremonial site dating to the Millingstone period, based on artifact typology. Disarticulated human remains were identified at the site, along with a number of artifacts (Walker 1951). Ground stone artifacts recovered from the site included 67 complete metates, 105 metate fragments, 23 "killed" metates, 7 manos, 1 mortar, 2 stone bowls, 1 discoidal, 1 possible whale effigy made of yellow shale, and 1 paint-grinding slab. Flaked stone artifacts included 1 chalcedony knife and 2 dart points. No debitage was noted. Other lithic artifacts included "several boulders with red paint" (Walker 1951), one of which was painted with geometrical designs. Two blocks of diatomaceous earth, 2 abrading stones, and 149 unworked boulders were also recovered. Artifacts of note included 1 pecked elliptical boulder, 1 block with a shallow depression, and 1 columnar boulder with a battered end. Many of the metates had been placed upside-down, and some manos were fire affected. The co-occurrence of disarticulated human remains and a large number of broken ground stones (including purposefully broken, or "killed," artifacts), suggests that this site may have functioned in a similar fashion to other features believed to be early examples of the Mourning Ceremony.

LAN-1575/H (Yaanga)

LAN-1575/H (Yaanga) is located near Union Station in downtown Los Angeles and east of the historic El Pueblo de Los Angeles (Goldberg 1999:1–2). The site was discovered during the archaeological monitoring and excavations associated with the Los Angeles Metro Red Line project in 1987 and 1989 (Goldberg 1999). LAN-1575/H is a Native Californian burial area that, because of its location and site chronology, might be associated with Yaanga, an ethnohistoric Gabrielino/Tongva village located on the west bank of the Los Angeles River that was visited by the Portolá expedition in August of 1769. Its precise location, however, is currently a matter of debate (Goldberg 1999:28, 31). The burials at LAN-1575/H appeared to date between the Late and Mission periods.

In total, 14 primary inhumations, 3 cremations, 2 possible cremations, and 2 clusters of scattered human remains were recovered from the site (Goldberg 1999:Table 4.1). In terms of demography, all ages, except between 13 and 20 years of age, were represented by these burials; the sexes were found to be relatively evenly represented, with 4 males and 5 females (Goldberg 1999:Tables 5.5 and 5.6).

When possible, the dentition of the individuals recovered during the excavations at LAN-1575/H was analyzed. Nine of the burials had sufficient dentition to make observations concerning enamel hypoplastic defects, and of these, only two exhibited any evidence of that stress indicator (Goldberg 1999:Table 5.7). Although no sweeping observations can be made based on the small sample, these hypoplastic events possibly occurred during early childhood. For one individual, these events occurred twice, once between 3 and 3.25 years of age and a second time between 4.25 and 4.5 years (Goldberg 1999:Table 5.7). Furthermore, dental attrition was extensive, and the average wear scores for females were consistently higher than the scores for males. A *t*-test comparing mandibular-tooth wear for males and females found that they had statistically significant different amounts of dental wear associated with the first molar ($p = .019$) (Goldberg 1999:129). However, a comparison of the caries index for the population (3.55 percent) to the caries indexes of hunting-and-gathering economies (0.0–5.3 percent), mixed economies (0.44–10.3 percent), and agricultural economies (2.3–26.9 percent) established by Turner (1979:622, Table 3) proved ambiguous (Goldberg 1999:133).

The majority of the observed skeletal pathological conditions at LAN-1575/H were related to skeletal degeneration (e.g., osteophytosis and osteoarthritis). On average, degenerative changes, in this instance osteophytosis, progressed from least severe expressions in the cervical spine to most severe in the lumbar spine. Only a single individual (Feature 6) exhibited definitive osteoarthritis in the cervical spine (i.e., eburnation of the first and second cervical vertebrae) (Goldberg 1999:134, Table 5.12). Two individuals displayed pathological fusion of several skeletal elements—fused fourth and fifth lumbar vertebrae as well as fusion of the right sacroiliac joint (Feature 6) and fusion of the left sacroiliac joint (Feature 14) (Adams 1999:281, 287; Goldberg 1999:5.12). Such symptoms are suggestive of more-severe progressive spondyloarthropathies, such as diffuse idiopathic skeletal hyperostosis (DISH) or ankylosing spondylitis (Rogers and Waldron 1995) (see also Chapter 7, this volume). Feature 6 also exhibited a small periosteal reaction on the shaft of the left fibula (Adams 1999:281).

Additionally, a small-group-affiliation analysis was conducted. The four complete crania recovered during excavations at LAN-1575/H were compared to remains from the prehistoric and historical-period components of the Humaliwo site (LAN-264) and Gifford's data from Santa Catalina Island and San Clemente Island. That analysis (Goldberg 1999:136–138) revealed that the individuals from the Humaliwo site (average cranial index = 8.74, mesocranic) and those from LAN-1575/H (average cranial index = 68.81, dolichocranic) were distinct from one another, whereas the cranial indexes associated with LAN-1575/H were similar to those associated with Santa Catalina Island (average cranial index = 71.48, dolichocranic) and San Clemente Island (average cranial index = 74.47, dolichocranic) (see Gifford 1926). A *t*-test comparing the maximum cranial length of the LAN-1575/H and Humaliwo populations was statistically significant (p = .022). These results suggested that the LAN-1575/H crania were more similar to Gifford's Western Mono cranium type—the cranial type associated with Santa Catalina Island and later San Clemente Island populations, as well as the Gabrielino/Tongva—than to those of the Chumash, who were associated with the Humaliwo site and fall within Gifford's California physical type.

Interestingly, comparison of other metrical data revealed no other statistically significant differences, indicating that with the exception of cranium shape, the population from LAN-1575/H was phenotypically very similar to the prehistoric and historical-period populations at Humaliwo (Goldberg 1999:Tables 5.16 and 5.17, 155). Although the sample size was small, stature analysis of the remains from LAN-1575/H revealed that the average stature of the LAN-1575/H population (163 cm) was more similar to the stature associated with Gifford's Western Mono physical type (165 cm) but exhibited some overlap with the range associated with the California physical type (161–172 cm) (Goldberg 1999:143).

Mortuary analysis of the burials from LAN-1575/H revealed several general trends. First, using Warren and Maples' (1997) regression formula (for details, see Goldberg [1999]) to estimate total cremation weight from stature and sex, one of the cremations from LAN-1575/H (Feature 11) was found to contain only about one-quarter of the estimated total amount of remains for an adult individual of that height and sex (Goldberg 1999:145–146). That information, coupled with the lack of thermally altered sediment and small pit size associated with other cremations at the site, indicated that these cremations were likely secondary deposits (Goldberg 1999:146). Additionally, all inhumations were flexed, and they were primarily placed on the left side and oriented to northerly directions (Table 3) (Adams 1999). The inhumations, however, were facing in a multitude of different directions, and no single direction appeared to be favored over any other (see Table 3) (Adams 1999). Finally, the burial area was spread over a wide area and, as a result, only two burials (Features 20 and 22) impacted one another.

Table 3. Summary of Orientation, Direction of Head Facing, Treatment, and Position for the Burials Recovered from LAN-1575/H

Feature No.	Orientation	Direction of Head Facing	Treatment	Position
1	northwest	north	probable flexed	left side
2	n/a	n/a	n/a	n/a
3	north/northeast?	east?	probable flexed	left side
5	north	east	flexed	left side
6	northeast	southeast	flexed	left side
7	south	west?	flexed	left side
9	n/a	n/a	n/a	n/a
11	n/a	n/a	n/a	n/a
12	n/a	n/a	n/a	n/a
13	south/southwest	down/southeast	flexed	right side
14	north	west/southwest	flexed	right side
15	n/a	n/a	n/a	n/a
16	northeast?	indeterminate	n/a	supine?
17	northwest	north/northeast	flexed	left side
19	north/northwest	down/southwest	flexed	right side
20	south	down/northwest	flexed	left side
21	unknown	unknown	unknown	unknown
22	southeast	south/southwest	flexed	left side
23	unknown	unknown	unknown	unknown

Key: n/a = not applicable.

Only 3 of the 14 inhumations had associated artifacts. These consisted of 3 bone pins (Feature 6), 1 Cottonwood projectile point and 1 piece of red ocher (Feature 7), and 2 olivella full-lipped shell beads (Feature 17) (Denardo 1999:Table F.19; Goldberg 1999:73,149). Conversely, all 3 cremations had associated artifacts (e.g., beads, steatite bowls, basketry, worked bone, and red ocher). Feature 2, the burial of a child, had the greatest quantity of artifacts associated with a burial at LAN-1575/H (Goldberg 1999:149, Table 5.2). The feature contained approximately 215 shell beads, including olivella cupped, olivella wall disk, olivella full-lipped, olivella spire-lopped, and abalone disk; approximately 5 stone beads composed of talc schist, jadeite, and chlorite schist; 2 bone awls; and red ocher (Denardo 1999:238; Goldberg 1999:Table 5.2). The olivella cupped disk beads (approximately 170) were the most numerous in the burial, and all but 5 of them had been burned (Denardo 1999:238). Many of them also had either right- or left-facing, oblique, parallel lines; V-shaped markings; or X-shaped designs incised along the bead edges (Wyss 1999:238).

Various absolute- and relative-dating methods were used to establish site chronology. Overall, radiocarbon dating indicated that LAN-1575/H was in use between A.D. 950 and 1800 (Goldberg 1999:120). Different temporal groups of burials, however, were established via radiocarbon dating. Goldberg (1999:120–122) indicated that five separate primary interments were radiometrically dated to between the Late and Mission periods, whereas the ages of two cremations both dated to the Mission period. Either there were two gaps in the use of the burial area—one between A.D. 1130 and 1630 (during the Late and Protohistoric periods) and a second between A.D. 1700 and 1810 (during the Protohistoric through Mission periods)—or the burial area was used on a fairly continuous basis, but the site-use area gradually moved from the northern portion of the site to the southern portion (Goldberg 1999:122).

Finally, a number of artifacts unassociated with burials were recovered from the site. The ground stone artifacts included 1 pestle half, 1 ground stone fragment, 1 bowl-mortar fragment, and stone beads. The flaked stone artifacts included 1 flaked-tool tip, 7 projectile points (6 Cottonwood and 1 indeterminate type), and nearly 70 debitage flakes. Other lithic artifacts included 1 metate fragment reused as a hammerstone, red and yellow ocher, 1 stone pipe fragment, 1 flat pebble, and fire-affected rock. Worked-shell artifacts included 2 fragments of shell-bead detritus; 1 scallop pendant; 5 modified abalone fragments; 1 modified clam fragment; and a variety of olivella-, California mussel–, and abalone-shell beads. Three sherds of Tizon brown ware were also recovered, which is consistent with a Protohistoric through Mission period occupation. Asphaltum was noted on beads, and its application was apparently used to help provide definition to the incised grooves used as decoration on some of the beads.

SBA-1 (Rincon Point)

The Rincon Point site, SBA-1, was located approximately 5 km south of Carpentaria. The site was first excavated from 1966 to 1967 by Edward Gary Stickel. It was considered to be a burial area and, based on radiocarbon dates obtained from shell, was in use in ca. 1735 B.C. (that is, during the late Millingstone period in the Ballona chronology). A minimum of 43 burials, 5 of which were double interments, were identified at the site (Stickel 1968). The presence of midden was noted, and a small number of artifacts were recovered from the site. An asphaltum-plugged abalone shell was found with Feature H. The ground stone artifacts consisted of 1 pestle, 1 metate, and 2 sandstone vessels (1 of which had been burned) from Feature F and 3 pestles and 16 manos from Feature G. The flaked stone artifacts included 3 blades from Feature A and 1 blade from Feature G. No projectile points or debitage was noted. Other lithic artifacts included ocher from Feature H; in fact, all of the shell artifacts from Feature H were covered in ocher. The recovered worked-bone artifacts included 1 fragment of worked bone associated with Feature H. Also of note was one whale scapula with 3 blades and 5 other whale-bone features (Stickel 1968).

SBA-520 (La Purisima Mission Cemetery)

La Purisima Mission Cemetery, SBA-520, was located within the city limits of Lompoc. After the secularization of the mission in 1834, the cemetery was abandoned, and its location was forgotten until the early quarter of the twentieth century, when the State of California acquired the land and constructed a schoolhouse (Humphrey 1965:184). Students attending the school unearthed several human-skeletal elements, and in 1940, when the State of California acquired the land adjacent to the schoolhouse, H. R. Harrington, consulting archaeologist, was hired to investigate the earlier reports of skeletal finds (Humphrey 1965:184). During the course of his investigations, which consisted of excavating a series of trenches, Harrington discovered 17 burials oriented in a similar direction. Harrington concluded that the burials were part of the cemetery associated with the mission. The individuals were reburied with white crosses marking their locations, and a row of stones delineated the boundary of the cemetery (Humphrey 1965:184).

Between 1940 and 1951, the cemetery was lost once more, because the stones and crosses had been moved several times by landscapers (Humphrey 1965:184). In 1951, Norman E. Gabel excavated an exploratory trench to rediscover the boundary of the cemetery. By the 1960s, however, many of the crosses were missing (Humphrey 1965:184).

In 1962, a field school associated with UCSB was conducted on the mission grounds. In addition to surveying the mission grounds to locate the remains of structures, part of the field school was tasked with finding the "lost" cemetery (Humphrey 1965:185). It wasn't until 1963, however, that Harrington's and Gabel's work came to light. In 1964, the cemetery was once again the focus of archaeological inquiry by James Deetz and Richard Humphrey, both from UCSB.

Although Humphrey (1965) did not indicate in his report the exact number of individuals uncovered, a figure in his report suggested that at minimum, 34 burials and 27 isolated or disturbed burials were discovered during the 1964 excavations (Humphrey 1965:Figure 3). The poorly preserved and fragmentary skeletal remains associated with the site were interred extended in a supine position, with their arms crossed over their abdomens or chests, and were oriented in a west-northwest direction (Humphrey 1965:189). Humphrey (1965:190) indicated that the uniformity of orientation was probably significant, although the reason for the significance remains unclear. It may be that the orientation was toward a structure that no longer exists (e.g., the church) or toward the El Camino Real. Mortuary accompaniments were all but absent, suggesting that the vast majority of individuals buried in this cemetery had been interred in shrouds. Only burial Feature 2 had any appreciable number of artifacts; approximately 120 glass beads were recovered from the head and neck regions, and 1 shell and 1 brass button were recovered from the thoracic region (Humphrey 1965:190). That burial and burial Feature 14 were oriented to the southwest. That difference in orientation and the presence of artifacts in burial Feature 2 suggested that these individuals had been buried after the majority of the individuals at the cemetery had been interred. Burial Features 36 and 38 exhibited evidence of Mission period disturbance and reburial.

Further research at the La Purisima Mission Cemetery has been conducted by Walker et al. (1988) on mission records related to the deaths of neophytes and a collection of burials from the cemetery. Death records from Mission La Purisima indicated that the mission cemetery had been used between 1813 and 1849. Previous excavations, described above, unfortunately uncovered poorly preserved human remains; as a result, age and sex determinations for the remains were difficult. It was only possible for Walker et al. (1988) to assign burials to the following age brackets: <18, 18–24, 25–45, and >45 years old. In contrast, mission records recorded the approximate ages at death of neophytes buried in the cemetery. Analysis of the two data sets produced similar sex ratios, although comparison of age distributions using the same data sets revealed discrepancies that were highly significant. The age distribution in mission records suggested that approximately one-third of the burial population ought to have been under 18 years old at death, whereas the skeletal collection indicated that only 6 percent were in that age bracket. Further analysis revealed that the skeletons of juveniles and elderly individuals were less well preserved, which offered insight into why so few young individuals were identified in the burial population.

VEN-11 (Muwu or Wihachet)

The early-historical-period village of Muwu, VEN-11, was located northwest of the Pacific Coast Highway, approximately 2 km northwest of Point Mugu (Gamble 1995:2). Muwu was a Chumash village that was still occupied during the period of European contact (Martz 1984:299). The site was first explored in the 1920s by John P. Harrington and David B. Rogers. The first excavations, which took place in 1929 and 1933, were conducted by Arthur Woodward and C. Van Bergen, both from the Los Angeles County Museum of Natural History (Gamble 1995:3). Numerous follow-up excavations were conducted through the 1990s. Based on artifact typology, the site was occupied from the Late period to the time of European contact, between the 1500s and 1800s (Gamble 1995:21).

The site was described as a dark and greasy shell midden (Gamble 1995:2, 3). Significant amounts of faunal materials, including the remains of terrestrial and marine mammals, fish, and shell, were recorded at the site (Gamble 1995:2). Disturbances to the site included road construction, because the highway cut through the southern portion of the site, as well as bulldozing and looting (Gamble 1995). Burials were noted at the site. Martz (1984:299) suggested that subadults had been buried with less formality at Muwu than in the prehistoric burial areas at Humaliwo, Simo'mo, or Medea Creek. Some children had been buried "beneath the floor of a house" (Van Valkenburgh 1935 [as cited in Martz 1984:299]).

There have been at least six loci identified at the site. The recorded features included at least 10 pit houses and 1 sweat lodge (Gamble 1995:3). Asphaltum use was noted as found in the shapes of possible containers that showed evidence of basketry impressions. The recovered ground stone artifacts included steatite bowl or olla fragments and *comal* fragments (Gamble 1995:20). The recovered flaked stone artifacts included knives and projectile points (Gamble 1995:3, 17). Over 340 steatite "artifacts and fragments," including shaft straighteners and beads, were also recovered (Gamble 1995:20). The recovered worked-shell artifacts included at least one olivella disk bead, two olivella cupped beads, at least one olivella rough disk bead, and at least one *Haliotis rufescens* bead (Gamble 1995:3, 17). The recovered worked-bone artifacts included over 1,000 bone artifacts recorded by Woodward, including needles, flutes, and beads; wedges; over 150 flakes; and over 600 awls, of which over 200 were manufactured from bird bone and over 200 were manufactured from deer bone (Gamble 1995:20). Gamble (1995:19) noted that many of the artifacts from early collections could not be located at the time she was writing, although those collections are known to have included fishhooks, fish-vertebrae ornaments, and ceramic artifacts.

VEN-26 (Simo'mo)

This site was located west of the Santa Monica Mountains, near Point Mugu. At the time of its occupation, it would have been located along the edge of Mugu Lagoon, which is now located approximately 3 km away from the site because of flood-control construction. The site was first excavated in 1932 by the Los Angeles County Museum of Natural History, and the work was supervised by Richard Van Valkenburgh. The UCLA field class also conducted work at the site in 1955, and UCLA and San Fernando Valley College worked at the site in 1958 and 1959.

Based on artifact typology, the site was occupied during the late Intermediate period, between A.D. 300 and 700, and the burial area was in use around A.D. 700 (Martz 1984:154; Raab 1994:42). Radiocarbon dates obtained from shell placed occupation during the "3rd and 13th centuries A.D." (Martz 1984:151). That time frame has the site of Simo'mo predating the Calleguas Creek site (VEN-110), which Raab suggested may point to a continuation and development of mortuary practices started at Simo'mo and continuing to the Calleguas Creek site (Raab 1994:42). It is possible that Simo'mo and Calleguas were contemporary, which could also explain the similarities between the two sites (Raab 1994:42), but unfortunately, because of the lack of more-accurate dating techniques at the time the Simo'mo site was excavated, this relationship is unknown. Ethnographic accounts regard Simo'mo as "the largest and most important village in the region," but that may have been precontact, because there are no historical-period artifacts at the site, and it appears that it was abandoned in ca. A.D. 1250 (Martz 1984:154, 155). Martz cited Van Valkenburgh as suggesting that the population relocated toward Muwu as the lagoon began to recede (Martz 1984:156).

The site included a burial area and a dense shell midden (Martz 1984:146, 156). At minimum, 152 individuals, 6 features, and 653 associated artifacts (strings of beads were counted as single artifacts) were recovered from or identified at the site (Martz 1984:150). There were no cremations noted (Martz 1984:212). The 1955 excavations recovered 2 individuals, and the 1958–1959 field classes identified an additional 47 individuals; additional burials were stolen by vandals (Martz 1984:152–153). Two of the features appeared to represent the proto–Mourning Ceremony (Martz 1984:150). One consisted of a large collection of large cobbles, sandstone slabs, "broken beach cobbles," and artifacts that included fragments of mortars, knives, charmstones, fishhooks, beads, and ornaments (Martz 1984:149). The second was described as an offering area and included a collection of burned, broken, and undamaged artifacts; ash; and charcoal (Martz 1984:149; Raab 1994:24–25). Among the artifacts recovered from that feature were drills, awls, ground stone implements, beads, fishhooks, an arrow, a swordfish bill, whistles, basketry, canoe planking, and ornaments (Martz 1984:150).

A third feature was a burial pit lined with fired clay that contained an individual who had been placed in the pit and covered with a wooden mortar (Martz 1984:149; Raab 1994:24–25). The mortar had been burned. The pit was covered in a "layer of whale bone" "capped with a layer of stone," and the rim was partially covered with a sandstone slab (Martz 1984:149). The practice of lining a burial pit in this manner has been associated with burials in the Inezeño territory (Martz 1984:149). Included in the fired burial pit were artifacts, most of which had not been burned, including charmstones, whistles, fishhooks, spear points, slate saws, and beads (Martz 1984:149). One of the whistles was made from a human femur and had been placed in the right hand of the buried individual. The proximal portion of a human femur that had been cut and burned was also recovered from the fired burial pit and may have been the source material for the whistle (Martz 1984:149). The fourth feature identified at Simo'mo was a house floor. Seven reburials, 8 primary burials, and 20 skulls were interred in the floor (Martz 1984:150). Two hearths were also identified in the northern portion of the site during the 1955 excavations, but they were not associated with burials (Martz 1984:151). The burial area also included 2 fetuses that had been "placed in a bed of charcoal and shell" (King 1982:56).

According to Martz, the Simo'mo burial area exhibited the classic practices associated with Chumash burial areas: overcrowding and later burials intruding upon earlier burials (Orr 1943 [as cited in Martz 1984:157]). The demography of the burial area included individuals identified as 114 adults, 8 adolescents, 16 children, and 14 infants (Martz 1984:197). Twenty-three individuals were associated with ritual artifacts. Age could be estimated for 19 individuals (16 adults and 3 adolescents) (Martz 1984:169, 173). Primary interments accounted for 71 percent (n = 89) of the identified burials. The most common orientation (44 percent; n = 33) was to the northwest; 40 percent (n = 28) of the burials were face down, and 56 percent (n = 36) were buried in the ventral position (Martz 1984:166). The majority of the individuals had been buried in a westerly orientation with the individuals facing toward Point Conception, which was considered the "gateway to the west and the land of the dead" (Blackburn 1975:97, 98 [as cited in Martz 1984:207]).

The majority (82 percent; n = 78) of the individuals in the burial area were in a bent or semiflexed position, and most (16 percent; n = 15) of the rest were in a tightly flexed position; 2 individuals were in an extended position (Martz 1984:166). In examining treatment of the body, it was noted that red ocher had been painted on 25 (14 percent) of the individuals, and approximately 51 percent of the burials were recovered with associated artifacts (Martz 1984:167–168). As in the case of the Trancas Canyon burial area, children and infants seem to be underrepresented, and of those that were interred within the burial area, 43 percent had been buried with adults (Martz 1984:196–197). The southern portion of the burial area contained the majority (77 percent; n = 130) of the individuals. Martz (1984:223) suggested that the northern portion of the burial area was reserved for more "elite" members of the group, as evidenced by 57 percent of the northern burials containing "body or grave treatment indicating prestige." A similar spatial distribution of "elite" burials was noted at Calleguas Creek (Raab 1994:40–41). Overall, Raab (1994:40–41) (see below) suggested that the Simo'mo and Calleguas Creek burial areas showed "unmistakable similarities," including burial orientation, body flexure, ocher painting of burials, and ranking segregation.

Macrobotanical remains from the burial area included seeds, charred wood, and canoe planking. No ceramic artifacts were noted; however, there was reference to basketry recovered from one of the features. The recovered ground stone artifacts included fragments of mortars and "ground stone implements" (Martz 1984:150). The flaked stone artifacts included drills and knives, "spear points," and an "arrow" (Martz 1984:149, 150). Other lithic artifacts of note included charmstones, ornaments, and slate saws. The recovered worked-shell artifacts included shell beads, and the worked-bone artifacts included awls, whistles, and fishhooks. Artifacts of note included canoe planking, seven artifacts with bead inlay, and the previously mentioned swordfish bill and whistle made of human bone (Martz 1984:212, 213). The recovered faunal remains included those of mammal and bird as well as fish and shellfish.

VEN-110 (Calleguas Creek Site)

The Calleguas Creek site, VEN-110, is a burial area located near the confluence of the Pacific Ocean and Calleguas Creek, near Point Mugu, in Ventura County. The site was first explored in 1975 by Briuer and McIntyre. Singer and Romani conducted more-extensive work at the site, which they reported in 1980. Additional work was conducted in 1981, when dredging operations exposed midden, artifacts, and human remains. In 1985, Greenwood and Associates tested the site, and subsequently, in 1986, the Northridge Center for Public Archaeology at California State University, Northridge, under L. Mark Raab, conducted a more thorough investigation.

At minimum, 16 burials, which dated to the late Intermediate period, were exposed during the first phase of excavations conducted by Raab (1994). Once human remains had been discovered, controversy over the excavation of the site increased, and work was stopped. During that time, a local paper published an exact map showing the location of the site, including a detailed description (Raab 1994:9). In less than 2 months, the site had been "severely vandalized" and looted, resulting in the loss of significant amounts of cultural materials and scientific information and the desecration of human remains. After the court rejected a lawsuit to stop work at the site, the second phase of work was started. Fieldwork occurred between December 1986 and January 1987. During that phase of work, an additional 122 individuals placed within 96 "discrete burials" were identified, although the number of individuals could only be estimated, because of the damage caused by flooding and looting (Raab 1994:13, 24).

A number of features were documented by investigators at the Calleguas Creek site. Feature 4 was a hearth feature that included evidence of continued use and repeated burning; ash, charcoal, shell, and animal bone were recovered from the feature. Raab (1994:24) suggested that Feature 4 may have been used to make offerings as part of mortuary rites and the Mourning Ceremony. Of the 96 discrete burials, Raab (1994:26) noted that 95 were articulated primary inhumations; 27 were oriented to the southwest, 43 were oriented to the west, and 25 were oriented to the northwest. One individual (burial Feature 58) may have been a reburial or a burial of an individual in an advanced state of decomposition, because the burial consisted of a pile of remains (Raab 1994:33). The majority of the burials (n = 62) were tightly flexed, with their heads facing downward; 10 were on their right sides, 11 were on their left sides, and 1 was noted as prone; orientation could not be determined for the rest. Of the 96 burials, 31 were identified as male, 33 were identified as female, and the rest could not be identified. It was possible to identify 62 individuals as adults, 15 as subadults, and 10 as children or infants. No burials at the site showed evidence of burning or cremation. Of note were 12 individuals that had been painted with ocher; they were located in two areas: the northeastern and southwestern quadrants (Raab 1994:34–35).

Raab (1994:57) indicated that the research conducted by Walker et al. in 1989 had demonstrated that the occupants at Calleguas Creek suffered "some of the most severe health conditions observed in the study region for any time period." There was a high frequency of enamel hypoplastic defects on the teeth (nearly twice that at other sites), which can represent periods of stress or disease during childhood (Walker et al. 1989:208 [as cited in Raab 1994:57]). Lesions on the bone were present on the skeletal remains and were noteworthy, not because of their frequency in the overall population but because of the number and severity of lesions present on the affected individuals, which may reflect systemic infection (Walker et al. 1989:208 [as cited in Raab 1994:58]). Stature analysis revealed, overall, a smaller population than at other known sites, which suggests conditions such as poor nutrition and stress during periods of growth and development (Walker et al. 1989:208 [as cited in Raab 1994:58]). Walker et al. indicated that it appeared that during the late Intermediate period, occupants of the site suffered from stress in the form of high levels of infectious disease, violence, and nutritional stress (Walker and Lambert 1988 [as cited in Walker et al. 1996:4]).

Interpersonal violence was evident and prevalent in the remains from the Calleguas Creek site; over 10 percent evidenced arrow trauma (Walker et al. 1989:210). Burial Feature 36 had three points around the spine, burial Feature 59 had a point in the pelvis, burial Feature 55 had a healing wound, and additional points were recovered from burial Features 67 and 30a. Approximately 12 percent of the burials exhibited evidence of fractures to the crania, not all resulting in death (Walker 1989:314). The burial of an adult male (burial Feature 24) included three human crania, which Raab (1994:35) suggested could be evidence of kin worship or trophy taking. Raab (1994:69) pointed out that the level and degree of trauma evidenced in the burial area (as in the cases of other burial areas) probably underestimated the true level of violence. Some injuries could have been confined to soft tissue, and some of the individuals who died of traumatic injury may have been buried elsewhere or may not have been recovered.

Artifacts associated with the burials varied greatly in number and variety. At least 67 of the 96 burials had one or more shell beads. Burial Feature 73, an infant, was associated with 19,062 shell beads, and burial Feature 13 was associated with 4,359 shell beads. Other recovered worked-shell artifacts included shell ornaments made from giant keyhole limpets in the form of either whole edge-ground shells or ring ornaments from the calluses of the shells (Raab 1994:23). Five of the six large "cigar"-style steatite beads recovered from the site were found in a single burial (burial Feature 13). These "cigar" beads and giant-keyhole-limpet ornaments were considered "high-value artifacts" and were more commonly associated with the burials in the northeastern portion of the burial area (Raab 1994:31). Raab (1994:28) noted that the burials that contained 50 or more shell beads also tended to be concentrated in that section of the burial area and that this pattern may represent segregation of individuals with higher status. Raab also noted, however, that the recovered remains may not be truly representative of the burial population, because of problems with flooding and looting that resulted in considerable loss of burials and artifacts. An adult male, burial Feature 55, had been covered by a whale-scapula fragment, a practice that has been associated in ethnographic accounts with grave markers for chiefs (Martz 1984:97). Stone bowls, two of which had been placed over heads and one in which an infant had been interred, were recovered with six burials, but there was no pattern of association (Raab 1994:39). Other types of ground stone artifacts also were recovered with a number of burials. Raab (1994:40) suggested that a crystal recovered from burial Feature 18, an adult male, may be representative of "ritual" behavior and that such objects have been ethnographically associated with shamans.

VEN-132 (Awhay Village Site)

The Awhay Village site, VEN-132, was located near Ojai, on land that at one time was known as the Hofmeister Ranch. Originally recorded in 1959, the site was identified as a large village site in 1968 by Tom Blackburn. In the summer of 1969, the site was excavated by Robert Browne, a respected avocational archaeologist who lived in the local area. Those excavations exposed a large Chumash burial area that included between 140 and 243 or more individuals and likely dated to the Protohistoric and Mission periods (Clewlow 1977:14; Lopez 2001; Lopez 2004:9; McManamon 1995:1; Wlodarski 1995:16, Appendix C). Over 12,000 funerary objects were recovered from the burial area (McManamon 1995:1), including a mixture of artifacts of aboriginal and Hispanic/European manufacture. These items included projectile points, shark teeth, crystals, shell beads, glass trade beads, metal bowl fragments, a copper chocolate pot, and pestles and mortars (Wlodarski 1995:Appendix C). The remains were accessioned at the Ojai Valley Museum and were later transferred to UCSB. Unfortunately, little is known about the burial area, and no report on the excavations has been published.

VEN-662 (Port Hueneme Site)

The Port Hueneme site, VEN-662, was located in the city of Port Hueneme, approximately 0.75 km from Ormond Beach and the Pacific Ocean. The site has been known since the 1930s, when the first informal studies began. In 1933, Richard Van Valkenburgh noted that a number of complete ground stone bowls, mortars, and pestles had been found at the site. A report on work done in 1979 at the site noted the presence of ashy midden with a light scattering of artifacts, but no human remains were reported. There is anecdotal evidence (local rumors), however, that subsequent housing construction in the area did reveal numerous burials, but that has not been verified. Between 2004 and 2007, SRI implemented a testing and data recovery program at the site (Sutton 2008). During monitoring of construction grading in 2007, eight individuals (in seven burial features) were identified in a single area of the site. In addition, a dog burial and two concentrations of fire-affected rock were recorded nearby. Radiocarbon dating and diagnostic artifacts dated all of the features to the Late period.

The burials consisted of four adults (two females and two males), two juveniles, and two infants. All of the individuals were buried within a 3-by-3-m area on the central eastern edge of the site. All of the burials were primary inhumations. The adults were generally interred on their left sides (three on the left and one prone) with some degree of flexure (two were semiflexed, and two were tightly flexed) and were oriented to the west. The juveniles were buried on either their left or right sides with some degree of flexure (one was semiflexed, and one was tightly flexed) and were oriented in westerly directions (one to the west and one to the west-southwest); one of the juveniles was buried face down. Burial information was available only for one infant, who was buried semiflexed on the right side, oriented to the southwest. Although the relationship between the dog burial, the fire-affected-rock concentrations, and the burials remains unclear, the three features were relatively close to the burials and were the only nonburial features identified at the site during mechanical stripping and monitoring. Of the artifacts that were clearly associated with burials, most were utilitarian in nature, such as a fishhook, a biface, projectile points, and a piece of worked bone; only a few shell beads were found. It is interesting to note, however, that a single burial feature with two infants (Feature 3010) contained the vast majority of the shell artifacts recovered from burials. In total, over 100 shell artifacts were recovered from the grave, although approximately half of them could not be assigned to either individual. None of the shell artifacts was found in "stringing position," indicating that they had been scattered in the matrix. In addition, a complete sandstone bowl, which was determined to have been ritually "killed," was also found with the two infants.

Because of the small number of individuals recovered at VEN-662, statements about the frequencies of specific health traits or pathological conditions among the general population are difficult. However, some trends have been noted (Jones et al. 2008:155). First, there was generally poor dental health among the burial population and a high number of dental abscesses, enamel chipping, and periodontal disease. Each of the four adult individuals exhibited at least two abscessed teeth and showed some evidence of periodontal disease. Two of the adults also exhibited antemortem enamel chipping. Interestingly, however, no dental carious lesions were recorded in the burial population. Other trends included the presence of porotic hyperostosis, osteophytosis, and various reactive lesions among the adults. Generally, the high presence of pathological lesions among the four individuals may point to an overall moderate to low level of health among the burial population at VEN-662.

The concentration of eight individuals within such a small area suggested that the area was a discrete and well-defined burial area for the inhabitants of the site. The buried individuals may have been members of a single extended family or of another kind of small social group. The absence of other human remains from the portion of the site investigated by SRI supported that interpretation (Jones et al. 2008:136). Mitochondrial DNA was extracted from a right third mandibular molar from Individual 5 (Feature 3005). Results placed the individual in Haplogroup A, a common haplogroup reported among the Chumash, Esslen, and Utian-speaking groups (Eshleman 2008; Lorenz and Johnson 2006).

Comparative Site Descriptions, South Coast and Interior Sites

This section presents detailed descriptions of comparable sites in southern California within portions of Los Angeles and Orange Counties. Although many sites have been recorded in this region of California in the past several decades, only the larger and better-reported sites with substantial burial populations are presented here in detail.

SCLI-43 (Eel Point Site)

The Eel Point site, SCLI-43, was located on San Clemente Island. Based on radiocarbon samples from human remains recovered from Eel Point B, a date of 5362 ± 80 B.P. was obtained (placing it within the Millingstone period of the Ballona chronology) (Titus and Walker 2000:79). An obsidian-hydration date of 2000 B.P. was obtained from a Native Californian burial area at Eel Point C (dating to the Intermediate period) (Titus and Walker 2000:79). All of the primary inhumations of the burial area at Eel Point C were males. Titus and Walker (2000:83) believed that to be an example of a burial practice in which males and females were interred in separate burial plots.

A number of pathological conditions and injuries were noted for the individuals in the burials at the Eel Point site. Osteoarthritis was common in the population (Titus and Walker 2000:85). Additionally, there was a high frequency of auditory exostoses, a bony overgrowth within the ear canal that would result in partial or complete hearing loss. Auditory exostosis is a trait that is often associated with populations that frequently swim in cold water. A high rate of dental attrition was noted in the remains recovered from the site, which may reflect a diet heavy in food that contained a great deal of grit, such as roots and tubers (Titus and Walker 2000:83). The dental wear resulted in an increase in the prevalence of abscesses and antemortem tooth loss (Titus and Walker 2000:83).

Titus and Walker (2000:84, 85) also noted that for such a small collection, the Eel Point site skeletal remains exhibited a large number of traumata, several of which involved healed cranial fractures resulting from blunt-force trauma, a situation also observed among the inhabitants of the northern Channel Islands. They noted, "Burial 5b has a depressed fracture of the right parietal. Burial 2 . . . has depressed fractures of both temporal bones. . . . Burial 3 has a fracture of the left nasal bone" (Titus and Walker 2000:84). The authors also noted that "Burial 2 also has several healed rib fractures" and that a "radius, ulna, and coccyx from Burial 5a have healed fractures" (Titus and Walker 2000:84).

Burial Features 2, 3, and 5b were primary inhumations placed in a flexed or semiflexed position with their arms folded across their chests (Titus and Walker 2000:85). Burial Features 2, 4, and 5a all showed some evidence of disturbance; burial Features 2 and 4 were slightly out of anatomical position, and burial Feature 5 was highly disturbed and consisted of several commingled individuals (Titus and Walker 2000:85). Burial Feature 7 consisted of a single cremation, possibly a female between 15 and 20 years of age. There was evidence to indicate that the cremation had occurred while the bone was still "green" or fresh (Titus and Walker 2000:85). Unworked bird bone was recovered with the cremated individual of burial Feature 7 (Titus and Walker 2000:85). Titus and Walker (2000:85) noted that the practice of cremation was more common among the Gabrielino/Tongva than among the Chumash, although the sparse presence of cremations may have been due to the lack of wood on the island (Titus and Walker 2000:85).

Recent mitochondrial-DNA studies of burials from the Eel Point site (Potter and White 2009:175) suggested that the prehistoric Eel Point population may have had the closest maternal genetic affinities with modern Takic groups of the Los Angeles Basin (e.g., Gabrielino/Tongva groups). However, as Potter and White (2009) pointed out, the genetic affinities involve complex and fluid movements of peoples through time. For example, Sutton (2009) has argued Takic groups may have arrived in the Los Angeles Basin approximately 3,500 years ago and that the languages of the Takic groups was adopted by biologically Yuman people. Mitochondrial DNA from the Eel Point site suggested to Potter and White (2009:175) that the population buried there may be Yuman.

SCLI-1215 (Nursery Site)

The Nursery site, SCLI-1215, was also located on San Clemente Island. Titus and Walker (2000) indicated that morphological differences in the crania between SCLI-43 and SCLI-1215 suggested two genetically distinct populations occupying San Clemente Island. A radiocarbon sample from sea grass collected from a burial yielded a date of ca. 8000 B.P. (placing it in the early Millingstone period of the Ballona chronology), leading the authors to believe that the sample may have been contaminated, because the date was off from other dates obtained for nearby sites (Titus and Walker 2000:79). Other dating results yielded a time of occupation for the site of ca. 1500 B.P. (within the Intermediate period) (Titus and Walker 2000:79). The burials from the site were all primary inhumations in a flexed or semiflexed position with their arms folded across their chests (Titus and Walker 2000:85).

A smaller number of pathological conditions and injuries were noted at the Nursery site than at the Eel Point site. Osteoarthritis was as common in that population as it was in the Eel Point population (Titus and Walker 2000:85). The similarities between the two populations ended there. Unlike the Eel Point site, there was a complete absence of auditory exostoses from the examined crania. Also, whereas the Eel Point population exhibited a high rate of tooth wear and a high frequency of abscesses, the Nursery site population exhibited very little evidence of the presence of tooth attrition and abscesses but instead showed evidence of a high rate of dental carious lesions, which tend to result from carbohydrate-rich diets (Titus and Walker 2000:83). They may be indicative of differences in diet. Titus and Walker (2000:83) suggested that the differences between the Eel Point and Nursery site dentitions may indicate dietary differences and that the Eel Point population consumed more marine resources, rich in protein and fluoride, than the Nursery site population.

Titus and Walker (2000) indicated that morphological differences in the crania between the SCLI-43 and SCLI-1215 burials suggested that two genetically distinct populations occupied San Clemente Island at different points in time. Titus and Walker discussed two aboriginal California groups that occupied the Channel Islands and can be distinguished using cranial morphology. One "widely distributed California physical type" associated with occupants of the northern Channel Islands and adjacent mainland coast has a "high" face and a broad head (Titus and Walker 2000:79). A second type, referred to as the "Western Mono," is characterized as having a narrow head and a broad nose and occupied a more "restricted area" encompassing the Monache territory in the Sierra Nevada and the territory of the Gabrielino/Tongva on the southern California mainland, including the southern Channel Islands (Titus and Walker 2000:80). Titus and Walker (2000:80) also mentioned that the Western Mono group inhabited areas occupied by Takic groups in historical-period times. Titus and Walker indicated that the crania from the Eel Point site were more characteristic of the widely distributed "California type" and similar to the Chumash of the late Prehistoric period found in the northern Channel Islands (Titus and Walker 2000:81). The representation of the "California" type cranium supports the hypothesis that people of that type occupied areas on both the northern and southern Channel Islands (Titus and Walker 2000:81). By contrast, they characterized the crania of the Nursery site as similar to that of the "Western Mono" type (Titus and Walker 2000:81). The representation of the "Western Mono" type cranium supports the hypothesis that there was a later "intrusion" of the "Western Mono" Takic groups into the southern Channel Islands (Titus and Walker 2000:81).

Potter and White (2009) analyzed the mitochondrial DNA of burials from the Nursery site. Results of that genetic research suggested that the population at the Nursery site on San Clemente Island was significantly different from the population at the nearby Eel Point site. At the Nursery site, the population shared a high frequency of Haplogroups B and D, which partly consisted of Numic-speaking groups found in the Great Basin (such as Yakama and Northern Paiute). A consensus tree created by the researchers suggested that the mitochondrial DNA for the population from the Nursery site was closest to Penutian-speaking groups rather than the Takic-speaking groups associated with the nearby Eel Point site burial population.

LAN-138 (Malaga Cove)

The Malaga Cove site, LAN-138, was a sand-dune midden on a bluff top overlooking the southern end of the Santa Monica Bay, in the city of Torrance, between Redondo Beach and Palos Verdes (Walker 1951:30). The site was first excavated by Dr. F. M. Palmer, who published his findings in 1906. It was subsequently excavated 30 years later by Van Valkenburgh; however, his findings were not published (Wheeler 2004:85). According to Wheeler (2004:84), the site had been known, collected from, and excavated "for over a century by both archaeologists and pot-hunters"; the first professional archaeological investigation was conducted in 1936 by Edwin Walker. The final excavation at the Malaga Cove site was in 1955 by volunteers from local universities, museums, and archaeological societies, as salvage archaeology in response to the area's being developed (Wheeler 2004:85).

The site is a village site with evidence of occupation spanning from the Millingstone through the early historical period, using the Ballona chronology as a guide. Artifacts recovered from Level 2 seemed to represent the Millingstone period (Wallace 1955; Warren 1968). Based on the presence of glass beads in Level 4, Wallace (1986) dated this level to the Protohistoric or Mission periods. Obsidian-hydration results from unsourced material provided dates of A.D. 554, 774, and 1060 (Meighan and Scalise 1988; Van Horn 1990).

Although discrete levels were identified at the Malaga Cove site by Walker, later work failed to find those distinct strata. Instead, the site stratigraphy suggested that the site had been consistently reoccupied. Level 1, the lowest level, was approximately 3 feet (approximately 1 m) thick and yielded numerous artifacts, such as asphaltum-plugged abalone shells, abalone rim scoops, shell ornaments, red ocher, flaked stone knives and large projectile points, hammerstones, "pounders," worked-bone utensils, incised stones, and tarring pebbles (Walker 1951:38–39).

Within the second level, as identified by Walker (1951:39, 59), were reburied, unburned human remains located approximately 3 feet north of a series of rock cairns. The stone cairns consisted of eight small cairns of 10–35 small stones and mano and metate fragments surrounding a larger (measuring approximately 3 by 2 feet) platformlike cairn consisting of 110 stones and artifact fragments three layers thick and arranged in a north–south orientation (Walker 1951:53). Such an array was very similar to Cairn Group A at LAN-21. Approximately 30 more cairns were found throughout that level. Walker (1951:53) suggested that the cairns were related to the Mourning Ceremony. Walker (1951:53) described the human bones as follows:

> About the cairns, in places, were a few human bones, evidently reburials as the soil adhering to them was quite different from the sand-dune in which they were found. There were several isolated finger-bones and one arm-bone; but most significant was a cluster of parts of a female skull, two leg-bones, and a few ribs. The head of the burial was toward the north. On its right side, in an oblique line, were a discoidal stone and two manos. On its left side, in a line parallel with the other line, were five manos leading to a large flat metate. Not one of these artifacts were [*sic*] in fragments, but all showed evidences of fire and most of them were stained with red paint. About two feet to the left of the leg-bones was a little cairn of small stones, surmounting which was a tiny medicine mortar holding a pestle; and at the side were two objects of soapstone believed to have been for some ceremonial purpose.

Level 3 was approximately 8 feet thick. Manos and metates were plentiful in Level 2, but they were absent from Level 3, having been replaced by large stone mortars and long pestles (Walker 1951:60). The presence of shell fishhooks and tarring pebbles suggested a maritime culture that potentially had access to plank canoes (Walker 1951:61). Cremated human bone was found in the vicinity of a large platform cairn composed of more than 400 stones consisting of fire-affected and asphaltum-spattered broken mortars, pestles, hammerstones, drills, and scrapers (Walker 1951:63). This feature appears to have functioned much like Feature 587 from LAN-63, described above.

Level 4, the uppermost level beneath the overburden, was approximately 15 feet thick and was characterized by the presence of small projectile points, basket-hopper mortars, painted "gaming" stones, historical-period glass beads (in the upper portion of this level), fully flexed primary inhumations, and rare cremations (Walker 1951:38, 68). Overall, inhumations were more prevalent than cremations at the site.

LAN-270 (The Los Altos Site)

The Los Altos site, LAN-270, was located in the Los Angeles Basin, approximately 1 km north of California State University, Long Beach. The site was first excavated in ca. 1953 by faculty and students of California State College, Long Beach, and members of the ASA, under the direction of Ethel Ewing (Bates 1972; Simpson 1953). LAN-270 appeared to have been a Late period village with "fairly steady year-round occupation with a concentrated burial area" (Bates 1972:55).

The burial area included 21 burial features consisting of 20 inhumations and 1 cremation. Several of the inhumations were scattered or only partially represented. For instance, burial Feature 12 was represented by a single cranium (Bates 1972:46). Bates (1972:48) remarked that cremated bone was found scattered across the site, indicating that cremations were likely more common than the single intact cremation would suggest. Eleven of the individuals were chosen for advanced osteological analysis, but the lack of an available concordance table made it impossible to compare the data collected in that analysis with the field data. The analyzed individuals were 8 adults (5 males/possible males, 2 females, and 1 of indeterminate sex) and 3 infants (Bates 1972:Table 1). The field notes, however, revealed that the population structure was broader than just adults and infants. An excellent photograph of burial Feature 10 provided a view of the dentition. Cursory examination indicated that at least 1 of the burials was a child of at least 7 years of age. Furthermore, Bates (1972:51) commented that isolated teeth and mandibular fragments indicated that another 7–8-year-old child was also in the collection. Finally, the field notes indicated that burial Feature 20 was a much younger child, 2–4 years of age (Bates 1972:48). Map 1 (Bates 1972) revealed that the burials were distributed in a relatively diffuse pattern with few burials located in proximity to one another—a pattern reminiscent of the northeastern portion of the burial area at LAN-62 rather than the concentrated pattern suggested by Bates (1972:55).

In regard to mortuary practices, the available field data indicated that half the burials could be identified as having been interred tightly flexed; three individuals had been placed on their left sides, three had been placed on their right sides, and one was in a supine position (Bates 1972:44–48). There did not appear to be any preference for a specific direction of head facing; nearly all the nine individuals for which that trait was recorded faced in different directions (Bates 1972:44–48). Bates (1972:48) further noted a trend toward interring individuals with the bodies oriented in an east–west direction.

Dental data included evidence of a coarse, grit-laden diet evidenced by the significant attrition of the teeth (Bates 1972:51). Dental pathological conditions such as abscesses, carious lesions, and antemortem tooth loss were also recorded. Of special note was an unassociated frontal fragment that appeared to have purposeful scratches (possibly cut marks) on it, and on one section of the fragment, seven rows of circles of probable asphaltum were located superior to the right temporal line (Bates 1972:Figure 10).

By and large, mortuary accompaniments for these individuals were scant. Most of the burials had small numbers of shell beads and flaked stone or ground stone artifacts (Bates 1972:49–50). At LAN-270, nearly 2,800 artifacts were recovered; over 2,000 were shell beads (Bates 1972:7). The remainder consisted of a variety of ground stone, flaked stone, worked-shell, ceramic, and worked-bone artifacts (Bates 1972:9).

Four burials appeared to have more associated artifacts, and from a wider range of types. Burial Feature 6, the cremation, had 115 turtle-shell fragments (20 of which had been drilled), 3 bone tubes, 1 "arrow" point, 1 bone pin, 1 stone awl, bone awl tips, 1 bipointed bone object, 1 fish gorge, 1 harpoon fragment, 1 dart point, and 1 asphaltum-plugged abalone shell (Bates 1972:49). A small, crescent-shaped piece of steatite possibly representing a sea-mammal effigy was recovered nearby and was possibly associated with burial Feature 6 (Bates 1972:18). Burial Feature 8, an adult, had 1quartz blade, 4 dart points, 1 steatite bowl fragment, 4 shell beads, and 12 cowry shells with punched holes located nearby (Bates 1972:49). A bowl-shaped mortar that had been "killed" and broken into 6 pieces was found above that burial (Bates 1972:12). Burial Feature 13, another adult, was associated with 3 flaked stone tools, 1 stone pipe, 1 rubbing stone, and bone awls (Bates 1972:46). Burial Feature 14, an adult, had 40 ribbed cockle shells, flaked stone scrapers, 1 drill, 1 blade, 1 chopper, shaft straighteners, 1 bone whistler, and 1 bowl made from asphaltum (Bates 1972:50). Burial Features 13 and 14 were found adjacent to one another, and burial Features 6 and 8 were found on opposite sides of the site from one another and several feet east of burial Features 13 and 14. Assuming that these burials represented higher-status individuals, the distribution suggests that a specific area was not designated for those of higher status at the Los Altos site—a pattern also seen at the Medea Creek site (see above) and one that is inferred to indicate a ranked but not heavily stratified society (Bates 1972:Map 1; King 1982:188).

Burial Features 10 and 17—a child and an infant, respectively—were also noteworthy, because both burials had some of the largest concentrations of beads associated with burials at the site. Thirty-six whole and 6 fragments of keyhole limpet beads were found beneath the cranium of the individual associated with burial Feature 10, and 67 "tiny olivella disc beads" were associated with burial Feature 17 (Bates 1972:46 50). Based on that evidence, King (1982:99) inferred that status was a function of heredity and not necessarily achievement, as she observed at other sites, such as the Medea Creek site.

LAN-2682 (The ARCO Site)

The ARCO site, LAN-2682, was located at the ARCO refinery in Carson, adjacent to the Wilmington–San Pedro Wetlands, along San Pedro Bay. The site consists of a burial area (of unknown total size) that was used during the Late through Mission periods. It was first discovered in September 1998 during replacement of underground utilities at the refinery. Prior to the identification of human remains by construction workers, approximately 300 cubic yards of soil had been removed and stockpiled at another area of the refinery. At this point, archaeologists from Bonner and Associates were contracted to excavate any human remains (Bonner 2000:154). No formal report has been published on these excavations; the only published material available are papers presented at the annual meeting of the Society for California Archaeology and subsequently published in the proceedings.

Despite natural historical-period and modern disturbances to the site, two distinct components were identified. The upper component was generally 80 cm thick and contained the remains of at least 10 adult males, 4 adult females, 1 infant, 1 subadult, and 4 adults of indeterminate sex. That upper component appeared to date to the Protohistoric through Mission periods (ca. A.D. 1680–1810). The lower component was separated from the upper one by approximately 20 cm of soil and was approximately 55 cm thick. The lower component apparently dated to the Late period (ca. A.D. 1420–1620), based on radiocarbon dates, and contained at least 5 adult males, 1 child, and 1 adult of indeterminate sex. In addition to the 27 burials identified in situ, over 32,000 human-bone fragments were recovered from the mechanically excavated soils, which were removed prior to the archaeological investigation. Hundreds of adult teeth were found scattered in that soil, as were representative samples of other elements from the human body. Bonner (2000:157) made it clear that at least some of the intact burials were also represented in the screened, mechanically excavated soils; 16 of the burials were impacted by mechanical excavation. All of the 32,000 bone fragments appeared to be associated with the upper component of the site.

The condition of the remains was surprisingly free of disease. Bonner (2000:157) stated that teeth were generally free of carious lesions and dental or gum disease, although the teeth had been ground down and extensively worn. There was some evidence of tuberculosis and some evidence of interpersonal violence. Of note regarding the burials was the presence of trauma. Two burials were identified as having had their extremities severed, and a third cremated skull appeared to have been burned in place (Luhnow 2000:166). The skull was recovered with ash, charcoal, and a burned steatite bowl fragment. One of the individuals, whose hands were missing, had suffered an antemortem fracture to the mandible and was also missing the sternum (Bonner 2000:157).

Compared to other burial areas dating to the Late through Mission periods in coastal southern California, the ARCO deposit contained few artifacts (Luhnow 2000:162). Single examples of ground stone and fishing implements were recovered, and shell ornaments (including shell beads) were few and far between. Burials from the lower component contained a total of 279 artifacts, including shell beads (many covered in asphaltum), lithic debitage and formed stone tools, ocher, 1 glass bead, 3 complete abalone shells, and 1 bone tool (a deer-tibia wand). Luhnow (2000:163–166) argued that there were 11 artifacts that were ritualistic in nature, including 1 deer-tibia wand, 1 steatite eccentric resembling a sewing bobbin that had been placed in an unburned basket, 1 large-stemmed obsidian dart point, 1 incised soapstone block, shell beads, red ocher, and 1 ground-columella-shell ornament. Upper-component burials exhibited a different pattern from lower-component burials. Lower-component burials, both human remains and artifacts, were placed specifically and with care, whereas upper-component burials had fewer artifacts and were less-formally organized (Luhnow 2000:166). In total, 608 artifacts were recovered from the upper component, with shell beads, lithic debitage, and formed tools being most common. Very few historical-period artifacts were recovered from the upper component; they consisted of 2 leather disks and 13 glass trade beads, some of which were recovered from trenched soil. Glass trade beads were all a drawn variety, half translucent and half opaque. The colors of the beads were blue, white opaque, and clear. Luhnow (2000:167) argued that overall, a few items in the burial area were related to shamanism or ritual, including an incised soapstone tablet fragment, a soapstone eccentric, the previously mentioned deer-tibia wand, and a soapstone pipe. Because it was unclear how much of the burial area had been removed prior to archaeological investigation and because the published data were very limited, the specifics of the burial area were not as detailed as may otherwise have been the case.

LAN-2757, LAN-2792, and LAN-2796 (Alameda Corridor Project)

During the course of archaeological work along the Alameda Corridor, a transportation corridor between Long Beach and downtown Los Angeles, 13 burials were discovered at three Late period archaeological sites: 2 burials at LAN-2757, 10 burials at LAN-2792, and 1 burial at LAN-2796 (Mirro et al. 2005:Table 5-9). All burials that could be identified to sex (9 of 13) were female, with a mixture of children, adolescents, and adults; all were inhumations. DNA results for 3 individuals indicated that 2 were likely of Gabrielino/Tongva descent, and 1 was of Chumash descent. However, because the results suggesting ethnic affiliation were based only on mitochondrial haplogroupings, the conclusion that 1 of the burials contained a Chumash individual was not certain. The burial interpreted as Chumash, for example, had DNA consistent with membership in Haplogroup A, and although that haplogroup was present among the majority of Chumash samples, it has also been detected among people of documented Luiseño maternal ancestry. Thus, it is not exclusively limited to peoples speaking Chumash languages, and its presence within the territory occupied by Gabrielino does not necessarily mean that the individual was Chumash. Although the authors used the term “cemetery” to describe the burials at LAN-2792, the map of the locations of the burials (Mirro et al. 2005:Figure 5-2) indicated that they were scattered across the nearly 200-m-long site and were primarily found individually along the site margins. The two burials at nearby LAN-2757 were also found individually at two opposite ends of the site (Mirro et al. 2005:Figure 5-2).

Grave goods varied from burial to burial and included marine shell, bone tools, and projectile points (various Cottonwood types). In some cases, however, it was unclear whether these grave goods were directly associated with the burials or were from the surrounding midden in which the burials had been placed. Eight of the 13 burials lacked any substantial amounts of grave goods and generally were buried with a single marine bivalve (either *Haliotis* or *Argopecten*) each. Mirro et al. (2005:90) noted, however, that *Haliotis* shell often served as bowls or containers for perishable offerings, such as seeds, and may have been used for that purpose in those burials. Three individuals, all young-adult females, were buried with single specimens of Cottonwood projectile points. In total, four shell beads were recovered from burials; however, only one of the beads was in direct association with a burial. Generally, although some burials had more grave goods than others did, none contained a substantial number of items.

The overall health of the burial population from the Alameda Corridor project suggested that there was a general lack of nutritional stress. That said, Mirro et al. (2005) noted that the sample size was small and not sufficiently complete to make strong statements regarding that observation. The data were suggestive of a typical aboriginal diet, with largely worn-down teeth resulting from a diet containing grit from processing foods with ground stone tools.

ORA-58 (The Banning Estate, Norris Camp, or Fairview Hospital Site)

The Banning Estate (Norris Property), ORA-58, is located on the east bluff of the Santa Ana River, a short distance south of the old Don Diego Sepulveda Adobe in Orange County (Winterbourne 1968a:10). The site was first excavated in 1935 by John W. Winterbourne as part of a Works Progress

Administration (WPA) project. ORA-58 appeared to date to the Millingstone period of the Ballona chronology. During the course of the Winterbourne excavations, at least 44 inhumations, 1 possible cremation, 2 partial cremations, and several scattered human-skeletal elements were recovered (Winterbourne 1968a). For the majority of the burials, scant information was recorded, partly because of the poor preservation. In fact, only 8 of the burials had any age information recorded, and none had any sex information recorded. Three of the individuals were adults, 2 were adolescents (1 between 12 and 14 years and another between 12 and 16 years), 2 were children of indeterminate age, and 1 was a child of approximately 6 years of age (Winterbourne 1968a). The 12–16-year-old adolescent (no burial-number distinction was provided) had a possible lesion on a femur (Winterbourne 1968a:14).

Few burials had any mortuary information recorded concerning mortuary treatment. One burial (Skeleton No. 1) was described as an eastward-facing flexed inhumation, and a second (no burial-number distinction) was oriented downward in a possible prone position (Winterbourne 1968a:13, 15). In regard to the partial cremations, Winterbourne (1968a:16) did not describe the burials beyond indicating that the crania exhibited some burning and were found in a cluster with two other inhumations. The "cremation" consisted of numerous disturbed human remains that might have eroded out of the burial area above the site (Winterbourne 1968a:13). In the case of two burials (neither with burial-number distinctions), the remnants of mortars (most had been broken or "killed"; one was complete) had been placed over the skeleton (Winterbourne 1968a:14).

Other than the ground stone artifacts, few grave goods were recovered with the burials. Most consisted of a few broken or "killed" ground stone mortars, a few flaked stone tools, and shell beads (Winterbourne 1968a). Three burials, however, were noteworthy for their artifact concentrations. The 12–16-year-old individual was interred with approximately 60 shell beads and 1 "arrow" point (Winterbourne 1968a:14). A second burial (no burial-number distinction) of indeterminate age and sex was interred with 1 pestle, 1 obsidian "spear" point, 1 bird-humerus flute, and 1 shell dish (Winterbourne 1968a:12). The final burial, also without burial-number distinction or demographic information, had an oblong steatite artifact that had been intricately carved on both sides and drilled through the center (Winterbourne 1968a:15). In addition to these artifacts, Winterbourne (1968a:16–17) indicated that other artifacts were recorded, including several charmstones, worked-bone awls, steatite beads, steatite pendants, a *comal* or heating-stone fragment, quartz or tourmaline crystals, a steatite bowl, and other ground or flaked stone artifacts.

The site was later excavated by Keith Dixon (1970:62), who documented a large midden deposit and obtained radiocarbon dates and obsidian-hydration measurements. Radiocarbon analysis placed the time of occupation from ca. 1575 ± 100 B.C. to A.D. 990 ± 110 (Dixon 1970 [as cited in Demcak 1981:42]). Dixon (1970:64) obtained radiocarbon samples from a number of human burials identified at the site (from burial Features 4, 7, 8, 12, 21, and 22). The radiocarbon analysis of samples obtained from shell and human bone from the lower level indicated an occupation dating from 1700 B.C. to A.D. 400 (Millingstone through Intermediate periods of the Ballona chronology); samples from the upper level indicated an occupation dating from A.D. 500 to 1050 (late Intermediate through Late period of the Ballona chronology). Artifact typology and radiocarbon dates indicated that occupation occurred between the Millingstone and Late periods (Demcak 1981:42). Dixon (1970:62) also suggested these same time periods for occupation of the site, but he also noted that the site may have been occupied during other time periods, even though at the time of his writing, they had not yet been recognized.

A number of artifacts were noted at the site (Demcak 1981:35). Asphaltum was noted on an abalone-shell dish, presumably plugged. The recovered ground stone artifacts included an unknown number of manos, two metates, one pestle, two steatite beads, and one steatite pendant. One boat-shaped steatite bowl; one sandstone bowl; many broken mortars, possibly with a burial association; and one *comal* fragment were also recovered. The flaked stone artifacts included one obsidian knife. Nine projectile points, one drill, and one biface knife were made of fused shale. No debitage was noted. Other lithic artifacts included fire-affected rock, an unknown number of hammerstones, quartz and tourmaline crystals, concretions, a polishing stone, and an obsidian pebble. The recovered worked-shell artifacts included two abalone shells, which may have been dishes; a number of shell beads that may have been associated with a burial; one keyhole-limpet shell; and a cluster of ornaments cut from clam, abalone, keyhole limpet, and dentalium that may have been associated with a burial. The recovered worked-bone artifacts included an unknown number of awls. Many artifacts may have been in association with burials. Artifacts of note included one discoidal, two cogstones, one chunky stone, two plummet stones, four cigar-shaped charmstones, and four "beautifully carved ceremonial stones of steatite" (Winterbourne 1968a).

ORA-64 (The Irvine Site)

ORA-64 was located in Orange County, on a bluff on the eastern side of upper Newport Bay, approximately 483 km from the present-day shore of the bay and 1 km from the nearest freshwater source. The site is likely multicomponent, and the principal occupation and use occurred during the Millingstone period of the Ballona chronology, and there is strong evidence of even earlier occupation during the Paleocoastal period. The site was first excavated in 1971 as part of a California State University, Fullerton, field class, and additional work was conducted by volunteers and Christopher Drover in May and June 1972. In 1976, Drover and Frank Fenenga returned to work on the habitation site, further clarifying the time period of occupation to the Millingstone period of the Ballona chronology. A radiocarbon date obtained from shell provided a date of occupation of ca. 6435 ± 130 B.P. (Drover and Spain 1972). One intact and one dispersed burial also were identified at the site (Drover and Spain 1972).

Although midden was present at the site, the single primary flexed inhumation recovered during the excavation was not located within the midden area but, instead, on the periphery. The individual was a probable young female buried on her right side in a depression of sterile soil, with the head oriented to the south (Drover and Spain 1972:36, 40). Artifacts directly associated with the burial included a shell disk bead and a "highly unusual crescent" stone of percussion-flaked fine-grained basalt previously referred to as an "eccentric crescent" (Drover and Spain 1972:36). Although the burial was considered the only primary inhumation from the site during that early work, Drover and Spain (1972:36) mentioned that the earlier 1971 excavation had recovered fragments of human long bone, probably from a reburial. Rock cairns that consisted largely of fragments of milling stones were also discovered during that time; the cairns were associated with the fragmentary human remains (Drover and Spain 1972:36).

A number of artifacts were also noted at the site. They consisted of two ceramic-vessel sherds with punctuation; fired-clay cylinders; three fired-clay figurines; ground stone artifacts (manos, metates, stone beads, and stone bead blanks); flaked stone artifacts (scrapers, crudely flaked blades, knives, projectile points, and five eccentric crescents); spindle whorls; red ocher; "Shaman's crystals" (possible quartz crystals); worked-shell artifacts (a clam-shell disk bead, perforated *Argopecten* and *Chione* shell, and possible rattle pieces); worked-bone artifacts (awls, a fish gorge, sheepshead pharyngeal-plate beads, and worked bone with parallel rows of drilled impressions); one nondescript effigy; one spheroid; two cylindrical, bullet-shaped charmstones; one charmstone with tapered and blunted ends; and one cigar-shaped charmstone. No debitage was observed, and one of the projectile points was a fossilized shark tooth. One of the stone beads was a marine fossil. Red ocher was observed on the clamshell beads and human remains; a large clamshell and a metate with ocher residue may have been used as ocher palettes. The clamshell and metates were recovered from a feature that was possibly related to the Mourning Ceremony.

In the late 1990s, Macko, Inc. (Macko), returned to investigate ORA-64 prior to development of the property for the Irvine Company. Following data recovery excavations conducted with hand tools, Macko (1998) monitored controlled mechanical grading of the property and recovered additional features. During that data recovery, more than 500 individuals in burials were identified and excavated (Benjamin Vargas, personal communication 2009). The report by Macko (1998) did not provide any details about the numbers or locations of the burials or the osteological data beyond a cursory level. The report did state that 772 features were identified during data recovery work, many of which contained human-bone fragments (Macko 1998:87). Human remains appeared to have been associated with rock cairns that contained fragmentary ground stone tools (Macko 1998:88). In addition, Macko (1998:87) indicated that there were groups of human remains clustered together in portions of the site, although no additional information was provided. A number of unique artifacts were found outside burial contexts, including 4 large "ceremonial bifaces" that had been "placed in caches similar to contexts where they are found in southern Oregon and Idaho," as well as over 100 stone balls, 2 cogged stones, and over 1,000 disks (Macko 1998:52–53, 114–116).

Radiocarbon dates obtained from primarily unworked shell, obsidian-hydration analysis, and radiocarbon dating of shell beads all indicated that the site had been occupied between approximately 9000 and 4900 cal B.P. The shell beads all dated in excess of 7600 cal. B.P., and the majority clustered between 8950 and 8300 cal B.P. (Macko 1998:95–96). In addition, obsidian-hydration dates indicated that the site had been occupied for a longer time span, from approximately 11,000 to 2500 B.P. (Macko 1998:42–43).

ORA-135 (Griset Site)

The Griset site, ORA-135, is located approximately 1 km north of the Adams-Fairview adobe, on the Santa Ana River. It was first excavated in 1938 by John W. Winterbourne as part of a WPA project (Winterbourne 1968b:18) and likely dates to the Late period. The identified features included 7 hearths and a minimum of 19 inhumations (Winterbourne 1968c). As with many sites excavated in the early twentieth century, information regarding the human remains was minimal. That was further confounded by poor preservation of remains. Demographic information was available for only 1 individual (Burial A/Plot 1), an adult of indeterminate sex (Winterbourne 1968c:23). Additionally, mortuary observations were consistently recorded for only five individuals. That information can be found in Table 4.

Although numerous artifacts were recovered at this site, very few were actually associated with the burial features. These consisted of a polishing stone (Burial C/Plot 17), a shell bead (Burial B/Plot 17), and a plugged abalone shell (Burial A/Plot 17) (Winterbourne 1968c:35–36). Also, according to Winterbourne (1968c:31), a whale vertebra was located between Burial C/Plot 10 and Burial D/Plot 10.

Other artifacts at the site consisted of a variety of ground stone, flaked stone, worked-shell, and worked-bone artifacts (Winterbourne 1968c:38–45). Ceramic artifacts were also recovered but only as surface finds (Winterbourne 1968c:64). Artifacts of particular note included one steatite pipe; one discoidal; one carved slate; three cogstones; one steatite whale effigy; one piece of steatite; a stone with two tar crosses; two charmstones; one boat effigy; one carved steatite; one carved, snakelike concretion; and one ground stone ball.

Table 4. Available Mortuary Observations for Burials Recovered from ORA-135 (Griset Site)

Burial Letter	Plot No.	Treatment	Position	Direction of Head Facing	Orientation
A	1		supine		south
A	5	flexed	prone	down	south
A	7	flexed		down	
A	17			down	north
A	21	flexed			south

Note: From Winterbourne (1968c).

ORA-183 (Newland House Site)

The Newland House site, ORA-183 was located near Huntington Beach and has been the focus of numerous excavations, including those by Winterbourne in 1935; the Pacific Coast Archaeological Society (PCAS) in 1961; Herman Strandt in 1966; Archaeological Research, Inc., in 1973; and Marie Cottrell with PCAS from 1975 to 1979 (Cottrell et al. 1985:8–9). Based on radiocarbon dates obtained from shell, charcoal, and human remains; dates obtained from obsidian-hydration analysis; and artifact typology, the site was determined to have been successively occupied 11–12 times between 3500 B.C. and A.D. 1000 (from the Millingstone period to the Late period of the Ballona chronology) (Cottrell et al. 1985:69). During the course of the 1975–1979 excavations conducted by Cotrell and PCAS, five hearths or ovens (Features 1–5), one hawk burial (Feature 6), and one inhumation (Feature 7) were identified at the site (Cottrell et al. 1985:52–59). The inhumation was identified by Dr. Judy Suchey as a female greater than 16 years of age who was interred flexed on the left side with her head oriented to the south and facing west (Cottrell 1985:56). The only artifacts found with this burial were an asphaltum-plugged abalone shell located over the ribs and three *Argopecten* shells clustered at the neck (Cottrell 1985:56). When this burial was compared to other burials recovered from the vicinity, Cottrell et al. (1985:58) found that only three of the burials recovered by Winterbourne had any shell artifacts in association and that the orientation and head facing of the burial were atypical.

Numerous artifacts were recovered during the 1975–1979 excavations, including nearly 500 ground stone artifacts, over 170 flaked stone tools, approximately 5,500 flakes of debitage, red ocher, 1 quartz crystal, tarring pebbles, hammerstones, "cooking rocks," nearly 200 worked-shell artifacts, and nearly 50 worked-bone artifacts (Cottrell et al. 1985:17–52). The hawk burial was associated with an upright flat stone (Cottrell et al. 1985:54).

ORA-236 (Coyote Canyon Cave)

The Coyote Canyon Cave site, ORA-236, is located on Irvine Ranch in Orange County. The site was first excavated from 1967 to 1972 by Duane Hafner and Lavon Burnhamn. Based on radiocarbon dates obtained from shell, obsidian-hydration analysis, and artifact typology, this rockshelter site was occupied from ca. A.D. 400–500 to 1600, during the Intermediate through Late periods. The identified features included four rock walls, one mano cluster, seven hearths, one grooved boulder, one floor, and one fire-related flat rock stand (Mitchell 1991). At minimum, four individuals were identified, based on analysis of scattered bone that was recovered from the site (Mitchell 1991).

The presence at the site of midden and a large number of artifacts was noted. Macrobotanical remains noted included *Quercus*, *Opuntia*, *Anagallis*, and Fabaceae. A large number of artifacts were recovered from the site. By far, the most numerous artifacts were stone tools, consisting of dozens of ground stone implements (e.g., metates, manos, pestles, bowls/*comales*, bedrock mortars, and beads), flaked stone tools (e.g., bifaces, performs, blades/knives, drills, gravers, picks, reamers, choppers, scrapers, cores, projectile points, and utilized debitage), and various expedient-use tools (e.g., hammerstones, abraded stones, grooved stones, and shaft straighteners). Obsidian artifacts were sourced to Coso, Sugarloaf, and Obsidian Butte. Worked-shell artifacts consisted of fishhooks, ornaments, pendants, and beads, and worked-bone tools consisted of beads, flakes, needles, and awls. A single fired-clay cone represented the only ceramic artifact recovered from the Coyote Canyon Cave site. Artifacts of note included a schist ornament with five perforations, 10 incised stones, 1 charmstone, and 1 oval sandstone object. Some artifacts exhibited evidence of burning and asphaltum residue.

ORA-237 (Santiago Canyon/South Bank Site)

The Santiago Canyon/South Bank site, ORA-237, is a semisedentary base camp that was occupied between A.D. 1450 and 1750 (that is, between the Late and Protohistoric periods of the Ballona chronology). It was located on the south bank of Santiago Creek, on the western fringes of the Santa Ana Mountains (Hudson 1969:2–3). Although the site was the focus of amateur collectors in the 1920s, formal excavation of ORA-237 did not begin until the late 1930s, when John Winterbourne, under the auspices of the WPA and the State Emergency Relief Administration (SERA), began excavating in 1935 and again in 1937 (Hudson 1969:5). Those excavations uncovered numerous features, including eight inhumations, seven cremations, two cairns, and eight hearths (Hudson 1969:16).

The first burial feature to be reported at the site was found in the 1920s, when a cowboy discovered a cremation in a stone bowl (Hudson 1969:5). As previously mentioned, the SERA/WPA projects uncovered an additional eight inhumations and seven cremations.

The cremations recovered from the site were of two types: Type 1, an unarticulated cranium with "killed" mortars or hearthstones above the grave, ash, and burned bone, and Type 2, a complete cremation deposited in a bowl-shaped depression or in a deep stone bowl (Hudson 1969:18). Hudson (1969:19) commented that the Type 1 cremations, of which there were three, had the most associated artifacts. These consisted of "killed" mortars above Cremation 3, two deer-bone whistles discovered southwest of that same cremation, and two deer-bone whistles encountered beneath a basket-hopper mortar east of Cremations 1 and 2 (Hudson 1969:19). By contrast, artifacts were rare for the Type 2 cremations, of which there were four. Cremation 5 had a Tamyush mortar and pestle associated with it, and Cremation 4 was found beneath a cairn in the center of the site (Hudson 1969:21, 26).

All three Type 1 cremations were found adjacent to one another. Cremations 1 and 2 were considered a double burial and were found beneath the center of a hearth feature in the eastern portion of the site, and three of the Type 2 cremations, which had been buried shallowly and were subsequently disturbed by plowing, were more scattered on the western side of the site (Hudson 1969:20, 26).

Oddly, no burning was evident on the crania associated with the Type 1 Cremations 1 and 2, although both were found beneath the hearth and were associated with ash and burned bone. Femoral fragments were found with Cremation 3 (Hudson 1969:26). For Cremation 4, a Type 2 cremation, the remains appeared to have been more extensively burned. According to Hudson (1969:26), they were "no longer than three inches."

Demographic information was recorded only for Cremations 1 and 2, an adult female and a 2-year-old child, respectively (Hudson 1969:26). Wheeler suggested that the Type 1 cremations might support evidence of the practice of taking the heads of casualties of "organized conflict," a behavior that has been associated with the Gabrielino/Tongva (Wheeler 2004:51). However, there is a lack of information regarding the presence of cut marks on these crania. Furthermore, the presence of femoral fragments in Cremation 3 suggested that other behavior patterns, such as the reburial of disturbed remains, might be equally plausible.

Overall, the inhumations recovered from the site were poorly preserved. Many of the burials appeared to have been in a flexed position lying on their left sides; four faced east, and one faced west (Hudson 1969:19). Although a cairn was found over one of the inhumations (burial Feature 5), artifacts were rarely recovered with any of the inhumations. The artifacts that were found mostly consisted of broken pieces of ground stone, although a crude pestle was recovered near burial Feature 7 (Hudson 1969:19). Generally, these burials were scattered between both clusters of cremations. However, two inhumations (burial Features 5 and 7) were located in a relatively tight cluster, along with Cremation 4 and a hearth feature located in the center of the site (Hudson 1969:20).

Only 34 artifacts were recovered. These consisted mostly of ground stone (e.g., manos, pestles, mortars, a slate awl, doughnut stones, and steatite bowls), although 1 asphaltum-plugged abalone shell, 2 pottery pipes, 1 arrow-shaft straightener, red ocher, yellow ocher, and 1 deer-bone whistle were also recovered (Hudson 1969:27–48).

ORA-260, ORA-261, ORA-262, ORA-263, ORA-264, and ORA-1472 (Landing Hill)

All six Landing Hill sites (ORA-260, ORA-261, ORA-262, ORA-263, ORA-264, and ORA-1472) were located on Landing Hill, in the community of Seal Beach (Cleland et al. 2007). Although the sites had components dating to the Millingstone, Intermediate, and Late periods of the Ballona chronology, the primary occupation appeared to date to the Intermediate period. During mechanical grading in the summer of 2002, 37 human burials were identified, some located within site boundaries and some between sites. The 37 burials, which included a large cremation area, represented the remains of at least 40 individuals. In addition to human burials, a badger burial was also identified. Although DNA analysis was attempted on all burials with teeth, no DNA could be extracted.

Based on radiocarbon dating, the burials recovered at these sites dated to three time periods: Millingstone (9 burials), Intermediate (10 burials), and Late (2 human burials and the badger burial) (Gross et al. 2007). All burials, except those in the cremation area (see below), were interments. According to Gross et al. (2007:164–165), burials were tightly flexed during the Millingstone period, but by the middle portion of the Intermediate period, a loosely flexed inhumation appeared to be favored. By the Late period, however, burials were once again interred tightly flexed. The Millingstone period burials also tended to be oriented east–west, whereas the burials were oriented north–south during the Intermediate period. Dates from the large cremation feature, another example of a feature associated with the Mourning Ceremony, also indicated that it had been used during the Intermediate period. Gross et al. (2007:164) argued that these changes in burial treatment and orientation and the appearance of the cremations may have been related to the influx of Takic groups ca. 2000 B.P.

Because of tight, restrictive conditions, all burials were analyzed in the field and only to a limited degree. Regardless, some interesting trends were noted. First, there was a surprising absence of infants and young children. The reason for that was not clear but may have been related to preservation issues; only isolated infant and juvenile bones were recovered. In regard to pathology, high degrees of dental wear and disease, as well as osteoarthritis, were observed on a number of skeletons.

The large cremation area (burial Feature 29) was located at ORA-263 (Cleland et al. 2007:97–116). The feature measured approximately 23 m^2 and contained large amounts of fragmentary cremated human bone and ground stone fragments. It was clear that many of the ground stone fragments had been broken and left in place by the prehistoric inhabitants of the site. In total, 135 pieces of ground stone were recovered, nearly all within a roughly 3-by-5-m area. Most of the recovered bowls and mortars appeared to have been intentionally broken or "killed." The main concentration of cremated human bone also contained an exceptionally dense concentration of beads (primarily stone disks, although some shell beads were represented) or ornaments. That deposit represented an Intermediate period (ca. 2300–1900 B.P. cluster) cremation feature placed within a Millingstone period deposit. As a result of radiocarbon dates on human teeth within the cremation feature, it appeared that the feature had been used for a few hundred to 1,500 years (ca. 2300–800 cal B.P.) to deposit the cremated remains of certain individuals and grave goods or offerings. Another interpretation is that the cremated remains were primarily of individuals that were perhaps much older than the cremation feature (that is, curated human remains) that were all deposited at one time in a single ceremony. Finally, it is possible that the radiocarbon dates represent several closely related events occurring between ca. 2300 and 1900 cal B.P. Based on similarities with ethnographic and ethnohistoric documents, Cleland et al. (2007:114–115) argued that the cremation feature at ORA-263 may represent a Mourning Ceremony feature.

ORA-282 (Newland Hillside)

The Newland Hillside site, ORA-282, was located on the Associated Oil Company Tank Farm, on the western bluff of the Santa Ana River, 4 km inland (Winterbourne 1968d:1). The site was formally excavated in 1935 by John W. Winterbourne, under the auspices of SERA. Although it was unclear, the site likely dated to between the Late and Mission periods. Prior to Winterbourne's investigation, it appears that the site was the subject of a 1900 *Los Angeles Examiner* expedition in which a team spent several weeks excavating the hillside and left with "three wagon loads of artifacts and skeletal materials" (Chace 1965:5; Winterbourne 1968d:1). According to Chace (1965:5), however, the *Los Angeles Examiner* did not begin publishing until 1904; so, no information may be available regarding their findings. Although only 8 burials were collected by Winterbourne (1968d), 13 inhumations at minimum, as well as scattered isolated bone, were identified at the site. Cottrell et al. (1985:58), however, indicated that as many as 28 burials were recovered during Winterbourne's excavation.

Very little information was available regarding the skeletal remains. Age information was available for seven individuals: five adults, one infant, and one child approximately 9 years of age. One adult (burial Feature 15) was identified as a female and was found with the infant mentioned above (also part of burial Feature 15) (Winterbourne 1968d:5). Burial Features 16 and 17 were also found in association with one another, although no demographic information was available, because of poor preservation (Winterbourne 1968d:6). The 9-year-old child (burial Feature 5) was the only individual for whom a pathological condition was recorded, a possible ectopic right "lower maxillary" first molar that Winterbourne described as "not being able to erupt without surgical aid (Winterbourne 1968d:3).

All burials at ORA-282 were described as flexed inhumations (Cottrell et al. 1985:58). Although several combinations of positions were noted, there were some notable trends (Table 5). For example, all major cardinal directions were represented, although the western direction was represented in over half the burials. There were approximately equal frequencies of burials interred on the left and right sides of the body; one burial was interred on the back. Finally, north- and south-facing burials were more frequent and in relatively equal frequencies, and a few burials faced east, west, or up.

Additionally, the cranium associated with burial Feature 5 was a deep red color, because according to Winterbourne

Table 5. Positions of Burials at ORA-282

Directional Configuration	Body Position	Direction of Head	Direction Facing	No. of Burials
East–west	left side	west	north	6
East–west	left side	east	south	1
East–west	right side	west	south	5
East–west	right side	east	north	2
East–west	back	west	up	1
North–south	left side	north	east	2
North–south	right side	north	west	2
North–south	left side	south	west	1

Note: From Cottrell et al. (1985:58).

(1968d:3), the skull was "painted or packed with red ocher." Winterbourne (1968d:2, 4) also commented that a few burials had been placed in pits just barely large enough to accommodate the inhumations.

Few artifacts were recovered with the burials. In most instances, mortuary accompaniments consisted of a few flaked stone tools, as well as abalone or *Cardium magnum*–shell dishes (Winterbourne 1968d). In rare instances, other artifacts were recovered. In burial Feature 10, an asphaltum-lined basket was recovered (Winterbourne 1968d:4). Additionally, "several rings made from the giant key hole limpet" were recovered from an unidentified burial feature. Burial Feature 5 had "34 inches of beads"—alternating olivella and tusk—around the neck and "gathered in the right hand which was placed under the right cheek as children often pillow their heads in sleep" (Winterbourne 1968d:3–4).

Other artifacts found at the site that were not associated with the burial features consisted of an unfired-clay pigment pot, tarring stones and pebbles, a bell pestle, several manos, a paint mortar, flaked stone tools, shale "digging tools," two bone awls, two hairpins, two cogstones, two discoidal scrapers, a tubular steatite pipe with tobacco in place, and worked shell (Winterbourne 1968d:8–9).

Bonita Site

The Bonita site was located in a protected cove approximately 3 km up Bonita Canyon from the South Main Street extension and 152 m southwest of the Bonita Dam, near Irvine (Winterbourne 1969:19). The site, referred to as Anthropological Project 7680, was excavated in 1938 by John W. Winterbourne, under the WPA. Although it is not entirely clear, the site likely dates to the Intermediate period of the Ballona chronology. During the course of the excavation, 7 hearths and a minimum of 24 inhumations, 2 of which were found in mortars, were identified and recovered (Winterbourne 1969).The human remains were discovered in very poor condition, and most of the burials were found beneath large rock cairns. Additionally, very little demographic information was available, and only 6 burials yielded any age-related data (3 infants, 1 child, and 1 adult). Two infants (Burial Unknown/Plot 5 and Burial Unknown/Plot 6) were found inside mortars; one of the mortars was broken and had an associated pestle (Winterbourne 1969:21, 24). Winterbourne (1969:24–25) suggested that the remains of the infant found in the mortar in Plot 6 might have been disturbed during the inhumation of Burial G/Plot 6 and that during reburial, the bones had settled in the mortar. In Burial F/Plot 6, the ashes of a ceremonial fire had been scattered in the grave prior to placement of the cairn (Winterbourne 1969:24).

Only five of the burials (Burial C/Plot 5, Burial B/Plot 9, Burial A/Plot 6, Burial F/Plot 6, and Burial K/Plot 6) had any information regarding layout. Two were flexed (indeterminate degree), one was semiflexed, and one was tightly flexed. The fifth burial, Burial A/Plot 6, was flexed but in quite a different manner. Winterbourne (1969:22) wrote, "the lower legs were doubled back over the femurs, the foot bones pressed flat against the pelvis."

Burial orientation was also only recorded for a few burials. Three burials (Burial A/Plot 6, Burial F/Plot 6, and Burial K/Plot 6) were buried in three different orientations: north, northwest, and west, respectively (Winterbourne 1969:22, 24, 25). In regard to head facing, only four burials (Burial L/Plot 6, Burial K/Plot 6, Burial C/Plot 5, and Burial A/Plot 6) had any associated directions recorded: east, north, south, and west, respectively (Winterbourne 1969:21, 22, 25). Position within the grave was only known for two burials (Burial A/Plot 6 and Burial K/Plot 6), which were prone and on the left side, respectively (Winterbourne 1969:Plate I).

The burials recovered at the Bonita site were mostly found within two clusters (a southeastern cluster and a northwestern cluster) centrally located within the excavation area (Winterbourne 1969:29, 31–32). The southeastern cluster appeared to be much denser (16 burials within an approximately 15-by-12-foot area) than the more diffusely scattered northwestern cluster (6 burials within an approximately 25-by-10-foot area). A large number of artifacts (e.g., "killed" and broken mortars, pestles, steatite bowls, and metates) were associated with the southeastern cluster (Winterbourne 1969:31).

Few artifacts were found in association with the individuals. With the exception of the mortars associated with the two infants mentioned above, the only other artifacts associated with the burials were an asphaltum-lined basket, two abalone shells, and complete or fragmentary mortars and pestles (Winterbourne 1969).

Numerous other artifacts consisting of a variety of ground stone, flaked stone, worked-shell, and worked-bone implements and tools were also recovered (Winterbourne 1969:34–42). Many of the artifacts, particularly the ground stone artifacts (e.g., mortars and pestles), had been broken. Winterbourne (1969:28) wrote,

> It is interesting to note that many fragments of mortars were found that could not be pieced together, in fact in many cases only small fragments of bowls were found even after the major portion of the site had been uncovered. This is explained by the fact that the mourners from other villages, relatives and friends of the deceased carried away fragments of the implements which had belonged to the dead person as a memento or remembrance. It is also known that the Indians believed that articles which had belonged to a dead person could impart his good characteristics or attributes to the one holding them. This may account for the missing fragments of ceremonially broken or killed artifacts.

Goff's Island

The Goff's Island Sites A and B were located approximately 1,000 feet southwest of Goff's Island proper, in Laguna Beach, and were investigated by John W. Winterbourne as part of a series of archaeological site excavations funded by the WPA from 1939 to 1940 (Winterbourne 1967). Both of the components to the site, though not entirely clear, may date to the Millingstone period. Of the two sites, only Site A was excavated. Site A was a multicomponent village site consisting of two superimposed components, referred to as Culture I (earlier) and Culture II (later). Although Site B was not excavated, Winterbourne (1967:7) speculated that it might correspond to Culture I observed at Site A. It was considered a village that contained an Early and possibly an Intermediate period component.

At minimum, 19 inhumations were identified at the site. Although Winterbourne indicated that burials were associated with both temporal periods at Site A, the field notes did not clearly indicate which burials were associated with each period. Winterbourne (1967:47) did, however, summarize the burial groups as follows:

> The Culture I burials without exception were placed in their graves with their heads to the west or southwest. There is some variation in the direction in which the faces were turned, but the majority was in a general easterly or southeasterly direction. All but one of the burials were flexed, some more than others.
>
> In the Culture II group we have noted a definite change in orientation of burials. With one exception, the anterior ends of the skeletons were toward the north and northeast. Here as in the case of the Culture I group, there is a variation in the directions in which the faces were turned. The majority however are either up or toward the east.

Furthermore, although the field notes provided very little data regarding the demographic profile of the burial populations, Winterbourne (1967:47) indicated that male and female individuals as well as the remains of a child were recovered from the site, and there did not appear to be any sex or age bias. Finally, according to an analysis conducted by Dr. Ivan A. Lopatin, the individuals were likely Takic (Winterbourne 1967:47).

Although the data are seemingly sparse, several points of note regarding mortuary practice can be garnered from the field notes. First of all, as with many other burial sites, the disinterment and reburial of earlier burials, accidental or otherwise, to make way for subsequent burials appear to have been common practices among the population (Winterbourne 1967:41). Additionally, Burial A/Plot 3, a Culture II burial, was associated with a cairn possibly representing a ceremonial firepit into which offerings, such as a mortar, an awl, a projectile point, a steatite pipe, and an asphaltum-lined basket, were thrown; the mortar, pipe, and awl had all been broken or "killed" (Winterbourne 1967:43). Near that burial were three dog burials, which Winterbourne (1967:43), though expressing some skepticism as to the confidence of association, indicated might have been ceremonially killed as offerings to Burial A/Plot 3. Finally, Burial I/Plot 35 was the most elaborate burial recovered from Site A. Winterbourne (1967:44) provided the following description of Burial I/Plot 35, hypothesized to have been that of a shaman who achieved old age:

> The skull of I #35 was surrounded by three shells turned with the nacreous side toward the head. Just in front of the face a large abalone dish had been inverted perhaps over a food offering of seeds or meal. Three inches south of the Haliotis dish a fragment of deer tibia bone was found, broken at the middle, leaving a jagged edge at one end and the distal end of the bone at the other; over this was a large key-hole limpet shell. We feel this may represent the remains of a food offering . . . South of the Haliotis shell dish a slab of whale bone extended for thirty inches in much the same manner as a lining for this grave. At the southern extremity of the whale bone slab a stone crudely triangular in shape projected several inches above the bone. Whether this stone had any significance other than forming an extension to the bone slab is problematic. However, the thought that the stone might be symbolic of the dorsal fin, the slab of the body, and the Haliotis shell dish of the head of either the grampus whale or some other sea animal held sacred by these people, is not too far-fetched to consider. Associated closely with the food, was the only example of the right-angle elbow pipe that has come to my attention from this area.

A long steatite tube or pipe was discovered to the northwest of the whale bone in Burial I/Plot 35 and next to the arm bones. The steatite tube was unique in construction and might have had a use that was more ceremonial than utilitarian. Cut into the side of the pipe was an oval-shaped aperture, and associated with the pipe was a small, oval-shaped piece of schist. Winterbourne (1967:23) suggested that the shaman would, through simple sleight-of-hand, palm the schist fragment and slip it into the pipe through the aperture while sucking the illness out of the person. The schist fragment would be a visual representation of the illness and provide confirmation to the infirm that the shaman's ministrations were successful.

In addition to these burials, both human and dog, numerous other features, including three pits, one abalone pile, four possible pit houses, three possible hearths, one possible roasting pit, and random postholes associated with possible windbreaks were observed by Winterbourne (1967). Artifacts recovered from the site consisted of a variety of ground stone (e.g., metates, manos, awls, a maul, a pestle, bowls, and pendants), numerous flaked stone tools (e.g., drills, knives, scrapers, cores, a chopper, projectile points, and blades), a variety of utilized lithic artifacts (e.g., hammerstones, tarring pebbles, red ocher, a tested quartz pebble, wedges, a file, abraders, and a digging stone), worked shell (e.g., fishhooks; possible projectile points; pendants; and a variety of olivella, limpet, abalone, and giant-rock-scallop beads), and worked bone (e.g., awls, spearheads, barbs, a drill, and an antler punch).

Discussion and Conclusions

This summary of sites with burials dating from the prehistoric to the Mission period offers insight into the variability in burial patterns of Native Californians along the Southern California Bight. Unfortunately, in some cases (especially in pre-1970 excavations, such as those conducted by the WPA and ASA), the reporting was quite inadequate, and apart from cursory information on the presence of burials at sites, few details were presented. Regardless, the information offered in this chapter demonstrates that in earlier periods, deceased persons in the greater Los Angeles Basin were buried as individuals or placed within relatively small burial areas. In addition, although there were notable exceptions, the early residents of the region generally did not bury their dead with large numbers of burial goods. One exception to that rule was at the Irvine site (ORA-64), which was largely a Millingstone period site that contained a very large burial area that likely had in excess of 500 burials. However, because there was no report of the findings, the layout of the burials and mortuary patterns remains unknown. Burials appeared to be associated with rock cairns, for example, but it is unclear whether they date to multiple periods, whether that pattern was constant or changing over time, and so forth. It is clear, however, that the site was a major exception to the general pattern during the Millingstone period, when burial areas were small and burials contained few associated artifacts. By the late Millingstone or early Intermediate period, cremation began to play a role in burial practices. That change has been attributed to the influx of Takic groups, although a direct connection is not clear.

By the Intermediate period, burial patterns in the Los Angeles Basin were becoming more complex; larger numbers of people were buried in one location, at times with large numbers of grave goods or offerings. The Intermediate period appears to have been a time when proto–Mourning Ceremony features were beginning to become more common. The Landing Hill sites (especially ORA-263), as the locales for the burial of cremated human remains and burial goods for perhaps a millennium, are good examples of that. LAN-63 and LAN-64, sites in the Ballona, also offer good evidence of burials' being clustered, perhaps in family plots, and also of communal activities, such as the proto–Mourning Ceremony, associated with cremating and burying and/or memorializing deceased members.

Another change in burial practices occurred sometime during the Late period and into the Mission period. During those time periods (roughly the past 1,000 years, from A.D. 1000 forward), even larger burial areas developed. In some ways, those patterns were more like Chumash burial patterns, with dedicated burial areas. Of course, there were exceptions to that trajectory and the association of large burial areas with Chumash culture. Gamble and Russell's (2002) argument that Gabrielino/Tongva burials were typically individual or in relatively small groups relative to the larger burial areas of the Chumash was based on meager data from the Los Angeles Basin. Several sites in the Los Angeles Basin, including Yaangna, Encino Village, Sheldon Reservoir, and the ARCO site, suggest that the pattern of larger burial areas was becoming common. The burial areas not only appeared to contain large numbers of individuals but also were very compact in area; as more individuals were placed in the confined burial areas, older burials were commonly displaced and moved to the side, to allow room for a new burial to be placed. As a result, individual burial features tend to have a fair amount of disturbance and dislocation of grave goods. In several cases, burial areas appeared to be separated either vertically or horizontally by time period. In the case of Humaliwo, horizontally, there were two separate burial areas, one associated with the Middle period and one associated with the Mission period. Alternatively, in the case of the ARCO site, there were two distinct layers in the burial area in the same horizontal space, one dating to the Late period and one dating to the Mission period.

In the Chumash region, burial areas were associated with villages from at least the Middle period (generally corresponding to the Intermediate period in the Ballona area); that pattern appears to have begun in the Los Angeles Basin only during the last 1,000 years and perhaps even more recently, during the Protohistoric or Mission periods. The burial practices within the Chumash region have generally been better documented and more intensively analyzed and reported than those of the Los Angeles Basin. Mortuary patterns at several Chumash burial areas, including Humaliwo and Medea Creek, have suggested that there may have been an increase in the complexity and density of grave goods through time, perhaps reflecting an increased demarcation of social status between community members. For example, at both of those sites, as well as Calleguas Creek, there were some individuals with overwhelmingly disproportionate amounts of grave goods compared to the majority of burials (Gamble 2008:212). Gamble (2008:212–213) has also noted that at both the Humaliwo and Medea Creek burial areas, which date to roughly the same time periods, there were similar proportions of subadults (i.e., under the age of 12) with large quantities of beads (either shell or glass). She also noted that children and adults with large quantities of beads were buried close to one another, perhaps suggesting ascribed status and a ranked hierarchical social system. In their analysis of the Humaliwo burial area, Gamble et al. (2001) have suggested that, in addition, wealthier or higher-status burials were buried more deeply than the surrounding less-high-status burials; burial-shaft depth was related to the number of baskets family members could provide the grave excavator. The distribution of religious artifacts in the Middle period (which corresponds generally to our Intermediate period in the Ballona region) Humaliwo burial area also suggested social differentiation. Gamble (2008:214) suggested that effigies (mostly representations of fish assumed to be religious in nature) buried primarily with women may suggest that those buried with emblems of religious power are not generally buried with objects that represent wealth items (such as shell or glass beads). Gamble (2008:214) suggested that "political and economic power differed from religious power" and was probably controlled by different people. There also appears to have been an increase in the concentration of burials through time within more-tightly defined burial areas and a resulting increase in reburial and disturbance.

As a result, the data presented in this chapter have been used for comparison with the individual burials at LAN-54, LAN-193, LAN-211, and LAN-2768, as well as the complex burial area at LAN-62. This report is descriptive in nature and Volume 5, this series, discusses mortuary analysis. Burials and burial patterns offer keen insight into not only the individual and communal health and lifeway patterns but also questions about the community, including social organization, status, and political economy.

Burial-Related Field, Laboratory, and Analytical Methods

Patrick B. Stanton

Introduction

This chapter details the methods used to excavate and analyze the human remains and burials recovered from LAN-54, LAN-62, LAN-193, LAN-211, and LAN-2768 during the PVAHP. Although LAN-62 was divided into seven loci (Loci A–G), the only locus to yield human remains was Locus A. Thus, for this volume, any reference to LAN-62 is a reference to LAN-62 Locus A.

This chapter is divided into three sections: Field Methods, Laboratory Methods, and Data-Entry Protocol. The first section, Field Methods, presents the methods used during data recovery at the five sites. The second section, Laboratory Methods, discusses the methods used to analyze the human remains recovered from these five sites. These methods discussed include those used by SRI; those used by UCSB, who conducted the analysis in the early stages of the PVAHP; and those used by Bioarch, LLC, who conducted the dental analysis of the human remains recovered from LAN-62. The final section briefly details the data-entry protocol used by SRI personnel to transfer field and laboratory observations into a relational database.

Field Methods

LAN-62

SRI conducted data recovery at LAN-62 and exposed dense feature and midden concentrations in Locus A, beneath a thick mantle of redeposited fill. The data recovery was undertaken to mitigate adverse effects on the resource related to the construction of the Riparian Corridor—a native habitat and water-quality and storm-water-control system along the base of the Westchester Bluffs. The most salient of these is the dense Protohistoric/Mission period burial area in Locus A. LAN-62 was spatially divided into seven loci (Loci A–G) for management purposes; overall, it measured, as mapped, approximately 1.04 km^2 (258 acres) (Vargas 2003:117). The densest deposits were identified in Locus A, but subsurface portions of the site were present all along the bluff edge to the west in Loci B, C, and D. Overall, the site has a "mosaic pattern" of archaeological integrity, with patches of intact and heavily disturbed deposits (Vargas 2003:112) that probably reflect Hughes Aircraft Company's efforts to level the formerly undulating landscape in the area; many of the higher areas were probably truncated and removed during the leveling activities. The major focus of investigation was on Loci A, C, and G, and there were less-extensive excavations in the other loci. Overall, the data recovery excavations at LAN-62 exposed 600 features, including 374 human burial features and 226 nonburial features, the majority in Locus A. The dense cultural deposits in Locus A covered an area of nearly 700 m^2 and ranged up to 3 m in thickness in some areas. For detailed discussion of investigations at the site, please refer to Volume 2, this series.

A number of the nonburial features at LAN-62 Locus A were related to mortuary ritual and were concentrated in or near the burial area (Figures 6 and 7). In addition, no human burials were recorded at LAN-62 outside Locus A. Many of the human burials within the burial area in Locus A were associated with scattered and disarticulated bones from multiple individuals within the feature matrix, sometimes with a mix of thermally altered and unaltered remains. It appears that many of the earlier human remains in the burial area had been displaced or removed to make way for subsequent interments, resulting in a complex jumble of human bones within the discrete areas of individual features. Historical-period disturbances, most notably a farming trench constructed in the early 1900s, further displaced or removed the burials.

During and immediately after the excavations at LAN-62 Locus A, several discrete spatial contexts were defined, including the convex-hull area, the burial area, and Feature Blocks 3, 4, and 7 (see Figures 6 and 7); the focus of the data recovery in Locus A included these areas. The convex hull is a three-dimensional (3-D) analysis context that was created to identify the space around the densest concentration of human burials at the site—a mathematical mapping model used to bind the minimal space around points in vector space (in this case, human burials).

Figure 6. Site map of LAN-62, showing the locations of human-burial features and feature blocks.

Figure 7. Site map of LAN-62, showing the locations of nonburial features and feature blocks.

Long-term occupation has been documented at Locus A as starting in the early Millingstone period, during which prehistoric inhabitants primarily appeared to focus on subsistence activities. It appears that during the Millingstone, Intermediate, and Late periods, LAN-62 Locus A was a resource-procurement and residential area, likely for seasonal inhabitants. Beginning in the Protohistoric period, however, Locus A was rededicated as a formal burial area with a clearly defined interment area (possibly with boundary markers) and a well-defined locus of thermal mourning-ritual activities (e.g., burned offerings, such as baskets full of seeds) immediately to the west of the burial area. Locus A appears to have functioned as a mortuary-ritual complex through the Protohistoric and Mission periods, until sometime in the 1810s, based primarily on the glass-bead chronology. A small number of Protohistoric through Mission period nonburial features at LAN-62 located outside Locus A suggested subsistence-related activities, but such features were rare in Locus A. These few features, classified as domestic deposits, may have been discard areas for food and other debris generated during ritual ceremonies or feasts. The low density of Protohistoric through Mission period features and midden in Loci B, C, and D may indicate a sparsely used "liminal zone" (*sensu* Turner 1967) located between the domestic locus in LAN-211 and the mortuary-ritual complex in Locus A, which are roughly 1 km apart (see Volume 2, this series).

Excavation Methods

Excavation of the burial area at LAN-62 took place over a span of approximately 12 months. During that extended period of time, when field conditions were different from what was expected based on previous work in the area, the field methods were changed accordingly. For instance, a burial area that was much larger and denser than anticipated required an increase in the field-crew size. Detailed notes on individual burials and projectwide field memos documented burial-excavation methods through time. The field methods used at LAN-62 are detailed below.

The excavation crew consisted predominantly of archaeologists with varying degrees of experience and education. More than 20 human osteologists were employed by SRI to identify and recover human remains during the LAN-62 excavation, all of whom fulfilled or exceeded the requirements of the Secretary of the Interior's Standards and Guidelines for Archeology and Historic Preservation. All of the osteologists excavating the burials had a minimum of the B.A. degree, and most had attained (or were in the process of attaining) M.A. degrees with a specialization in biological anthropology. The use of osteologists in the field, rather than just in a laboratory setting, allowed for "real-time" analysis, which resulted in the minimization of damage to remains, reduction of misidentification, and maximization of observations, especially of fragmentary and fragile remains. In addition, 3-D noncontact digital scanning was performed by SRI personnel under the direction of staff from Mimic Studios, Inc., a firm specializing in applications of such technology. The osteologists were supervised by the author, who served as chief osteologist, and also assisted the scanning crew.

MLD Recommendations and SRI Protocols

Robert Dorame of the Gabrielino/Tongva Tribe of Los Angeles, California, was the MLD during the PVAHP and made several recommendations as to the treatment of human remains and burials recovered within the project area. These recommendations, which evolved over the course of the project, were incorporated by SRI personnel into the excavation and laboratory protocols. Protocols used for excavation of the LAN-62 burial area included the following:

- Implementation of an arbitrary 30-cm soil buffer (ARB-30) around identified human-burial features.
- No photographic documentation of human remains.
- The use of noncontact 3-D digital-scanning technology to document burial features and isolated human remains in both field and laboratory settings.
- No destructive analysis of human remains, including ancient DNA, radiocarbon, and stable-isotope analyses.
- No offsite analysis of human remains.
- No nonnatural, chemical stabilization methods for human remains, such as polyvinyl acetate or acryloid B-72.
- No flotation of burial-feature sediment.
- The use of containers composed of natural materials, such as cloth bags, for storing human remains.

General Administrative Protocol

Notification of the discovery of human remains was a crucial daily procedure. Regardless of whether a find was an intact burial or an isolated human bone, all instances of discovery were recorded for each provenience on the Human Remains Notification form. At the end of every day, SRI personnel would contact the MLD and representatives for Playa Vista, the NAHC, the Corps, and the City of Los Angeles Planning Department to apprise them of the number of newly discovered burials and isolated human remains.

General Excavation

Once a 1-by-1-m grid was constructed over the site, large, horizontal areas of LAN-62 were excavated in arbitrary 10-cm levels in order to identify activity areas and investigate the complex relationships between disarticulated, commingled human remains and intact burials. Human remains were identified, recorded, and recovered in a systematic manner to reduce damage from handling. When bone was encountered during the excavation, an on-site osteologist examined the remains to determine if they were human. If the remains were human, the area was carefully excavated to identify any additional remains and to determine whether the remains were isolated or part of a burial feature.

Furthermore, for all remains, observations on age, sex, pathological conditions, morphological variation, behavioral indicators, taphonomy, treatment, and, in the case of a burial feature, position, layout, orientation, and head facing were systemically recorded in a detailed manner. Most of the data were recorded in the field because of differential burial preservation. In some instances, however, remains were recovered with large amounts of surrounding matrix, to increase their stability during transportation for later study on-site. These remains were packed carefully, and many observations were postponed until remains could be examined in a stable, on-site laboratory-type environment.

Human remains, once collected, were generally placed in a cloth bag or, if too large for a bag, wrapped in a cloth, per recommendations by the MLD. Poorly preserved human remains of special scientific interest were carefully wrapped in cloth and placed in padded containers to prevent damage during transportation, inventory, and analysis. These remains were not treated with chemical consolidants, such as acryloid B-72 or polyvinyl acetate, in accordance with MLD recommendations.

Provenience Designations and Itemization

Burial features were normally identified within multiple units and levels. Initially at LAN-62, each portion of a burial feature within each 1-by-1-m grid unit was treated as a separate horizontal recovery space for each vertical level. SRI protocol required excavators to maintain these grid divisions within the feature boundaries and provenience materials accordingly. This resulted in several different provenience-designation (PD) numbers for each vertical level.

Very often, items in burial features were associated with multiple units or transcended different levels. During earlier excavations, if an item crossed a unit boundary, the PD number assigned to it was that of the level of the unit where most of the item was located. When the feature extended through multiple levels, the attributed PD number was that of the lowest level. For situations in which the item crossed both unit and level boundaries, the PD number associated with the lowest depth was assigned. During later excavations, multiple PD numbers were created for each vertical level excavated within a feature but not for multiple units in which the feature was identified. This change in procedure reduced the number of PD numbers assigned. Toward the end of excavation of the burial area, a less-complex system was used to simplify provenience further: a single PD number was used, regardless of level, for each burial and associated ARB-30.

In addition to a PD number, every artifact and human bone recovered from a burial feature was given a discrete item number. Initially, these were from a continual series of numbers for the entire feature, regardless of PD number. For the majority of burial features at LAN-62, a single series of item numbers was used for the entire burial feature, regardless of PD number.

ARB-30

During the excavation of initial burial features at LAN-62, only soil in direct association with each feature was collected. However, as the complexity of the burial area unveiled itself, an ARB-30 buffer was excavated around each burial to the extent possible. The purpose of the buffer was to ensure that all remains associated with a given burial were recovered with that burial. Excavation of the buffer was not required if a burial pit could be located, in which case the entire pit fill was included with the burial. Unfortunately, because of the high density of commingled remains and intrusive burials, only partial ARB-30 boundaries were possible; in most instances, burial features were bound by or overlapped other features on multiple sides.

Sediment-Collection Protocol

All sediment from burial features and associated ARB-30s from LAN-62 was collected in 5-gallon plastic buckets and dry-screened by hand through 1/16-inch mesh. Sediment associated with isolated human bone was dry-screened by hand through 1/8-inch mesh.

During the course of excavation, sediment from the abdominal regions of select burial features was retained separately for potential paleoparasitology studies. Only intact, well-preserved burial features were chosen for this sampling procedure. Each soil sample was placed in a cloth bag—in light of its proximity to human bone—itemized, and stored with the remains associated with the burial feature. Abdominal soil samples were taken from 26 burial features: Features 187, 210, 234, 256, 260, 267, 269, 277, 289, 300, 309, 311, 375, 396, 398, 412, 427, 438, 444, 459, 472, 481, 494, 500, 505, and 522.

Tracking System

LAN-62 produced thousands of individual artifacts and thousands of buckets of sediment. In order to track the immense amount of material collected, a bar-code system was introduced midway through the excavation of the site. Each bar code was unique and linked to a specific set of information in a relational database, including PD number, site number, feature number, and, ultimately, storage location.

Upon completion of a burial-feature excavation, a request was made for a series of bar codes for items and sediment. These bar codes, in addition to hand-written information, were placed on a tag on each bag and bucket. Although redundant, this information facilitated the tracking of all materials, with the ultimate goal of reducing errors and establishing a chain of custody.

Mapping

Each burial feature at LAN-62 was mapped. Most of the burial features were hand-drawn by an osteologist, illustrator, or archaeologist. In some cases, not only illustrations of the burial itself but also close-ups of individual elements with particular, unique characteristics were made. At LAN-62, the top and bottom depths of each artifact and skeletal element were recorded.

Some burial features were also mapped using techniques other than hand-illustrations. During the course of excavation at LAN-62, SRI instituted the use of noncontact 3-D digital-scanning technology to increase accuracy and map-production speed. When the archaeologists and osteologists had a burial feature ready for documentation, they would call the scanning crew. That crew would take a series of perhaps 10 individual scans from a single scanning location before moving to a new location. Usually, two or three set-ups were required for each burial feature. The numbers of set-ups and individual scans were based on the complexity of the burial feature. Total field scanning of each feature varied from about 30 minutes to 1 hour. After each scan set-up, the data were taken to an on-site computer laboratory so that processing could be done. Thus, scan processing was kept concurrent with scanning. Processing consisted of merging each individual scan, cleaning up the data, and printing a 1:2-scale plan map of the surface created from the *x*-, *y*-, and *z*-point cloud.

Many features were scanned multiple times as upper levels were removed, and the different levels could be assembled for more-detailed 3-D documentation. Additionally, because no chemical consolidates could be used to stabilize human-bone material, poorly preserved and extremely fragile skeletal remains of particular scientific interest were scanned at higher resolutions to provide acceptable images for later study. The friability of some bone made noncontact 3-D digital scanning crucial for complete documentation of the remains.

This scanning process, from the instigation of field scanning to the production of a paper map, took approximately 2 hours. The paper plan maps were then sent back out to the field, where they were placed on clear-plastic tracing boards. The field osteologists then traced, labeled, and annotated each bone element and artifact on a new sheet of paper. For many projects, that step would be unnecessary. In this instance, however, SRI needed a polygon outline of all mapped elements with their associated identification numbers so that the data could be entered into a geographic information system (GIS) model and linked with the extensive project database. GIS-based spatial analyses were necessary, because the archaeological record lacked visible grave indicators, and spatial inferences were required to resolve issues of integrity and associations for reinterment. Thus, the annotated paper maps were placed on a digitizing table, and the traced elements were hand-digitized into the GIS model and attributed with their identification numbers. SRI experimented with a number of techniques for the auto-vectorization of the 3-D scanned data, but we were unable to identify a method that produced the clean polygon results as quickly as hand-digitization. Approximately 125 in situ burials and a number of other features were documented using this method.

Paperwork

Several forms were used to record field and laboratory observations. Data and information related to skeletal analysis were collected and annotated with a high level of detail. All aspects of information regarding skeletal analysis were commented upon with a high level of detail. While in the field, each form evolved with the corresponding changes in field methods, to facilitate future data entry and to allow for efficient data collection. Clearly visible fields helped to ensure that all requested information was completely gathered in a standardized format.

The Human Bone Inventory (HBI) form was the main recording form used. This form summarized all information about a specific element or element set (e.g., cranium). Spatial information (e.g., PD number, test pit number, and level) as well as the name of the element, completeness, segment of the element, count, and analytical information (e.g., age or sex) were recorded. Information about remains recovered from each burial feature or, in the case of isolated remains, for each excavation unit/level was recorded on a separate HBI form. The organization of this form also played a crucial role during the data entry process. Because a large portion of the data was recorded in a single location, the information could easily be entered into the database.

Additional forms were adapted from those used by the Arizona State Museum and *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994) and altered to meet our requirements. Such alterations are discussed in the Recording Methods section below.

LAN-54, LAN-193, LAN-211, and LAN-2768

The following section details the excavation methods used to recover the human burials found during the excavation and monitoring of the mechanical stripping of LAN-54, LAN-193, LAN-211, and LAN-2768. These four sites are discussed together because of similarities in context and findings, which involved a few scattered burials at each site, in a simpler configuration.

Burial-Excavation Methods

Burials within the boundaries of LAN-193 have been identified twice, once in 2000 and again in 2005. In 2000, a single burial was found within the boundaries of LAN-193 during archaeological monitoring of a V-shaped trench constructed for storm-water mitigation. The burial was excavated by SRI archaeologists and was positively identified in the field as human by representatives of the Los Angeles County Coroner's Office. Maps were hand-drawn by the field crew and geospatially referenced using a series of mapping nails and a total station.

In 2002, the scheduled widening of Culver Boulevard prompted the archaeological monitoring of mechanical stripping within the street-widening right-of-way and the footprint of a recently removed structure at LAN-54. SRI archaeologists monitoring the mechanical stripping identified archaeological features and human burials. These burials were excavated by hand by professional archaeologists, and the task of positive identification of the burials fell upon representatives of the Los Angeles County Coroner's Office. Maps were hand-drawn by the field crew and geospatially referenced using a series of mapping nails and a total station.

In 2005, SRI archaeologists and osteologists monitored construction of the Riparian Corridor through LAN-193 and LAN-2768 to identify archaeological features and human remains and conducted data recovery and monitoring of construction of the Riparian Corridor through LAN-211. Upon discovery of a human burial during that activity, SRI personnel cordoned off a 100-foot-diameter area around the remains. No machinery was allowed to operate within the confines of that space. The remains were then covered with cloth and soil for protection from the elements while the appropriate notifications were made.

Once SRI personnel were permitted, excavation of the human remains consisted of several steps. First, the remains were exposed, to determine the extent of the burial. Careful attention was paid to associated cultural materials and pit identification. If a pit boundary was not identifiable, an ARB-30 boundary, as described above for the LAN-62 excavations, was excavated to ensure the recovery of all skeletal remains and cultural artifacts associated with the burial. Burials were mapped by hand and geospatially referenced with a total station. No photographs were taken of human remains, and no destructive analysis was conducted. In-field observations regarding osteological and archaeological information were recorded. The skeletal remains were placed in a cloth bag and stored for future inventory. Some skeletal remains were removed intact with the adherent matrix, to expedite the recovery process during the rainy season. These remains were examined later in a controlled onsite laboratory-type environment. Tracking bar codes were not used in the field but were retroactively added to artifacts and human remains recovered by the crew. Skeletal remains were stored in a secure location in the PVAHP area.

Soil associated with the burial and ARB-30 was stored in lidded buckets and dry-screened by hand through $^{1}/_{16}$-inch mesh. Screened burial and ARB-30 soil was saved for future reinterment. Windrows and areas of disturbance that might contain human remains were also dry-screened through $^{1}/_{8}$-inch mesh.

Laboratory Methods

The following section details the laboratory procedures used to analyze the human-skeletal materials recovered during the excavation and monitoring of the mechanical stripping of all sites associated with the PVAHP. As with the excavation methods, sites associated with similar laboratory protocols are discussed together.

LAN-2768 (2000 Excavation), LAN-193 (2000 Excavation), and LAN-54

Skeletal material recovered from LAN-2768 and LAN-193 in 2000 and from LAN-54 in 2002 was analyzed at UCSB by Phillip Walker and his students, following protocols established in *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994). Commingled bones were sorted, and human bones were given proper scrutiny. An inventory and extensive analysis were performed for the relatively complete skeletons from these three sites. The inventory included the identification of bone or bone type, side, segment, and completeness. Observations regarding the color of burned bone fragments (e.g., brown, black, or white) were also made. Each bone or bone type was separated and weighed. The number of individuals present was determined, and age and sex estimations were made. All possible cranial and postcranial metrical and nonmetrical observations were recorded. Metrical analysis was performed before washing the bones and loosening the hardened sediment. Finally, all elements were examined for evidence of skeletal and dental pathology and postmortem changes (taphonomy). Descriptive observations were recorded upon discovery of these conditions. For further information, please refer to Appendix A, this volume.

LAN-62, LAN-211, LAN-2768 (2005 Monitoring), and LAN-193 (2005 Monitoring)

Immediately following excavation of the burials at LAN-62, the remains were studied in a field laboratory, where quality assurance (QA) was conducted on the collected field data and to amend the field notes. During this postfield stage, osteologists worked together to clean excess matrix from the remains through $^{1}/_{16}$-inch mesh over a plastic container.

Particular care was taken to avoid mixing of proveniences. All material that did not pass through the screens was retained for hand-sorting. Most importantly, SRI recognized that matrix that passed through the screen was likely to include small particles of human remains; therefore, no matrix was discarded, and all of it was retained for each provenience. The crew worked closely with the QA team—which consisted of a group of crew chiefs and field technicians, the number of which changed based on immediate project needs—to make corrections in an efficient manner. Photocopies of all original paperwork were made, and laboratory observations were appended to these.

During the course of the laboratory phase for LAN-62, specific elements with particular pathological or other conditions of scientific interest were scanned using the same 3-D technology used in the field. These scans, however, were made at a higher resolution than the field scans. This allowed for the documentation of pathological conditions and morphological variation that could only be described or sketched in field notes because photographic documentation was prohibited. In addition to documentation, some crania—damaged from ground pressure and other taphonomic processes—were scanned and reconstructed in a 3-D environment, allowing more craniometric data to be collected. These techniques were not available during the laboratory phase of LAN-211, LAN-2768, or LAN-193, and particular conditions of skeletal remains from these sites were illustrated by hand.

The laboratory methods established for LAN-62 were also used for analysis of human remains recovered in 2005 from LAN-211, LAN-2768, and LAN-193.

Dental Analysis

Dental analysis of approximately 214 individuals from LAN-62 was conducted by professionally trained dental anthropologists. Selection of the population sample was based on quality of preservation and with the research objective of obtaining representative samples of the dentitions of children and adult males and females. The project's lead osteologist generated a master list of the burials with recovered dental remains, and age, sex, and level of burial integrity were noted for each. Individuals with high levels of integrity were considered primary candidates for dental documentation; those with moderate to low levels of burial integrity followed in importance. As expected, many individuals had moderate to low degrees of burial integrity, which necessitated inclusion of individuals from these categories in order to meet the sample-size goal. Sex identification was also a principal concern in the selection process, because equitable samples of male and female dentitions were desired for comparative analyses between the sexes. Multiple individuals were frequently recovered from a single burial feature at LAN-62. This necessitated the examination of all teeth from these individuals to ensure the proper assignment of teeth to each individual.

The dentition of each individual was assessed for all dental pathological conditions in the SRI field laboratory. However, only the permanent teeth of individuals aged 15 years and older were considered when determining the prevalence of carious lesions and other age-related dental pathologies. This "cut-off" age is used by many dental anthropologists, because it allows for some measure of exposure to daily food and activities that may be reflected in the dentition. The length of time that a tooth is present in the oral cavity (i.e., erupted) has bearing on that tooth's susceptibility to pathological conditions. The permanent dentition, excluding the third molars, has typically completed eruption by 12–15 years of age. Subadults were included in the PVAHP dental analysis but were essentially evaluated for their morphological dental traits.

When needed, a 10× hand lens was used to enhance observations. A number of pathological conditions were recorded, including carious lesions, enamel hypoplastic defects, abscessing, alveolar bone condition, calculus, and antemortem enamel chipping. Observations were also made for the ante- or postmortem loss of teeth and any dental anomalies. The criteria for the identification of dental pathologies presented in the *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994) were largely followed. Dental-wear patterns and degree of attrition were assessed according to the methods developed by Molnar (1971). In accordance with these methods, the lead project osteologist generated dental-recording forms that fully encompassed the range of potential pathological conditions. Documentation was performed via coding and written description.

The presence, absence, and degree of expression of dental morphological traits were recorded for minimally worn permanent teeth. Dental traits or characteristics include the number and size of cusps and roots, ridges, crenulations, and fossae. The traits were recorded following the written descriptions, cast representations, and recording-form content of the Arizona State University (ASU) Dental Anthropology System, a standard in dental anthropological protocol (Turner et al. 1991). The data collected during dental analysis were entered into the SRI database for osteology and dentition by SRI staff osteologists. These dental traits are believed to be genetically determined, quasicontinuous variables (Scott 1973; Scott and Turner 1997) useful in biological distance studies. Consequently, dental-trait data for populations can be used in affinity studies. In this type of analysis, dental-trait frequencies for a population are compared to those of other populations. These data are then used to assess biological relationships between the groups. This method of analysis has produced meaningful results regarding differentiation and groupings for populations at both regional and local levels (Greenberg et al. 1986; Scott 1973; Scott and Dahlberg 1982; Scott and Turner 1997; Turner 1969, 1986, 1998).

Recording Methods

The following information details the methodological underpinnings for osteological work at LAN-62, LAN-193, LAN-211, and LAN-2768. The volume of information available is very large, and the following discussion is meant as a brief summary of the types of data and major methods used to record these data, as relevant to the PVAHP. For further detailed information, please see the references cited in the text below. Additionally, the reader is directed to the glossary of terms provided in this volume.

Inventory

A detailed inventory was created for all the remains associated with each individual. That inventory consisted of basic information, including element type, side (if applicable), completeness, and segment of the recovered skeletal element. Options for completeness were as follows:

Complete: more than 75 percent of the element present
Partial: less than 75 percent but more than 25 percent of the element present
Fragment: less than 25 percent of the element present

Furthermore, because a burial area can be highly complex and may consist of commingled remains that can often be difficult to relate to one another, the methods used to determine associations between skeletal elements were recorded. For example, a mandible and a cranium found near one another might be determined to be from the same individual based on how close they were found to one another, similar demographic profiles, or even similar manners of treatment. Options for the determination method were as follows:

Age: refers to similar age
Sex: refers to similar sex
Metrical: metrical information appears similar
Proximity: remains found nearby and not in articulation
Redundancy: another element that is already represented has been found
Treatment: differing treatments of the remains (e.g., remains found with an inhumation)
Segment: portion of a fragment that was found to be in association
Articulation: bone found in direct articulation or in anatomical position

These associations were further qualified by quality of determination, which consisted of definite, inferred, or indeterminate, and assignment was based on the degree of confidence for the methods used to make that determination. For instance, articulated remains were always considered a definite association, whereas remains with other methods of association were almost always considered inferred, unless circumstances suggested otherwise.

Osteometrics

For this project, the standard 34 cranial and 44 postcranial measurements described by Moore-Jansen et al. (1994:49–72) were collected. Nonstandard measurements were collected if cases arose that warranted their collection. Standard osteometric equipment was used, such as spreading and sliding calipers. Because an osteometric board was not available, a set of 65-cm sliding calipers that are accurate to 1 mm were used. Osteometric data collected for the individuals recovered during the PVAHP can be found in Appendix B, this volume.

Because the small number of human-skeletal remains recovered in 2000 and 2002 were analyzed by Dr. Phillip Walker's team prior to the implementation of the methods developed during the excavation of LAN-62 and used thereafter, the reader is directed to Dr. Walker's reports and findings, which are presented in Appendix A, this volume. The data presented in these appendixes are not duplicated in the other appendixes because of differences between some recording protocols. These reports include information pertaining to osteometric, dental, epigenetic, and paleopathological observations.

Osteometric information was collected for a variety of reasons. Measurements of long-bone lengths, particularly of the femora, were used for estimation of stature, whereas craniometric information was the key factor in the assessment of group affiliation. Furthermore, many specific standard measurements can be used as supportive data for sex determination.

Age Determination

A variety of indicators was used to estimate the skeletal ages of the remains from each of the five sites in the PVAHP. These included cranial-suture closure, pubic-symphyseal- and auricular-surface topographic changes, dental attrition, dental and skeletal development, and, to a lesser degree, degeneration of joint surfaces and age-related proliferative bone growth. All available methods were considered, and the age ranges were estimated from these observations. Each method used to estimate the age of an individual, however, has its own inherent flaws and biases, which can often result in widely divergent estimations. In such circumstances, only the more-accurate methods were used. Appendix C, this volume, contains all nonmetrical age-specific information recorded for the individuals recovered during the PVAHP. Osteometric data used to estimate the ages of juveniles can be found in Appendix B, this volume.

For situations in which preservation limited the number of observable traits, a specific age range could not be reached, and it was more feasible to assign a relative age range for the individual. For the PVAHP, seven relative age ranges were used:

fetus (–0.75–0 years), infant (0–2 years), child (2–12 years), subadult (12–17 years), young adult (18–34 years), middle adult (35–50 years), old adult (50–99 years), and adult (18–99 years). In order to maintain consistency within the database, in which years was the recorded unit, time spent in utero was converted from months into negative years. Furthermore, 99 years was used as the upper limit of attainable age. Unfortunately, because of problems inherent with the basic methods, accuracy in estimating the ages of older individuals suffers. With younger individuals, methods used to estimate age are based on development sequences that are fairly consistent. In regard to older individuals, however, many methods are based on rates of degeneration, which can be extremely variable. Methods exist that can yield more-accurate age estimates for older adults, but they are either destructive or require special equipment that either was not available or was opposed by the MLD, such as radiograph (i.e., X-ray) machines.

Cranial-Suture Closure

Many elements of the cranium articulate with one another at relatively fixed joints, known as sutures. Initially, the sutures are open, zipperlike gaps between the bones. As the individual ages, however, the cranial sutures will begin to fuse, or obliterate, from the inner surface to the outer surface and form a single bone (Bass 1995).

Closure of the cranial sutures was recorded for four areas: endocranial, ectocranial vault, ectocranial lateral anterior, and palatal. Endocranial sutures are the representations of the sutures on the inner surfaces of crania, whereas ectocranial sutures are the external representations of sutures. Palatal sutures are sutures associated with the hard palate.

Locations on the four areas were scored using the following scale (Meindl and Lovejoy 1985):

0 open
1 minimal closure
2 significant closure
3 suture is obliterated

For ectocranial sutures, if the cranium was intact, a composite score was generated when the scores for each location were totaled (including seven locations for ectocranial vault and five locations for ectocranial lateral anterior) (Meindl and Lovejoy 1985:Tables 6 and 7). This composite score is associated with an age range. Unfortunately, the crania were commonly fragmented or exhibited obscured observation points. In such circumstances, the estimated age ranges were based on the series of ranges generated by calculating the age of each individual point (Meindl and Lovejoy 1985:Table 3).

Endocranial- and palatal-suture closures were based more on descriptions of suture-closure sequences from each method (Acsádi and Nemeskéri 1970:117–118; Mann et al. 1991). For ease in recording and data entry, the same scale used for the ectocranial-suture closure was used. The scores, although they do not correlate to a specific age range for these areas of suture closure, provided a means of quantifying the pattern of closure observed for an individual.

Pubic Symphysis and Auricular Surface

The terminal surface for each innominate near the midline of the body on the anterior, or ventral, surface is the pubic symphysis—each innominate articulates with its antimere at that point. The auricular surface, on the other hand, is the half of the sacroiliac joint located on the innominate. As an individual advances in age, fibrocartilage that covers these surfaces becomes less elastic, and the underlying bone becomes more irregular as a response to the stresses placed upon that connective tissue (Lovejoy et al. 1985:16–17; Meindl et al. 1985:36).

Generally speaking, each of the pubic-symphyseal and auricular surfaces moves from a billowy surface with much topography to an irregular surface with a comparatively lower relief, increased porosity, and nodules of bone growth. Although many procedures have been developed for estimating age from the pubic symphysis, for the purposes of this study, the Suchey-Brooks scoring system was used, as detailed in *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994:Figures 7, 8, and 13). For estimation of age from the auricular surface, the method established by Lovejoy et al. (1985) was followed.

Dental Attrition

Rate of dental attrition can prove to be a valuable asset when assessing the age of a given individual, especially if that individual is associated with an archaeological population. Once a tooth has fully erupted and occludes with the tooth on the opposing dental arcade, the hard enamel surface of the crown begins to erode during masticatory and paramasticatory activities (e.g., processing plant fibers or hide). In addition, abrasive materials that are inherent to food, such as phytoliths, and that are added during the processing of the food, such as grit from stone surfaces and sand from the environment, will increase the rate of attrition. The majority of population studies for indigenous California groups discuss at length degrees of attrition and rates of dental wear (Kerr et al. 2002; Molnar 1971; Walker 1978; Walker and Erlandson 1986; Walker et al. 1996).

A description of the attrition of the occlusal surface of each tooth was recorded using the methods described by Smith (1984:45–46) and Scott (1979:214). The descriptions were then used to quantify observations for estimating the age of an individual, and populations from the Santa Barbara Channel area served as models for comparison (Walker 1978). Because there is a lack of large Gabrielino/Tongva comparative populations, a Chumash comparative population was used, especially because that population exhibits a similar coastal subsistence pattern and geographical territory. During the dental analysis, a second method for scoring the dental attrition was used. That method, developed by Stephan Molnar (1971), is slightly more involved than the Smith and Scott methods, because it scores not only the occlusal wear but also the form of the tooth and the direction of wear.

Dental and Skeletal Development

Age determination for younger individuals involved the timing of dental development and the eruption and growth, development, and fusion of skeletal elements. In regard to dental development and eruption, Ubelaker's (1989:Figure 71) dental-eruption sequence was sufficient. For sequencing of epiphyseal fusion and growth of the skeletal elements, Scheuer and Black's (2000) *Developmental Juvenile Osteology* was consulted extensively.

Joint Degeneration and Bone Proliferation

Several bony responses can occur as an individual ages. Although many of these have already been detailed, two less-accurate responses were also used as supporting evidence. Observations of the degeneration of joint surfaces were recorded. Essentially, the cartilage that protects the articular surfaces of the bone can erode until the two surfaces are no longer protected, permitting bone to slide against bone in a phenomenon known as osteoarthritis. As a result, joints can appear pitted, deformed, sclerotic, and highly polished (eburnated) (Rogers and Waldron 1995:43–44). In addition to erosion, soft tissue, such as ligaments, tendons, and cartilage, can ossify, as is seen with costal cartilage and osteophytosis (Rogers and Waldron 1995:20–26; Stewart and McCormick 1984).

Although both of these responses can occur as a result of aging, other factors, such as sex, genetic predisposition, trauma, and pathological conditions, must be also considered (Rogers and Waldron 1995:Figure 4.1). This is especially important because these observations are also often used as behavioral indicators (Capasso et al. 1998). Because of the multiple associated factors, these conditions should be used only as supportive data when other, more accurate information is available.

Sex Determination

Estimation of sex was based on numerous nonmetrical and metrical traits. Most of the nonmetrical traits were standard observations, as described in *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994:Figures 1–4). These included observations of morphology of five cranial traits and five pelvic traits: observations on the nuchal crest, the mastoid processes, the superorbital margins, the glabella, and the mental eminence for the cranium and the ventral arc, subpubic concavity, ischiopubic ramus ridge, greater sciatic notch, and preauricular sulcus for the os coxae. Appendix D, this volume, contains all sex-specific information recorded for the individuals recovered during the PVAHP.

In addition to these, parturition scars (also known as dorsal pubic pitting) were also recorded. Parturition scars are depressions of varying size and depth located on the dorsal surfaces of the pubic bones of females and are believed to be morphological characteristics linked to the stresses of childbirth and pregnancy. However, one must be cautious in using the magnitude of parturition scars as an assessment of the number or difficulty of births. Snodgrass and Galloway (2003:1229) found that although these scars do exhibit a strong correlation to increasing numbers of births ($p < .01$), especially in younger women, for women older than 50 years, parturition scars display a correlation with body mass index ($p < .05$) and are not significantly correlated with the number of births.

Osteometric information was used to support nonmetrical observations. Many measurements—particularly the maximum vertical diameter of the humeral head, the maximum diameter of the femoral head, and the epicondylar breadth of the humerus—can display strong sexual dimorphism and were crucial for the overall assessment (Stewart 1979; Thieme 1957). One must use caution, however, when applying methods developed using vastly different (culturally and temporally) populations, because it has been demonstrated by Meadows-Jantz (1996) that skeletal remains are highly sensitive to secular trends.

Stature

Although it is important to apply the correct stature formulae to a given skeletal population, examples of stature formulae for a specific population can be extremely rare. Stature was calculated using Genovés's formulae for stature estimation among Mesoamericans, because of all available formulae, these were based on a reference population most closely matched to the native population of southern California (Genovés 1967:Table 14). Stature was estimated based on the length of the femur. These associated formulae are as follows (MaxFemL = maximum femur length):

Male: Stature (in cm) =
$2.26(\mathrm{MaxFemL}) + 66.379 \pm 3.4170$
Female: Stature (in cm) =
$2.59(\mathrm{MaxFemL}) + 49.742 \pm 3.816$

Additionally, the living height of the individual was estimated by further subtracting 2.5 cm from the results of one of these formulae (Genovés 1967:Table 14). The reason behind this seemingly counterintuitive procedure is related to the sample population. The statures of cadavers, which were used to develop the stature formulae, have been found to be consistently greater than the living statures of the corresponding individuals (Genovés 1967:69). Trotter and Glesser (1952:512) have found that increase to be approximately 2.5 cm. Stature was calculated from the maximum length of the left femur, unless absent, in which case the right femur was substituted. Thus, the hierarchy used to select femora to calculate stature was left, right, possible left, and possible right. Stature was calculated only for individuals with estimated sex.

Pathology/Trauma

The literature regarding paleopathology is extensive and highly specialized. Because the expressions of some diseases are very similar, diagnosis of a given condition can be problematic. Thus, for many paleopathological conditions, detailed descriptions were required. These descriptions were generally recorded as case studies or as parts of the descriptions of other conditions.

Osteophytes are common bone growths that occur along the margins of joints or joint surfaces and are strongly associated with aging (Rogers and Waldron 1995:25). Although the prevalence of osteophytes on the skeleton of an individual increases with age, these areas of proliferative bone growth can also be associated with a wide variety of pathological and traumatic conditions, such as osteoarthritis and seronegative spondyloarthropathies. Because of the problematic and nonspecific nature of osteophytes, they were not systematically recorded for later analysis.

Appendix E, this volume, contains all pathological information recorded for the individuals recovered during the PVAHP.

Dental Pathology

Observations concerning dental pathological conditions can yield important information about diet, cultural practices, and health (Hillson 1998; Scott and Turner 1997). These observations primarily consist of the quantification and description of any calculus, carious lesions, antemortem enamel chipping, abscesses, enamel hypoplastic defects, and periodontal disease. These observations were initially made by osteologists and were later supplemented by the dental anthropologist (see the Dental Analysis section above). Appendixes F–H (this volume) contain all dental information recorded for the individuals recovered during the PVAHP.

Calculus is composed of mineralized plaque and trapped food (Hillson 1998:255). The location and degree of calculus formation were recorded based on Brothwell's method for scoring calculus deposition, as reprinted in *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994:Figure 28).

The most-well-known dental pathological condition is carious lesions, most commonly referred to as "cavities." Dental carious lesions are not simply areas on a tooth where the enamel, dentine, or cementum has been destroyed. They are instead a progressive oral disease that may spread to adjacent teeth and radically affect the overall dental and physical health of the individual (Mandel 1976; Tanzer 1995). Carious lesions are dark-brown and black lesions that occur when acids, generated as bacteria process sugars, begin to destroy the enamel, dentin, and cementum of a tooth (Hillson 1998:269, 276–279). For each carious lesion, the size, location, and pulp-chamber exposure (PCE), as well as whether it was located on interproximal tooth surfaces, was recorded.

Antemortem enamel chipping, which can result from activities such as breaking hard objects with the teeth, was recorded in much the same way as carious lesions, with descriptions of size and location.

An abscess is an infection of the alveolar bone and can occur when bacteria is introduced through an opening, such as an exposed pulp chamber from carious lesions, breakage, or dental attrition, or as a result of periodontal disease (Roberts and Manchester 1997:50). The type, location, and level of healing were recorded.

Enamel hypoplastic defects occur when the crown formation is disrupted as the result of a variety of stressors, such as malnutrition and illness, and their appearance can range from lines to pits (Hillson 1998:165–167). Enamel hypoplastic defects are typically present on the paired teeth of the same dental arch (e.g., maxillary canines and maxillary lateral incisors) and are generally in the same location. These defects are caused by a disruption in the enamel-formation process of a tooth and may reflect a single episode or a chronic condition of metabolic disturbance or environmental stress during childhood (Ensor and Irish 1995; Goodman and Armelagos 1985; Rose et al. 1985). The type of enamel hypoplastic defect and the location from the cementoenamel junction was recorded. However, current methods for determining the age at which the stress occurred were not used, because of problems inherent with those methods (Hillson 1998:172, 175).

Periodontal disease is the bony response to severe gingival inflammation from trapped bacteria between teeth, soft tissue, and bone (Roberts and Manchester 1997:56). It can lead to antemortem tooth loss as the ligaments responsible for tooth stability weaken and the bony crest surrounding the tooth begins to resorb (Hillson 1998:260; Ortner 2003:593). For periodontal disease, descriptions of the affected teeth were recorded.

Observations on dental morphological traits were also recorded, using Turner et al. (1991) for the adult dentition and Hanihara (1961) for deciduous dentition. Dental morphological traits can be found in Appendix F, this volume.

In addition, antemortem tooth loss and other defects or pathological conditions were identified and described.

Behavioral Indicators

Behavioral indicators refer to skeletal markers—which include proliferative bone growth, degenerative surfaces, dental attrition, developed muscle attachments, and trauma—that suggest that the individual habitually engaged in an activity or a set of similar activities. Thus, one must consider each marker separately and in relation to patterns expressed by other indicators. In addition to pathology information, Appendix E, this volume, contains all behavioral indicators recorded for the individuals recovered during the PVAHP.

This interplay allows for the development of hypotheses regarding daily activity, occupation, and idiosyncratic behavior. Unfortunately, behavioral indicators usually cannot pinpoint an exact activity or occupation, for a variety of reasons, such as nondiagnostic bony responses to activity and differences in how individuals perform activities. However, they can suggest a range of environments that could replicate such patterns. The *Atlas of Occupational Markers on Human Remains* was used as the main source of information for description and identification of the behavioral indicators observed (Capasso et al. 1998). With the exception of osteoarthritis and dental-wear patterns, behavioral indicators were only recorded anecdotally on an individual-by-individual basis during this project.

Epigenetic Variation

Every skeleton is different. Throughout the life of an individual, the skeleton radically metamorphoses as the forces of genetics, biology, and the environment act with and react to one another, ultimately culminating in a unique structure. One expression of this uniqueness is variation in the form and structure of skeletal elements. Considered minor anomalies and glossed over by researchers for more than 200 years, these variants, known as epigenetic traits, have been the subject of serious research for approximately the last 50 years, and research by Berry and Berry (1967) discussing epigenetic variation in the human cranium has acted as a springboard for later research (Hauser and De Stefano 1989:1). Some of these studies, which number in the hundreds today, are works by Gamble et al. (2001), Geelhoed et al. (1969), DeLaurier and Spence (2003), Howell and Kintigh (1996), Slavec (2004), and Suchey (1975), just to name a scant few. For additional information, Hauser and De Stefano (1989:245–287) presented a fairly exhaustive cross-section of literature associated with cranial epigenetic traits in their bibliography. The minutiae regarding the development of the research in this field, however, is beyond the scope of this volume. For further information, the reader is urged to consult Hauser and de Stefano (1989:1–2) for a more detailed synopsis about the history of research in epigenetic variation.

For any given epigenetic trait, there is a "liability" that the trait will appear in the skeletal remains of a population (Hauser and de Stefano 1989:6). This liability, represented as a normal distribution, includes not only the individual's own genetic predisposition to develop the trait but also all other factors, such as environment, sex, or age, that might positively or negatively affect the probability of displaying that trait (Hauser and de Stefano 1989:6–7). Associated with the liability are one or more thresholds, which represent expressions of the epigenetic trait (Hauser and de Stefano 1989:Figures 1c and 2a).

The analysis of epigenetic traits for a population can yield useful information. Hauser and de Stefano (1989:9–14) discussed several avenues of research regarding these traits, including (1) variations within a population, including differences in sex, age, symmetry, laterality (the frequency of unilateral traits that occur on one side more than another), and intertrait associations; (2) adaptativeness (how trait frequencies are affected by environmental changes); (3) variations between populations; and (4) medical relevance.

Data were collected on human variation as observed on the remains. Twenty-four standard epigenetic traits were recorded for each set of remains, per *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994:87–92). Definitions of these traits were acquired from Buikstra and Ubelaker (1994:87–92) and Hauser and De Stefano (1989). Nonstandard traits were recorded, with descriptions, under the osteological profile for each individual. Appendix I, this volume, provides a summary of all epigenetic observations.

Taphonomy

Although it is important to make observations on the skeletal remains themselves, it is of equal importance to understand the forces that directly impacted those remains. Thus, observations also were made regarding condition, preservation, discoloration, and mechanisms of disturbance (Schiffer 1987). Appendix J, this volume, provides a summary of all observations on taphonomy.

Additionally, when burned bone was discovered, both coloration and any characteristics of thermal modification on the bone were described. Coloration was recorded based on the following six-point scale:

0 unburned
1 burnished or partially blackened (external surface blackened but center of bone still unburned)
2 completely blackened
3 grayish blue or brown, partially calcined (external surface calcined but center of bone blackened)
4 completely calcined
5 differential (different portions of bone exhibited different coloration)

Each burned bone was given an overall score. Because there was a possibility that more than one color could be exhibited on a bone at any given time, an option for differential burning was available. Recording of bone color in this manner allowed for a more-fine-tuned approach than a three-point scale that only describes unburned, blackened, and calcined bone, and potential patterns became more apparent. Appendix K, this volume, provides a summary of all observations on burned bone.

Furthermore, characteristics of the bone resulting from contact with a heat source, such as longitudinal, transverse, and curvilinear cracks; presence of carbonized tissue; and patina, allow for differentiation between bone that was burned dry, green, or fleshed (Buikstra and Swegle 1989). This distinction is extremely important when determining a cremation vs. an incidental burning.

Mortuary-Analysis Recording Methods

Ritualistic activities surrounding death can be very complex. Ostentatious displays of wealth; ritualistic destruction of utilitarian, symbolic, and decorative items; meaningful placement of artifacts within a grave; and specific configurations of body layout and orientation are but a few behaviors that can be observed. For each burial feature, a series of observations were recorded to help reconstruct and compare mortuary behavioral patterns between components of the site with other components within and between sites. These observations included burial type, treatment, position, orientation, direction of head facing, burial integrity, and articulatory integrity. Appendix L, this volume, provides a summary of all mortuary observations.

Burial type: Four burial types were described during the PVAHP: inhumations without incidental burning, inhumations with incidental burning, cremations, and partial cremations.

Treatment: This category refers to a particular body layout—extended, fully flexed, or partially flexed—and describes the context (primary or secondary) in which the remains were discovered.

Position: For each burial, the position of the individual was recorded as supine, prone, seated, or on the left or right side.

Orientation: The cardinal (north, south, east, or west) or intercardinal (northeast, northwest, southeast, or southwest) direction toward which the main axis of the individual was oriented, from foot to head, was recorded.

Direction of Head Facing: The direction to which the individual was facing was recorded. These directions included cardinal and intercardinal directions as well as up and down.

Burial Integrity: A four-point ordinal scale was used to describe how much of each burial remained intact. The points on the scale included high (more than 75 percent of the burial remained intact), medium (75–50 percent of the burial remained intact), low (50–25 percent of the burial remained intact), and none (less than 25 percent of the burial remained intact).

Articulatory Integrity: Using a scale similar to that of burial integrity, articulatory integrity was used to quantify the remaining articulation of each individual. The interplay of burial and articulatory integrity helps to fine-tune observations on burial type, as well as to describe the appearance of the remains, and allows for observations regarding the order in which the burials were interred.

Data-Entry Protocol

Concurrently with the LAN-62 field and laboratory work, an extensive relational database was constructed in anticipation of the data-entry phase of the PVAHP. To help ensure that this process went smoothly, the structure of the database was largely based on the organization of the forms used to collect the data. Additionally, because of the nature of the information, data entry was done by professional osteologists, to ensure accuracy. Once the data were entered, they underwent QA procedures. The human remains recovered from LAN-2768 and LAN-193 during the 2000 data recovery and from LAN-54 in 2002 were not entered into the database, because of differences in recovery protocols. However, data from the burials recovered from LAN-2768 and LAN-193 during the 2005 monitoring and from LAN-211 in 2005 were entered into the database.

Conclusion

As stewards of the past, archaeologists have an imperative duty to record their findings in a thorough, responsible, and respectful manner. From start to finish, the excavation and analysis of human remains recovered from the PVAHP were complex endeavors undertaken with the utmost levels of care and respect. Because of the complexity of the LAN-62 burial area, new methods were adopted, and old techniques were modified with novel approaches, to ensure clear and precise data collection, management, and transmission through all levels of the project.

Chronological Relationships

Patrick B. Stanton, Andrew M. Bean, Robert A. Heckman, and Kelly L. Jenks

Introduction

This chapter will detail the chronological relationships identified between the burial features recovered during the PVAHP as well as the relationships between burial and nonburial features specifically related to the burial area identified at LAN-62. Because of the level of complexity, number of burials, and broad time range, this chapter is focused on LAN-62. The first section details the construction of the Feature Relationship Empirical Diagram (FRED) and includes information on design, research goals, and the implementation of the FRED in the PVAHP. Following that section is a brief discussion regarding temporally sensitive artifact categories used during the creation of the FRED. The final section addresses research questions regarding the formation of the burial area.

Application of the FRED Matrix to LAN-62

This section details the development and use of the FRED at LAN-62. It includes information regarding basic research goals, construction, and implementation.

Research Goals at LAN-62

Some of the key research goals proposed for this site include establishing the chronological relationship between outlying burials (especially those in the northeast portion of the burial area) and the main burial ground and distinguishing historical and prehistoric period burials. Secondary research goals of the project were to use biological features, mortuary goods, and other feature attributes to identify possible social or biological groupings among the burials.

In order to address these research questions, first one must be able to capture the spatial and sequential relationships among the burial features. The complexity of the site made it difficult to capture these relationships using standard tables and sites maps. To ease this process, SRI developed a process for incorporating feature-relationship data into its relational database and diagramming these data using graph visualization software. To establish the chronological placement of different features in a given sequence, SRI developed a process for mapping independent feature data (in this case, chronological data) onto the labels of the feature nodes in the diagram. This same method can be used to incorporate other sources of feature attribute data, including osteological and artifactual, onto the diagram to aid in the identification of temporal, biological, and social groupings.

FRED Background

SRI created the FRED to serve as an exploratory tool for identifying and defining relationships between features at LAN-62. The inspiration for the FRED was the Harris matrix (also known as the Winchester seriation diagram), developed in the 1970s by Edward Harris in Winchester, England, to illustrate the complex stratigraphic sequences encountered in urban archaeological sites (Harris 1979). The Harris matrix is a directed graph that draws on the laws of archaeological stratigraphy to diagram the sequential relationships among the different stratigraphic contexts at a site (Figure 8 shows a hypothetical archaeological sequence). Early contexts are represented at the bottom of the diagram, late contexts are represented at the top, and archaeological contexts whose sequential relationships cannot be determined via direct observation of site stratigraphy are plotted at the same level. The Harris matrix does not include higher-order groupings, such as features or structures, but interprets all distinct contexts as stratigraphic units. An example of a Harris matrix is given in Figure 9, illustrating the relationships among the strata (Strata I–IV) and features (Features 1–5) in the hypothetical archaeological sequence depicted in Figure 8.

The appeal of the Harris matrix for this project was that it enabled us to visualize and interpret sequential relationships between the numerous and often overlapping burial features at LAN-62 (Appendix O, this volume). The limitations of the

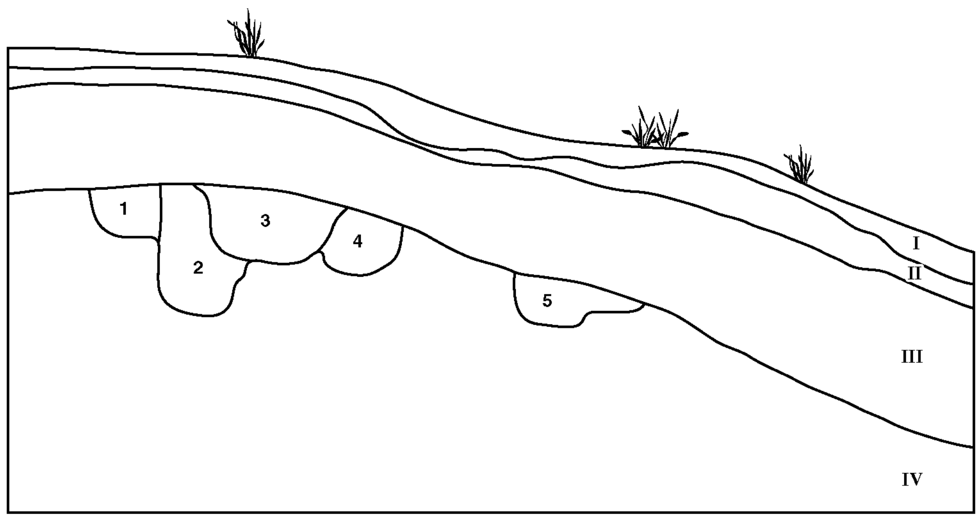

Figure 8. Illustration of the hypothetical archaeological sequence among the strata (Strata I–IV) and features (Features 1–5) at LAN-62.

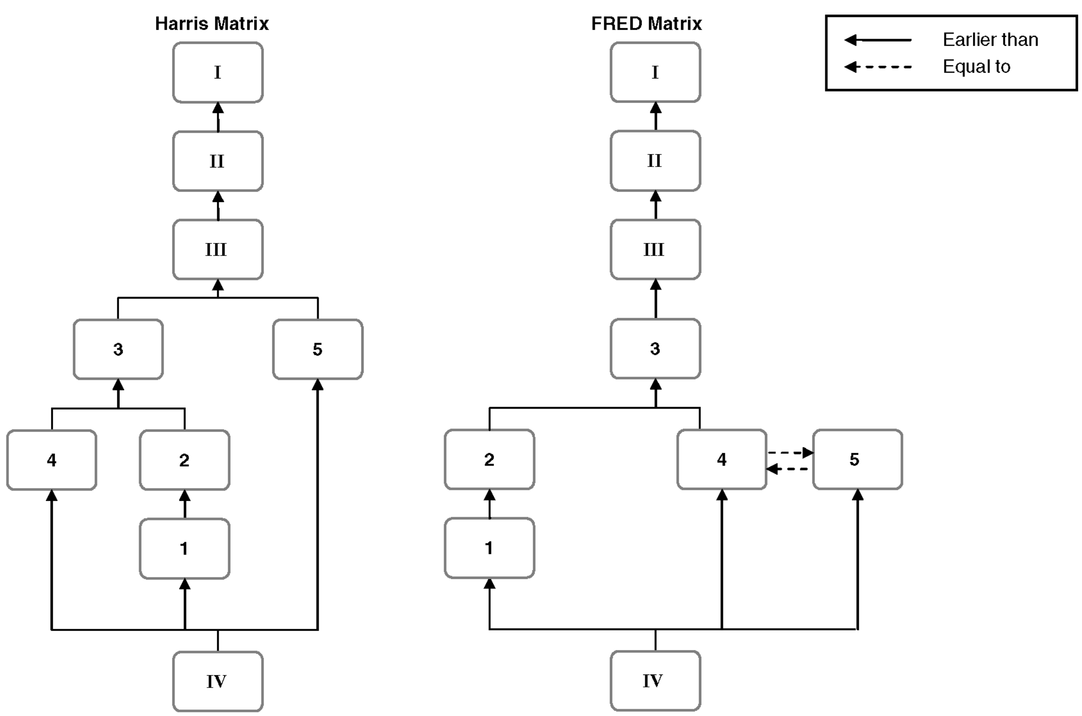

Figure 9. Comparison of the Harris and FRED matrixes.

Harris matrix, however, are that it fails to distinguish certain kinds of units (e.g., burial features), and it organizes these units only on the basis of observed stratigraphic relationships. Failure to distinguish certain units can be dealt with easily by distinguishing strata and features and defining the kinds of relationships that exist between the two. Organization of these units based on stratigraphic relationships poses a greater problem, however, as it limits the interpretive power of the matrix at a site like LAN-62, where many of the features were dug into the same stratum, and many cannot be relatively dated solely on the basis of superpositioning. Relative dates for these features may be obtained by drawing on other data sources (e.g., diagnostic materials associated with those features); however, the Harris matrix does not provide a mechanism for incorporating these data.

FRED Development and Methods

We addressed the limitations of the Harris matrix by developing a new matrix (FRED) that defines the relationships between features and strata, describes how these determinations were made, and allows users to draw on independent sources of data to refine the placement of features when the stratigraphic relationships are unclear. For example, in the profile depicted in Figure 8, Features 3 and 5 both originate in the boundary between Strata IV and III; however, because the two features do not come into direct contact, it is not possible to determine the relative ages of the two features by means of direct observation. Accordingly, the Harris matrix (see Figure 9, left side) depicts Feature 5 in its own branch below Stratum III and above Stratum IV. Yet, supposing that we know that Features 4 and 5 both contain refitting fragments of a broken *comal*, we can infer that Feature 5 is contemporaneous with Feature 4 and thus predates Feature 3. The FRED allows us to refine the Harris matrix by illustrating both physical and inferred relationships (see Figure 9, right side). The following section describes the process of constructing the FRED.

Data Collection

The FRED is generated from project data recorded in a relational database—especially those data that describe feature relationships (Table 6). The first step in defining feature relationships within this database is to identify temporal relationships between the feature in question and another stratigraphic context (feature or stratum). Relationships are tracked in one direction (from earlier to later); thus, a given feature can be defined as earlier or equal to a separate feature/stratum, or the feature/stratum can be defined as earlier or equal to the separate feature, but the feature cannot be described as later than the feature/stratum. Relationships also can be classified as indeterminate. The features or stratum in question are selected from a mutually exclusive look-up table containing all of the features and strata for the site (in this case, LAN-62). Stratum boundaries are recorded as distinct strata; thus, a look-up table for the example in Figure 8 would include Features 1–5, Strata I–IV, and Stratum Boundaries IV–III, III–II, and II–I.

Once a relationship has been defined in the relational database, the user is prompted to record whether this relationship was determined by direct observation or by inference. Direct observation, which refers to the observed physical relationship between two stratigraphic contexts, provides the most-reliable sequential evidence and thus takes priority. The type of observed relationship is selected from a mutually exclusive look-up table that includes intrusive, containing, and abutting feature-to-feature relationships and intrusive, originating, and terminating relationships between features and strata (see Table 6).

If, as in the hypothetical case of Feature 5 in Figure 8, it is not possible to determine the relationships between features via direct observation, it may be possible to infer a relationship using other feature data. If the user defines an inferred relationship between features or strata, they are asked to select one or more sources for this inference from a look-up table (see Table 6). Possible sources include independent dates (e.g., archaeomagnetic dates), relative dates (e.g., seriated ceramics), contemporaneous objects (e.g., refitting *comal* fragments), and spatial relationships. Table 7 presents the feature-relationship data for the hypothetical example presented in Figure 8. In this example, Feature 5 is defined as "equal to" Feature 4 by an inference drawn from the lithic assemblage of those features. One can refer to the lithic assemblage data to see that both features contained refitting fragments of a *comal*.

FRED Construction

The FRED matrix draws on data recorded in the relational database to populate the diagram. The matrix is constructed in the following steps:

1. Stratum to Stratum – earlier than
2. Feature to Stratum – equal to and Stratum to Feature – equal to
3. Stratum to Feature – earlier than
4. Feature to Feature – earlier than
5. Feature to Feature – equal to

Step 1 establishes the relative ranking of the various strata that include features. The first or oldest stratum is placed at the bottom, and later strata are placed above one another in sequence. Step 2 adds features that are equal to (i.e., originate in) a given stratum. Step 3 defines features that postdate the strata, giving those features a higher rank. Thus, if Features 1 and 2 both are defined as equal to Stratum IV and earlier than

Table 6. Field Names and Variable Types for Attribute Recording

Field Name	Variable Type
Project Data	
Project name	Project name
Site name	Playa Vista unique identifier
Feature name	Playa Vista site unique identifier
Feature Relationship	
Date	Entered automatically
Relationship type	Look-up table (select 1): Feature to feature/ Feature to stratum/ Stratum to feature
Feature/Stratum 1	Look-up table (select 1): list of features/strata from site
Relationship position	Look-up table (select 1): Earlier than/ Equal to/ Indeterminate/ Holds
Feature/Stratum 2	Look-up table (select 1): list of features/strata from site
Determination method type	Look-up table (select 1): Direct observation/ Inferred
IF direct observation:	Look-up table (select 1):
Determination method value	IF feature to feature: Intrusive to feature/ Contains entire feature boundary/ Abuts feature IF feature to stratum/stratum to feature: Originates in stratum/ Terminates in stratum/ Originates at stratum boundary/ Intrusive to stratum
IF Inferred:	Look-up table (select 1 or more): Arcmag, Ceramics, Human Spatial, C14, Lithics, Faunal
Chronometric Data	
Glass bead phase	Glass bead phase number
Shell bead date min	Starting date of shell bead manufacture
Shell bead date max	Ending date of shell bead manufacture
C14 episode 1	C14 dating episode 1 number
C14 episode 2	C14 dating episode 2 number
Historic artifacts	Yes/No
Lithic projectile point	Type and date range of temporally diagnostic lithic projectile point
Lithic *comal*	Yes/No
Lithic material	Type and date range of temporally diagnostic lithic material
European domesticate	Yes/No
Historic based on Harris matrix placement	Yes/No
Color Code Data	
Temporal period	Look-up table (select 1): Prehistoric (blue) Protohistoric (green) Historical (yellow) Indeterminate (orange)

Table 7. Example of Feature-Relationship Data

Relationship Type	Feature/ Stratum 1	Relationship Position	Feature/ Stratum 2	Determination-Method Type	Determination-Method Value
Feature to stratum	1	is equal to	IV/III boundary	direct observation	originates at stratum boundary
Feature to stratum	2	is equal to	IV/III boundary	direct observation	originates at stratum boundary
Feature to stratum	3	is equal to	IV/III boundary	direct observation	originates at stratum boundary
Feature to stratum	4	is equal to	IV/III boundary	direct observation	originates at stratum boundary
Feature to stratum	5	is equal to	IV/III boundary	direct observation	originates at stratum boundary
Feature to feature	1	is earlier than	2	direct observation	intrusive to feature
Feature to feature	2	is earlier than	3	direct observation	intrusive to feature
Feature to feature	4	is earlier than	3	direct observation	intrusive to feature
Feature to feature	5	is equal to	4	inference	lithics
Feature to feature	4	is equal to	5	inference	lithics

Stratum III, then the two features are assigned the same rank within Stratum IV. Steps 4 and 5 further refine the diagram by allowing one to define sequential and equivalent relationships between features in a given stratum. Relationships are depicted using solid directed lines for sequential ("earlier than") relationships and dashed directed lines for equivalent relationships, both beginning with the first/earlier feature and ending on the second/later feature. If there are inconsistencies in the ways that any of the preceding relationships are defined—for example, if Feature 3 is defined as equal to Stratum IV and Feature 4, and Stratum IV is defined as earlier than Feature 4, the error will be revealed in the diagram and appropriate steps can be taken to fix the mistake.

As constructed above, the FRED illustrates the relationships between features and strata at a site. In the case of LAN-62, the diagram demonstrated that most of the features were present within a single stratum, thus the relationships between features and strata had much less interpretive value than the relationships between features. In order to capture the feature -relationship data and improve the visual coherency and interpretability of the matrix, we created a new matrix ("No Strata" FRED) to illustrate only those relationships that occurred between features (Steps 4 and 5).

Visualization Software

Our data needs, i.e., displaying feature-to-feature relationships without constraining them to a stratum, surpassed the capabilities of basic Harris matrix programs. As a result, we chose to use a more general tool: Graphviz Graph Visualization Software. Although several graph layout programs are available through Graphviz, only one program, "dot," was used during this analysis. We chose to use an older version of this program (2.12) because, at the time of our analysis, there was an apparent bug in the current stable version (2.20).

The dot program makes hierarchical or layered drawings of directed graphs. The layout algorithm aims edges in the same direction (top to bottom or left to right) and then attempts to avoid edge crossings and reduce edge length (Graphviz 2009). Input to the dot program consisted of a formatted text file that defines the feature relationships using data drawn from the relational database. For example, the following was used to define features in a stratum:

{rank = same; "II/I"; "527\nRock Cluster"; "534\nRock Cluster"}

As another example, the following was used to define one feature as earlier than another:

"527" → "492";

The file creation follows naturally from the relational data structure. We have a feature table listing every feature. We also have a feature-relationship table listing the first feature, the second feature, and the relationship position (e.g., "earlier than" or "equal to"). The database output simply places a solid arrow between the first feature and the second feature for all "earlier than" feature relationships and a dashed arrow between the first and second features for all "equal to" relationships.

Independent Data

Once the known feature relationships are defined using the feature-relationship data, other pertinent data relating to those features can be retrieved from elsewhere in the relational database and included on the feature's node label. For example, the "Chronology FRED" draws on chronometric data (see Table 6) that are stored separately in the relational database to add labels to the nodes of features where a value exists for the particular field. The "Color Temporal FRED" makes temporal relationships more obvious by color coding the feature node according to whether they were defined as prehistoric, Protohistoric, historical, or indeterminate. Osteological data likewise can be displayed on the diagram; for example, "Osteo FRED" generates one line of data for each individual within a burial feature. These independent data only affect the feature node labels; the placement of the nodes within the diagram is determined exclusively by the feature-relationship data.

FRED Feedback and Future Potential

In many cases, it may be possible to refine the feature data based on connections seen in the diagrams above. For example, if we created a "Chronology FRED" for the example in Figure 8 and, in the process, added the line "GB = 4" to the node for Feature 1, indicating that this feature contained glass beads from the fourth phase of the glass-bead sequence (see Chapter 6, Volume 3, this series), then we would know that Feature 1 dated to the historical period. As a result, we could return to the database and enter "historical" into the "temporal placement" field. Then, if we created a "Color Temporal FRED" for the same data, the node for Feature 1 would be displayed in yellow to indicate that this feature dated to the historical period. Looking at the new diagram, it would be obvious immediately that Features 2 and 3, which postdate Feature 1 on the diagram, must also date to the historical period. Thus, we could return to the chronometric data and indicate that Features 2 and 3 are "Historic based on Harris matrix placement" (see Table 6).

Over time, it also may be possible to use FRED to refine artifact seriations. For example, the glass-bead sequence mentioned above was independently corroborated by the burial sequence at LAN-62 most of the time. Further investigation into the remaining cases may prompt changes in the glass-bead sequence or in our interpretation of the artifacts' associations with those burials.

Diagnostic Artifacts

Although much of FRED is based on feature relationships, this section details the main categories of temporally sensitive artifacts. This context includes relative frequency and distribution of these temporally diagnostic artifacts in the burials excavated during the PVAHP.

Shell Beads

Use of shell beads in California by aboriginal groups stretches back several millennia. For instance, olivella shell beads have been recovered in the southwestern Great Basin and demonstrate evidence for long-distance trade as early as 10,000 years ago (Fitzgerald et al. 2005). Over the course of these many thousands of years, bead style, as well as the type of materials used, changed and diversified. In some instances, change was fleeting, and a specific bead type might have only been used during a short period of time, whereas in other cases, a bead type might have been more ubiquitous throughout the course of history.

Several bead chronologies have been developed. James Bennyhoff and Robert Heizer (1958) created one of the first shell-bead chronologies using data from the Great Basin. Some years later, Bennyhoff and Richard Hughes (1987) refined the earlier chronology and expanded its scope to include California. Several years later, Chester King (1990b) published a specific typology and chronology of olivella beads and other types of shell beads from a wide variety of Chumash sites. Robert Gibson (1992) subsequently reclassified California bead types on the basis of much more complete data.

During the analysis of shell beads recovered from PVAHP, some 84 types of beads derived from 9 different shell types were identified, with associated date ranges starting at ca. 5500 B.C. and extending into the historical period. Furthermore, as detailed in Chapter 3, Volume 3, this series, 70 of these 84 different shell-bead types were identified in burial features, in addition to olivella and other shell beads of unknown type. More than one-half (55.5 percent) were identified as semi-ground disks, followed in decreasing frequency by olivella disk class (12.7 percent), bushings (7.0 percent), olivella beads of unknown type (5.6 percent), and red abalone epidermis disks (4.5 percent). Frequencies of shell beads ranged widely from a single bead to more than 6,600 beads recovered from a single burial feature. For further information regarding the specifics of the bead types, the reader is directed to the discussion on shell beads in Chapter 3, Volume 3, this series.

Glass Beads

Because glass beads were introduced by Europeans into Alta California, their presence is assuredly temporally diagnostic. Chapter 6, Volume 3, this series, details four periods associated with glass beads in Alta California. These include Protohistoric (A.D. 1500s–1769), early–middle Spanish Colonial period (A.D. 1769 to the mid-1820s), Late Spanish Colonial and Mexican Rancho period (A.D. 1820s–1840s), and the American Settlement period (A.D. 1850s to the late nineteenth century). The glass beads recovered from LAN-62 were identified as being manufactured between the late eighteenth century A.D. and the 1810s, which corresponds to the early Spanish Alta California colonial period and from which Ross seriates four phases of beads (see Chapter 6, Volume 3, this series).

Historical-Period Artifacts

As with glass beads, numerous manufactured goods ranging from the mundane and utilitarian (e.g., nails and belt buckles) to the more esoteric and rare (e.g., horse tack and guns) were also introduced by Europeans to the native population in Alta California. For this analysis, only the presence of these artifacts was recorded.

Old World Domesticates

Carbonized plant remains can provide valuable insight into the chronological placement of deposits, based on the types of seeds recovered. The recovery of domesticated-crop seeds from sediments at PVAHP sites provided strong evidence of postcontact occupations, because Native Californians did not have domesticated crops prior to Spanish contact. For example, the recovery of both Old and New World domesticated crops from particular deposits at LAN-62 and LAN-211 was firm evidence that these specific deposits date to Protohistoric or Mission period. Seeds of domesticated plants recovered from LAN-62 included *Cicer* cf. *arietinum* (chickpea), *Pisum* cf. *sativum* (garden pea), *Hordeum vulgare* (cereal barley) and *Triticum* cf. *aestivum* (bread wheat). The Spanish brought all of these Old World domesticates into California during the Mission period, and they cultivated them in the missions. There is little to no evidence of Native Californian populations cultivating these crops outside the missions. Instead, Native Californians were often paid for their labor and service in grain, which was then brought back to their villages for storage and consumption.

Lithic Artifacts

The introduction of new lithic technology or the use of specific material types during the manufacture of stone tools can be strongly correlated with individual temporal periods. This section details the temporally diagnostic lithic artifacts and materials recovered during excavations at the PVAHP and their significance in estimating specific date ranges for burials recovered during the PVAHP. For more-detailed information regarding the material culture of the PVAHP sites, please refer to Volume 3, this series.

Projectile Points

Although projectile point types can be associated with particular periods of time and the introduction of bow-and-arrow technology that occurred during the early Intermediate period in the Ballona, the presence of diagnostic dart and/or arrow point types cannot be a secure indication of temporal occupation (as previously discussed in Chapter 2, Volume 3, this series). The presence of both dart and arrow points in the same burials at LAN-62, as well as evidence of reworking and the observed material types, implies that in many cases, dart points were heirlooms or otherwise curated objects that predated the burials and thus could not be used as indicators of the period of interment. John Johnson (personal communication 2012) has questioned whether some of the projectile points identified as darts may have functioned as harpoon points, given the evidence of marine-environment exploitation by the native inhabitants of the Ballona. For details on the criteria for determining that these points were darts rather than harpoons, see Volume 3, this series.

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* (see Figure 36, Volume 3, this series) recovered during the PVAHP were all manufactured of steatite and found only in the following contexts: Feature Block 1 at LAN-211 and the LAN-62 burial area (burial features, nonburial features in the convex hull, and convex hull units), mourning feature (Feature Block 3), and Level 60 of Collection Unit 323.

Ethnographically, among the Chumash, *comales* were used for cooking tortillas as well as for toasting wheat, corn, and chia (Hudson and Blackburn 1983:196–197). It is important to note that *comales* were always 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. The *comales* themselves do not appear to have been brought by the Spaniards, who generally used iron griddles, or accompanying Native American groups from Mesoamerica or the Southwest, who typically used ceramic *comales*. The Spanish word *comal* is derived from the Nahuatl *comalli*. Thus, the *concept* of making tortillas on *comales* was introduced. Chumash terms for *comales* were the same as the names given to boiling stones (Hudson and Blackburn 1983:196–197), suggesting that the technology evolved from traditional cooking utensils.

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 replacing Coso obsidian during this time.

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). In this region, fused shale originates at Grimes Canyon and Happy Camp Canyon in Ventura County, as well as Lompoc in Santa Barbara County (Demcak 1981; Hall 1988). Grimes Canyon is located roughly 62 km (or 38 miles) north of Playa Vista. Fused shale likely was imported to Playa Vista as finished tools, because it was represented as projectile points and biface reduction flakes.

Obsidian Butte, located in Imperial County 277 km (or 172 miles) to the south of Playa Vista, lies between 40 and 70 m below sea level. It was unavailable when Lake Cahuilla was present during parts of the Late and Historical periods, with the last three submersions of the source occurring between A.D. 1200 and 1700 (Laylander 1997:64–68; Love and Dahdul 2002; Waters 1983; Wilke 1978:57). Artifacts from Obsidian Butte appear to have been exchanged down the line as complete tools.

What is noteworthy about the PVAHP sites is that artifacts made from fused shale and Obsidian Butte were recovered from Millingstone through Intermediate period deposits. This is contrary to the expectation of Coso dominating these earlier temporal periods. At the PVAHP sites, Coso obsidian tools dominate subsequent to the Intermediate period and through the end of the Late period. By the Mission period, as distance exchange waned between the coast and inland eastern Sierra Nevada sources (including Casa Diablo, Mt. Hicks, and Coso volcanic field) (Jackson and Ericson 1994:397), Obsidian Butte artifacts began to dominate assemblages in San Diego County (Hughes and True 1985). At Late period sites within Orange County, an increase in the use of fused shale (Demcak 1981; Hall 1988) as well as Obsidian Butte material (Koerper et al. 1986:53) has been documented.

At the PVAHP sites, particularly at LAN-62, Obsidian Butte was dominant during the Millingstone and Intermediate periods and then was replaced by Coso obsidian. However, fused shale persisted through the Historical period at LAN-211. Therefore, it appears that, instead of Obsidian Butte glass, fused shale was being 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).

Artifact Association

During the course of writing the burial feature descriptions, the question of what artifacts could be considered in association repeatedly arose. The complex nature of the burial area, with numerous disturbed and intrusive burials, often made assessment of association difficult. Artifacts, especially glass and shell beads, were often found scattered throughout the matrix. Thus, only artifacts clearly in association (e.g., a shell-bead necklace found around the neck of an individual), were used to determine the age of a burial feature. All other artifacts were described, but their temporal significance was diminished.

Radiocarbon Dating

In total, 98 samples recovered from LAN-62 were submitted for radiocarbon dating, including 90 from Loci A/G and 8 from Loci C/D. Only seven burial features from LAN-62 were dated using the radiocarbon-dating method. Most of these samples consisted of individual marine shells, including abalone, olivella, scallop, oyster, venus clam, littleneck clam, and Pismo clam. Other dated materials included bone gelatin (artiodactyl), soil humates, and charred seeds (barley and canarygrass). Because of the complexity of the site, sample submission occurred in several rounds over the course of 5 years, and the results obtained from each round guided sample selection for subsequent round(s), including the contexts targeted, the number of samples selected from those contexts, and the materials submitted for dating. The specifics of these samples and the results of the analyses are discussed within the context of the two primary areas investigated at the site: Loci A/G and C/D.

Use of FRED as an Analytical Tool

Visualization of the burial area at LAN-62 through the use of the FRED helped us explore the history of the burial area and to answer a number of questions regarding the development of the site through time. A full version of the FRED can be found in Appendix M, this volume.

Temporal Groups

As previously mentioned, absolute and relative chronometric data associated with artifacts were used to place burial and nonburial features recovered from the burial area at LAN-62 into a dynamic matrix. Because of spatial relationships observed both in the field and during the data entry process, researchers were able to infer potential date ranges for features without clear chronometric data. Through direct and inferred means, researchers were able to place the burial and nonburial features recovered from LAN-62 into four groups: Mission, Protohistoric, prehistoric, and indeterminate. Using these methods, 72 burial and 24 nonburial features were identified as being from the Mission period. All of the features associated with the Mission period were located in the southwestern portion of the burial area, in a relatively discrete, approximately 6-by-8-m area (Figure 10). Nonburial features associated with the historical-period mourning features associated with Feature Block 3 were located in a cluster within 5 m west of the burial area.

Fifty-three features were identified as prehistoric, based predominantly on their presence within the lower strata (i.e., Strata I–III). Because of difficulties in assigning these features to specific episodes identified within the strata, they were placed in a broader temporal category (prehistoric) instead of more-refined categories, such as the Late or Millingstone period. Unlike Mission period features, however, far more prehistoric features were nonburial features (n = 49). Only 4 burial features were identified as prehistoric. The majority

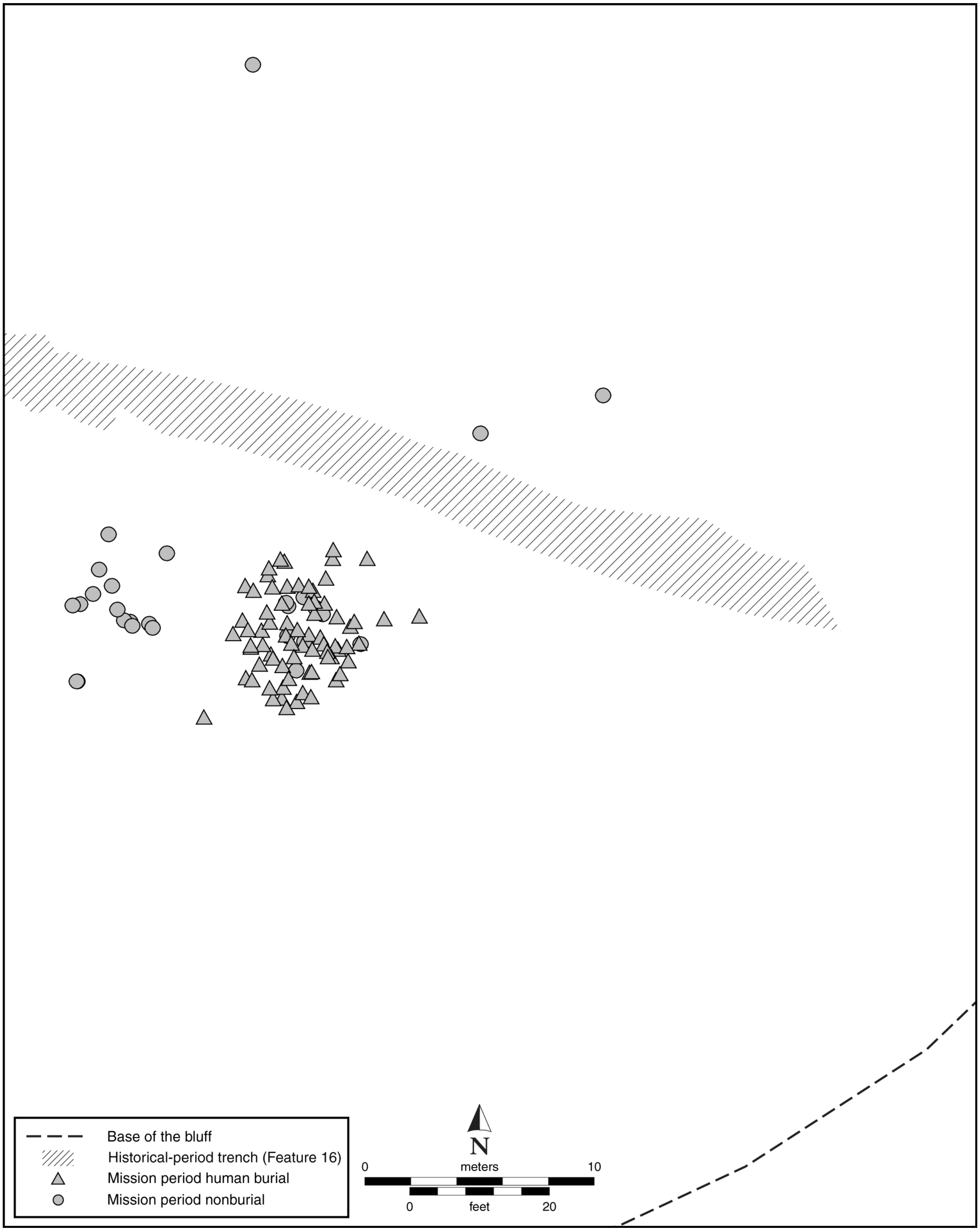

Figure 10. Distribution of Mission period burial and nonburial features at LAN-62.

of the prehistoric features were scattered in the burial area, and the 4 burial features were located either in the northernmost portion of the burial area or in the northern and eastern portions of the denser burial concentration along the southern edge of the historical-period trench (nonburial Feature 16) (Figure 11).

Comparatively fewer features were identified as Protohistoric (one nonburial and one burial). The burial was located immediately north of the historical-period trench (nonburial Feature 16), whereas the nonburial feature was located approximately 20 m northwest of the main burial area (see Figure 11).

Unfortunately, for the remaining 297 burial features and 175 nonburial features, no specific temporal period could be assigned using the rather conservative criteria and observations presented here. This was largely because of a lack of temporally diagnostic artifacts and feature-to-feature relationships, especially for the numerous discrete and scattered burial features to the north of the historical-period trench (nonburial Feature 16). A synthesis of burial chronology and temporal placement in the Ballona, based on an expanded method that was able to attribute more burial features to specific time periods, is discussed in Volume 5, this series.

Subgroup Models

The identification of subgroups within the complex burial area associated with LAN-62 helped to answer specific questions regarding the site formation, using small groups of closely related burial and nonburial features. Two subgroups were selected (Figure 12).

Subgroup 1 (Figure 13), located in the southwestern portion of the main burial area, consisted of eight burial features. This subgroup encompassed an approximately 2-by-2-by-0.70-m area with at least four layers of burials. Each burial feature in this subgroup was dated to the Mission period, specifically between A.D. 1800 and 1816.

Subgroup 2 (Figure 14) was located in the south-central portion of the main burial area and consisted of six burial features. As with Subgroup 1, each burial feature in this subgroup was dated to the Mission period, specifically between A.D. 1800 and 1816. This subgroup encompassed an approximately 2.0-by-1.0-by-0.7-m area with at least four layers of burials.

Changes in the Burial Area

One of the primary research questions regarding the PVAHP burial area was how the burial area at LAN-62 had changed over time. Because of the limited chronological information, dense burial concentrations, and often poor feature preservation, this question was very difficult to answer.

As previously mentioned, prehistoric features were scattered throughout the main burial area in the lower strata. These features were primarily associated with domestic activity (e.g., hearths) with a small number of isolated burials interspersed throughout; this trend has been observed at other sites in the PVAHP and elsewhere through southern California. At this point in time, individuals clearly were being interred close to where the inhabitants were living. Either LAN-62 was not a centralized burial ground for the region, or cultural norms at the time did not necessitate one.

At some point, however, use of the site changed from domestic to ceremonial. Unfortunately, it is unclear when or why this change occurred because of ambiguities in the data set and an inability to seriate features accurately. In fact, few features, burial or otherwise, were identified as being associated with the Protohistoric period.

The Mission period burial features were concentrated in the southwestern portion of the burial area. Based on glass-bead phase information, this concentration appears to have formed in a rather patchwork fashion, with burials associated with each subsequent glass-bead phase overlying a diffusely scattered layer of burials (Figure 15). In short, there did not appear to be particular concentrations of burial features from a particular phase.

Of particular interest are the feature-to-feature relationships observed in Subgroup 1. Normally, one would expect that shallower features would be more recent than features found at greater depths. Even with intrusive features, such as burials, this pattern held true for all but one feature at the site. This model appeared to have flipped in regard to Subgroup 1. The temporally earlier burials (e.g., burial Features 6–8) were actually encountered closer to the surface than the later burials. These earlier burials had been partially disturbed by later inhumations, which had been placed, in some instances, up to 0.5 m deeper. At the Humaliwo site (LAN-264), a correlation was found between depth of burial and amount of "wealth"; i.e., deeper burials were hypothesized as associated with higher status (Gamble et al. 2001:206). In this particular example, however, burial Features 13 and 90, which had some of the greatest concentrations of artifacts (e.g., nearly 2,500 shell beads and 1,400 shell beads, respectively), were found at mid-elevations in this subgroup. (For a rigorous analysis and discussion regarding social groups and aspects of social order within the Protohistoric through Mission period burial features at LAN-62, see Chapter 6, Volume 5, this series.)

Of Mass Graves and Epidemics

One of the most devastating epidemics during the Mission period was a diphtheria epidemic occurring between 1800 and 1802, which was believed to have started at Mission San Gabriel and spread to the Chumash (Castillo 1999). Several other epidemics—diphtheria, measles, typhoid, and influenza—ravaged Mission Santa Bárbara between A.D. 1785 and 1835 (Walker and Johnson 1992:Figure 3). These epidemics might have also affected the occupants of the Ballona Wetlands.

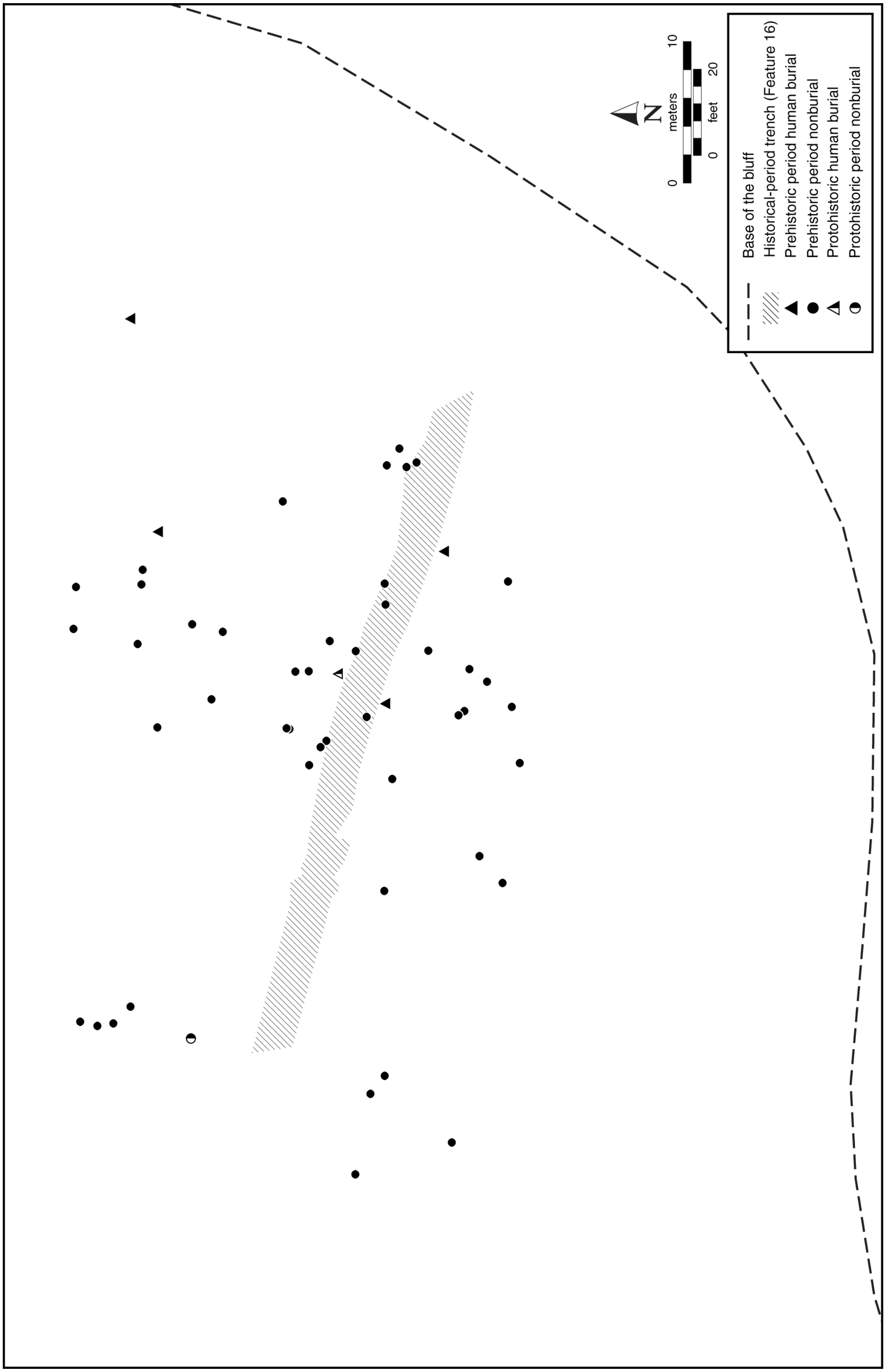

Figure 11. Distribution of prehistoric and Protohistoric period burial and nonburial features at LAN-62.

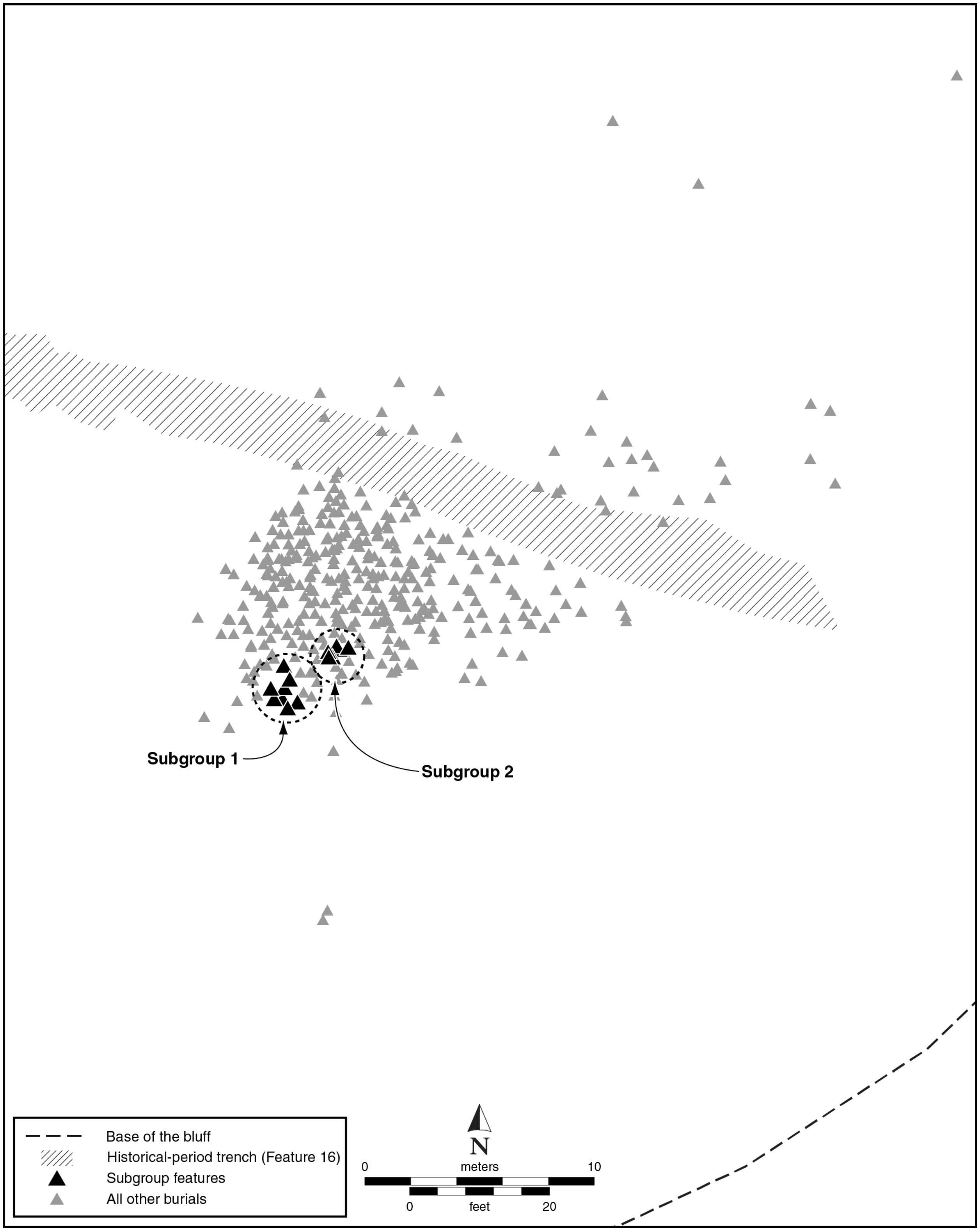

Figure 12. Locations of the two selected subgroups in the burial area at LAN-62.

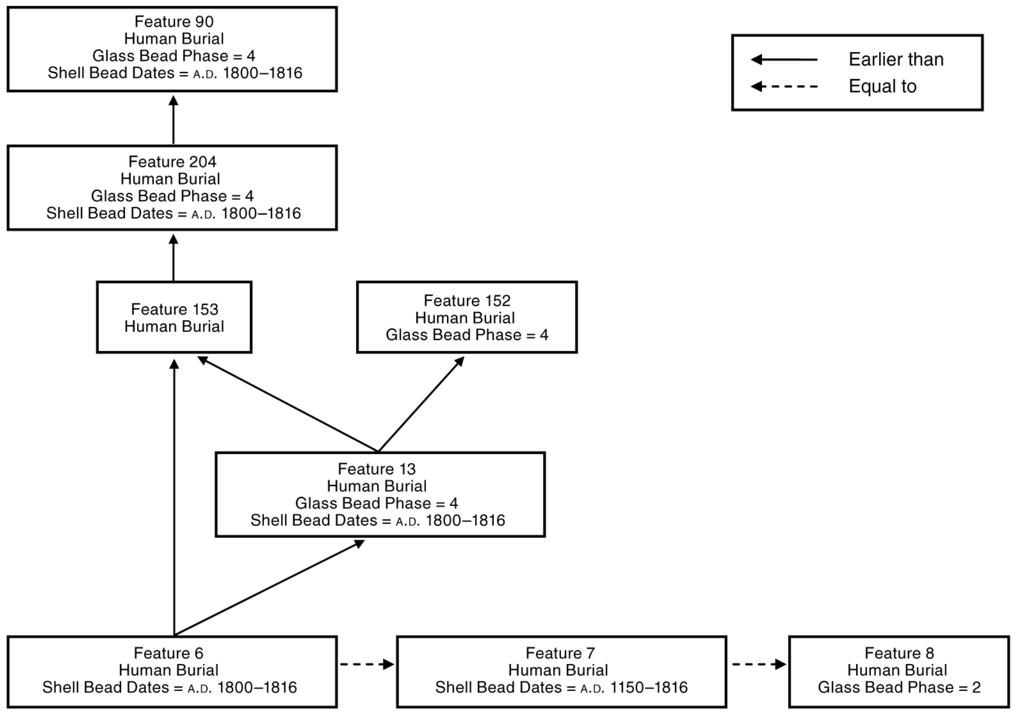

Figure 13. Chart of the feature-to-feature relationships in Subgroup 1 at LAN-62.

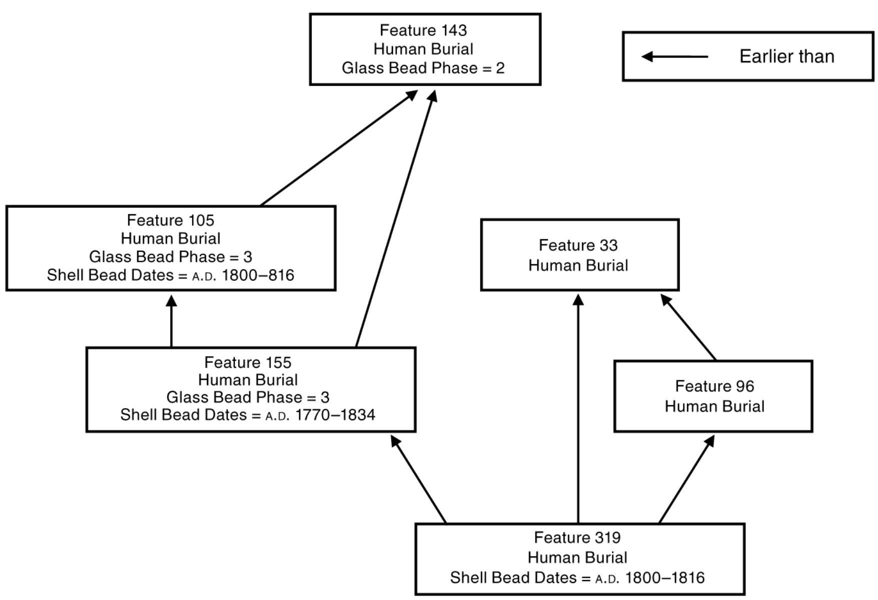

Figure 14. Chart of the feature-to-feature relationships in Subgroup 2 at LAN-62.

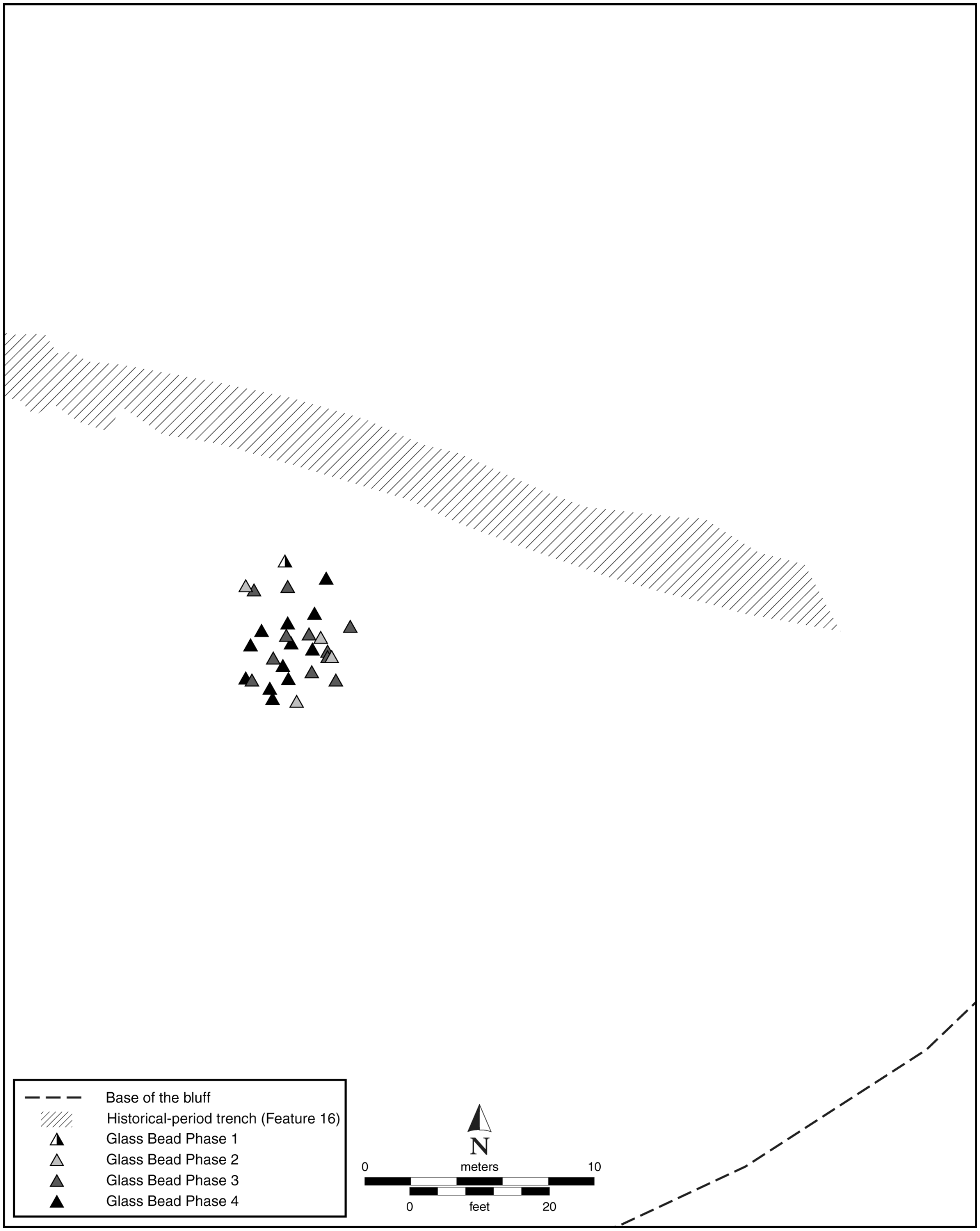

Figure 15. Distribution of the glass-bead phases associated with burial features at LAN-62.

As detailed in Chapter 9, this volume, it is often very difficult to identify individuals who died during epidemics, because skeletal indicators are either absent or too broad to allow the analyst to identify the cause of the lesion, and some epidemics do not leave any skeletal evidence. Some burial features at LAN-62 consisted of multiple primary inhumation individuals within one burial feature who appeared to have been interred simultaneously (e.g., the three primary inhumations in burial Feature 370 and the two primary inhumations in burial Feature 173). Based on the presence of a few burial features with multiple simultaneously interred individuals at LAN-62, it is possible that these individuals were buried when they succumbed to an epidemic; however, a link between an epidemic and such burials with multiple individuals has to remain hypothetical because of a lack of observable lesions. In other words, multiple individuals within a single burial may or may not be related to simultaneous epidemic death; this could instead reflect social relationships.

In an attempt to find further evidence of epidemics in the burial area at LAN-62, subgroups observed in the FRED were used. These subgroups exhibited clear feature relationships and good chronometric data and might serve as "snapshots" of the burial area during a specific period of time. As previously mentioned, all features associated with Subgroups 1 and 2 were dated to between A.D. 1800 and 1816 and represented several layers of burials.

The integrity of the burials associated with Subgroups 1 and 2 was examined. If epidemics are represented in these subgroups, one would expect a relatively high burial integrity for those individuals who died during the epidemics, because one would expect them to have been interred around the same time. The integrity would be high for these burials for two reasons. First, even if the burial area has limited space (as in the case of LAN-62), there would be limited displacement of skeletal remains from newly interred individuals when subsequent graves were dug, because the earlier human remains would not have had the time to deteriorate to a point where displacement of the remains could occur to any great degree. Of course, it is also possible that the integrity of older burials (pre-epidemic) would be altered with the burial pit of the individuals from an epidemic, if a large number of people were succumbing to the disease(s). Second, when several individuals rapidly died within a short span of time during an epidemic, they may have been buried together in a single burial pit for the sake of efficiency in the face of substantial loss of life in the community or because community involvement in grave preparations was strained (i.e., there were too few people to participate). Burial in a single, large mass inhumation is more labor efficient, especially in situations where many individuals are dying daily.

Initial inspection indicated that most of the burials exhibited a moderate level of integrity. Subgroup 1 seems more likely to fit the model of multiple epidemic-related deaths in the Ballona during the Mission period than Subgroup 2, as most of the individuals within the latter subgroup exhibited very low preservation. However, the feature descriptions of the Subgroup 1 burial features indicate that many of the feature-to-feature relationships were intrusive in nature. For instance, the primary inhumation associated with burial Feature 204 appeared to have directly impacted the primary inhumation associated with burial Feature 153, as indicated by the presence of several disarticulated human remains in the feature matrix in burial Feature 204. Although the burial features in Subgroup 1 appear to represent a brief moment in time (approximately 16 years), the elapsed time between each burial event was considerable in terms of decomposition, and they do not represent interments during any epidemic events.

Social Groups

One question that arose during analysis was whether social groups could be identified through the use of the FRED. Mortuary observations associated with Subgroup 1 were reviewed, and the results were ambiguous, at best. Subgroup 2 was excluded, because most of the mortuary observations were unavailable because of poor preservation.

Subgroup 1, however, did show some promise. Although head facing seemed to vary within this subgroup with individuals facing, east, west, south, and southeast, other mortuary observations were more uniform. Four of the seven individuals for which orientation was recorded were oriented to the south, with one individual oriented to the southeast and another to the southwest. Only one individual, the primary inhumation in burial Feature 8, exhibited a northwardly orientation (to the northeast). Furthermore, for these same seven individuals, all but one had been positioned on their left side, and all but one had been interred in fully flexed position. The exception was the primary inhumation associated with burial Feature 8, which had been interred in semiflexed position.

Could much of Subgroup 1 be representative of a particular social group? The answer remains unclear. Although the majority of the individuals in this subgroup exhibited a uniform mortuary behavior, these observations are very similar to observations recorded for the entirety of the burial area (see Chapter 5, this volume). Therefore, the pattern observed in this subgroup follows the greater trend of the burial area and is probably not indicative of any mortuary pattern particular to one social group. (For a rigorous analysis, identification and discussion of social groups and aspects of social order within the Protohistoric through Mission period burial features at LAN-62, see Chapter 6, Volume 5, this series.)

Conclusion

Understanding site-formation processes is one of the paramount goals of archaeological research. Complex sites such as LAN-62 are particularly rich sources of data, but at the same time, they can also provide unique challenges to archaeologists. Such was the case with the burial area at LAN-62, which appeared to be an amorphous, convoluted concentration of burials. Existing analytical methods could only suggest that there may be patterns in the apparent chaos. However, with the development of the FRED, we were able to tease out and explore those patterns (see Appendix M, this volume). Although many questions remain unanswered, the FRED provided a unique way to address not only site-formation processes but also many other research questions, as discussed throughout this chapter and subsequent chapters in this volume.

Mortuary Analysis

Patrick B. Stanton

Introduction

This chapter details the mortuary analysis of the burial features recovered from the five sites investigated during the PVAHP. In total, 386 burials were recovered during the PVAHP: 374 burial features associated with between 349 and 377 individuals from LAN-62, 3 burials from LAN-54, 3 burials from LAN-193, 3 burials from LAN-211, and 3 burials from LAN-2768. Details on identifying the numbers of individuals are discussed in Chapter 6, this volume. Much of this chapter is dedicated to the mortuary analysis of LAN-62 because of its level of complexity, which far surpasses that of any other site excavated during the PVAHP. Based on the temporal information described in Chapter 4, this volume, the burial population at LAN-62 was divided into non–Mission period and Mission period burial populations. This chapter describes and compares the mortuary practices of each population. Table 8 summarizes mortuary-treatment observations for these two burial populations at LAN-62, as well as mortuary observations of burial features from the other PVAHP sites (LAN-211, LAN-54, LAN-193, and LAN-2768).

The first section of this chapter analyzes the mortuary observations recorded for burial features recovered during the PVAHP. For each burial feature, information regarding burial type, treatment, orientation, position, and direction of head facing was recorded. Analysis of these traits starts by examining these observations on a site-level scale, with further refinement based on temporal and spatial components to follow.

The subsequent section presents a select group of burial-feature descriptions. These burial features were selected for more-detailed description because they represent examples of specific mortuary behavior, pathological conditions, and spatial relationships among burial features and between cultural materials and skeletal remains. Descriptions of the remaining burial features can be found in Appendix M, this volume. (Note that Chapter 6, Volume 5, this series, also presents mortuary analysis, but it differs from this chapter in that it focuses on a synthesis of burial chronology and temporal placement in the Ballona, using an expanded method whereby more burial features were attributed to time periods.)

Mortuary Observations

Seven observations regarding mortuary practices were made for each burial feature: burial integrity, articulatory integrity, burial type, treatment, orientation, position, and direction of head facing. Two of these observations, burial and articulatory integrity, are discussed in Chapter 6, this volume. The reader is also directed to Appendix L, this volume, where individual mortuary observations for the PVAHP are recorded.

Burial Types

Four types of burials were observed among the individuals recovered from LAN-62: inhumations with and without incidental burning, partial cremations, and cremations. Accurate assessment of burial type was recorded for 250 individuals for the non–Mission period population and 62 individuals for the Mission period population. Tables 9 and 10 show the distributions of burial types among these individuals, as well as the distributions of age and sex information for each burial type.

Inhumations

An inhumation is a burial feature for which the primary act of deposition is placing an individual in the ground and covering that individual with sediment. At LAN-62, the vast majority of the burial features (approximately 88 percent) were inhumations without evidence of burning (see Table 9). In some instances, skeletal remains associated with inhumations had localized areas of burning. At LAN-62, approximately 2 percent of the total burials were characterized as inhumations with evidence of incidental burning (see Table 9). Burned bones associated with these inhumations were blackened and in discrete locations on the skeleton—for example, just near the feet.

The presence of burned inhumations raises some interesting questions concerning mortuary behavior among the Gabrielino/Tongva. Based on the minimal amount of burning, it is

Table 8. Summary of Mortuary Tendencies of the LAN-62 Mission and Non–Mission Period Populations and the Populations at Other PVAHP Sites

Mortuary Treatment	LAN-62 Non–Mission Period Population	LAN-62 Mission Period Population	Populations at Other PVAHP Sites
Burial type	Primarily inhumations without incidental burning and some cremations, partial cremations, and incidentally burned inhumations.	Mostly inhumations and very few cremations. No partial cremations.	Only inhumations, although fragments of burned human bone were recovered.
Burial treatment	Primarily fully flexed inhumations and some semiflexed inhumations; few primary and secondary cremations and partial cremations.	Primarily fully flexed inhumations and some semiflexed inhumations; few primary and secondary cremations; no partial cremations.	Slight preference of semiflexed over fully flexed.
Orientation	Generally southeast and east.	Generally south and southeast.	Mostly oriented to the northeast, northwest, and southwest.
Position	Primarily left side.	Primarily left side.	Supine was most common.
Head facing	Primarily down; north was also common.	Primarily west; northwest and down were common.	Generally south.

Table 9. Distribution of Burial Types in the Non–Mission Period Burial Population at LAN-62

Burial Type	Fetus (n)	Infant (n)	Child (n)	Subadult (n)	Male (n)				Female (n)					Indeterminate Sex (n)					Total (n)	Frequency (%)
					YA	MA	OA	AD	YA	MA	OA	AD	Ind	YA	MA	OA	AD	Ind		
Inhumation without burning	4	11	13	9	24	27	3	6	50	29	6	3	2	20	3	3	8	—	221	88.4
Inhumation with incidental burning	—	1	—	—	—	1	—	—	1	1	—	—	—	1	—	—	—	—	5	2.0
Partial cremation	—	—	—	2	2	2	1	—	1	2	—	1	—	2	—	—	5	—	18	7.2
Cremation	—	2	—	1	—	—	—	—	—	—	—	1	—	1	—	—	1	—	6	2.4
Total	4	14	13	12	26	30	4	6	52	32	6	5	2	24	3	3	14	—	250	100.00

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; OA = old adult; YA = young adult.

Table 10. Distribution of Burial Types in the Mission Period Burial Subset at LAN-62

Burial Type	Fetus (n)	Infant (n)	Child (n)	Male (n)		Female (n)		Indeterminate Sex (n)				Total (n)	Frequency (%)
				YA	MA	YA	MA	YA	MA	Ind	AD		
Inhumation without burning	3	8	2	7	1	22	4	10	2	—	1	60	96.8
Cremation	—	—	—	—	—	—	—	—	—	1	1	2	3.2
Total	3	8	2	7	1	22	4	11	2	2	1	62	100.0

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; YA = young adult.

unlikely that this was the result of attempted cremation—it was more likely incidental. Research has shown that transference of energy to objects beneath a fire can produce discoloration and structural changes similar to those observed on bone directly in contact with a heat source (Bennett 1996). Bennett (1996:60, 64, 67) found that the type of alteration varied based on soil type (i.e., sand vs. clay) and depth below the heat source. Color changes were noted in bone up to 15 cm below the heat source in both sand and clay sediments. Fracturing occurred at up to 10 cm in sand but at only up to 5 cm in clay. Warpage, on the other hand, was observed in bone samples in sand at up to 10 cm below the heat source, whereas none was observed in the bone samples placed in clay sediments. Finally, microscopic changes were observed in bone structure at up to 5 cm below the heat source in both sand and clay.

As suggested previously, one possible explanation for this thermal alteration is proximity to funeral fires associated with primary partial or complete cremations. In some instances, funeral fires were apparently kindled on or near the graves; so, there is a cultural precedent for this theory (Ashby and Winterbourne 1966:27). The observed proximity of the inhumations to burned wood and human remains in burial Features 216 and 234, in the burial area of LAN-62, provided strong evidence in support of the theory.

In burial Feature 234, a concentration of charcoal and burned bone was found in association with the feet. Two unidentified metatarsals and a calcaneus fragment exhibited partial to complete blackening. The bones of the feet were also semidisarticulated, indicating that some minor disturbance had occurred.

The right scapula, the sternum, and the right femur of the primary inhumation in burial Feature 216 also exhibited partially blackened, burned areas. A potential origin for some of the thermal alteration observed in this burial feature can be found within 5 cm south of the posterior thorax of the primary inhumation, where the remains of a possible primary partial cremation were discovered. When one considers the information reported by Bennett (1996), 5 cm is certainly close enough for a heat source to impact nearby burials. On the other hand, the sternum associated with the primary inhumation in burial Feature 216 was located 10 cm north of the right scapula and was predominantly outside the area expected to have been affected by the cremation event, assuming a 15-cm radius around the heat source and that the heat source was centered on the partial cremation. Additionally, the right femur of the primary inhumation in burial Feature 216 was even farther away than the sternum and even less likely to be affected by the cremation event associated with the partial cremation.

Although evidence from burial Features 216 and 234 supports the theory of heat transference from nearby thermal features, small areas of unexplained burning were common among the incidentally burned inhumations, including the burned areas on the femur and sternum of the primary inhumation in burial Feature 216. However, as problematic as this might sound, with the level of disturbance associated with the burial area at LAN-62, it would not be surprising if nonburial or burial features associated with thermal activity in the vicinity of these burned areas had been scattered by subsequent burial events.

Additionally, the thermal features associated with these burned areas might not have been specifically related to the burial event for the burned individual. As previously indicated, funeral fires were sometimes kindled on or *near* a grave. Although these funeral fires probably would not have been hot enough to scorch the bone of a newly interred individual with flesh still present on the remains, earlier, skeletonized burials and scattered bone close to the surface would almost certainly have been impacted in some manner.

At approximately 97 percent, the Mission period burial population likewise displayed a predilection toward inhumations without burning (see Table 10). None of the Mission period burials exhibited any incidental burning.

Partial Cremations

Partial cremations represented an interesting type of burial recovered at LAN-62 during the PVAHP. These burials consisted of partially disarticulated and jumbled concentrations of minimally burned human-skeletal remains. Additionally, for several partial cremations, evidence of burning was located on the superficial skeletal landmarks, suggesting that at least some tissue was present on the remains and shielded the deeper portions of the skeleton from contact with the energy source. Furthermore, the majority of the partial cremations consisted of a pelvis with the proximal one-third to one-half of one or both femora still articulated. Half of the primary partial cremations with associated femora exhibited early postmortem transverse or spiral fractures of the femoral shaft. Many times, a cranium (represented in various levels of completeness) and other articulated segments were also recovered. Although these segments usually consisted of vertebral elements, other segments, such as a hand or an articulated tibia and fibula, were also recovered. Beyond a few scattered fragments, very little remained of the thorax, limbs, and extremities for these individuals. Burial Feature 406, detailed in the Selected Burial Features section (this chapter), represents an excellent example of a partial cremation recovered from LAN-62 (Figure 16).

Burial Feature 108, on the other hand, was an exception (Figure 17). This burial was very complete, unlike other partial cremations, and was found to have been interred extended in a prone position, oriented to the west. The cranium was disarticulated and located face up, immediately to the north of the lumbar vertebrae and right innominate. Several cut marks were observed on two ribs. The left first rib exhibited at least 12 shallow incisions consistent with defleshing on the visceral (inner) aspect of the superior (top) side. Additionally, the left second rib displayed at least 4 cut marks on the superior surface of the body. This was the only partial cremation exhibiting any cut marks.

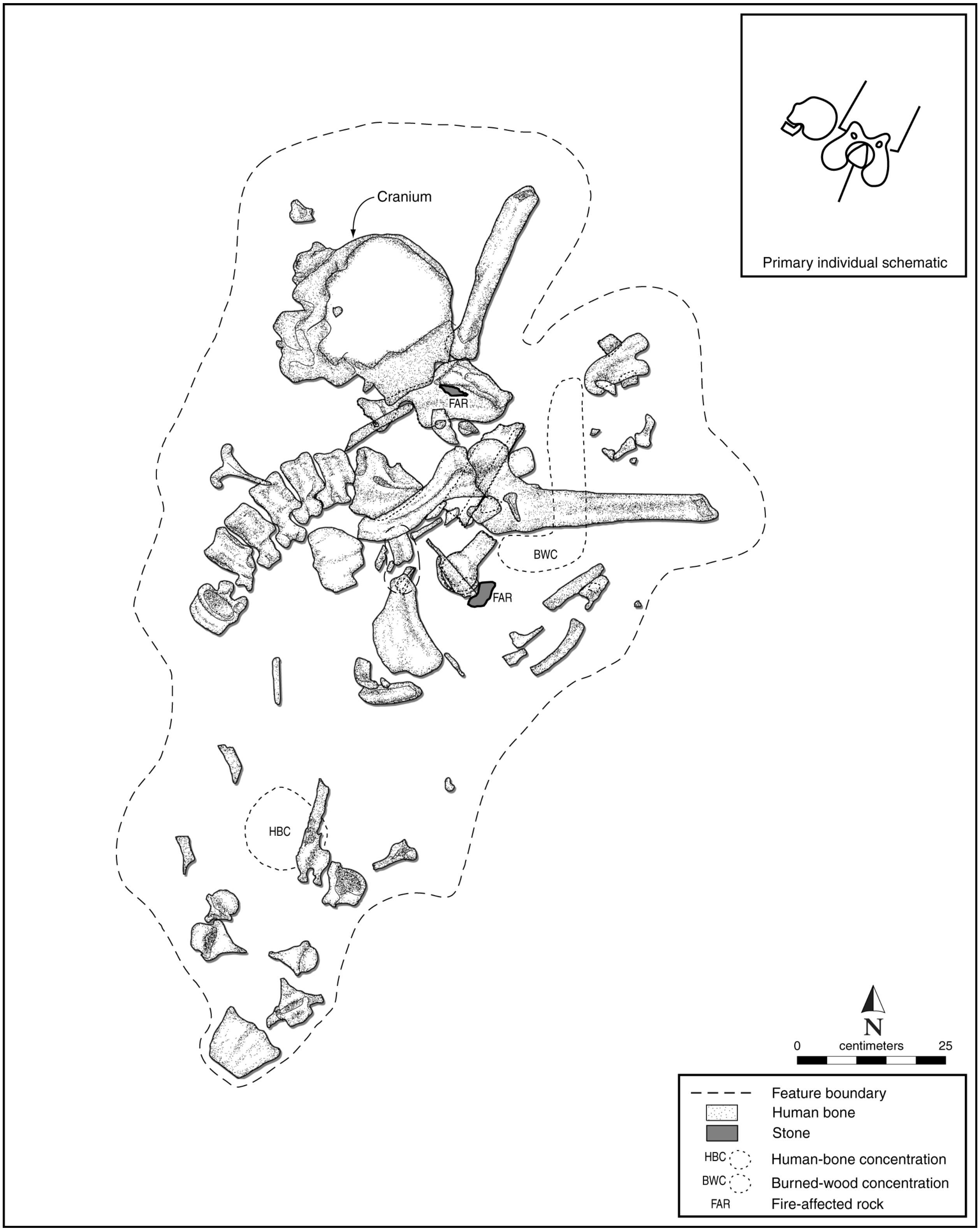

Figure 16. Illustration of burial Feature 406 at LAN-62, exhibiting the defining characteristics of a partial cremation.

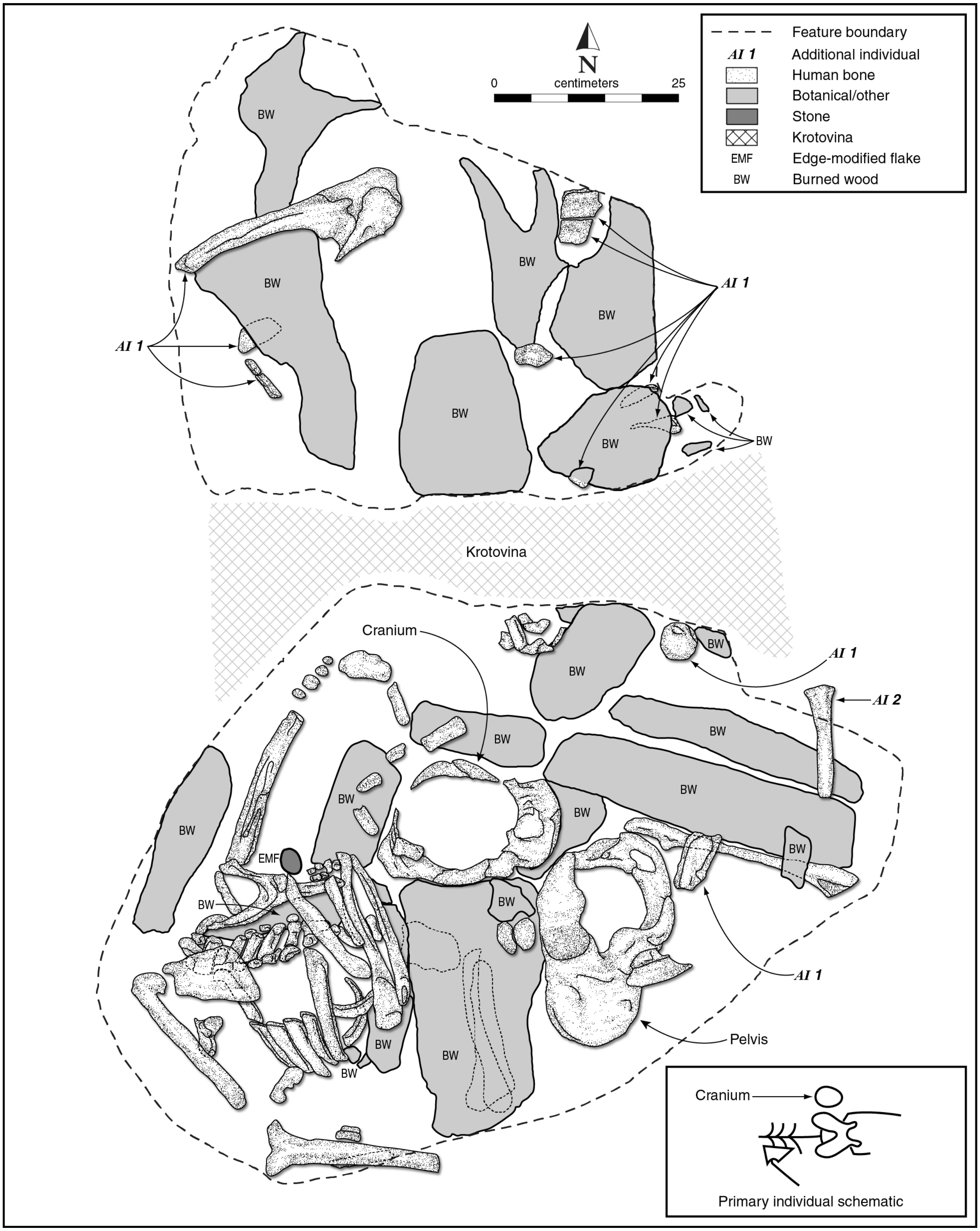

Figure 17. Illustration of burial Feature 108 at LAN-62.

The skeletal remains associated with burial Feature 108 were arranged in a rather interesting array. Above the main portion of this burial, a concentration of skeletal elements—including an articulated left humerus and scapula, an articulated right radius and ulna, an articulated right foot, and a right tibia—were recovered. With the exception of the humerus and scapula, all of the remains exhibited some areas of partial or complete blackening. These areas included the distal right radius and anterior tibial shaft.

Beneath this concentration of skeletal remains were large pieces of charcoal that covered sections of the primary partial cremation. Like the skeletal remains observed above the charcoal layer, the remains beneath the charcoal exhibited well-articulated segments. These included the cranium and mandible, which were located next to the pelvis; the left tibia and fibula; the left ulna and radius; the thorax; the pelvis; and the proximal left femur. The skeletal elements that were in direct contact with the charcoal exhibited partial blackening. These surfaces included the anterior mandible, superior-anterior frontal, posterior pelvis, proximal left radius, proximal left ulna, and posterior right femoral shaft. The burning and partial disarticulation likely occurred while the remains were still more or less covered with flesh. Figure 18 details the distribution of the skeletal elements associated with these partial cremations.

Eighteen individuals at LAN-62 were identified as partial cremations. The data presented in Table 9 indicate that this burial type was relatively evenly distributed among both male (n = 5) and female (n = 4) adults. Subadults were also represented, albeit to a lesser extent. Individuals younger than 12 years (i.e., fetuses, infants, and children) did not appear to have been treated in this fashion. With the exception of 4 partial cremations, all were found in a band extending northwest–southeast along the northeastern border of the burial area, immediately south of and roughly parallel to the historical-period trench, nonburial Feature 16 (Figure 19). Whereas approximately 7 percent of the non–Mission period burials were partial cremations, none of the Mission period burials was a partial cremation (see Tables 9 and 10). That may be because this manner of burial treatment was no longer practiced during the Mission period or because of vagaries in the data set—i.e., a lack of temporally diagnostic materials made association with any time period unlikely.

Further examination of the partial cremations indicated that very few skeletal elements were complete. In fact, the majority of the recovered skeletal elements were found in a partial or fragmented state (Figure 20).

It should be noted that although Figure 20 indicates that all sterna associated with the partial cremations were complete, comparison with Figure 18 reveals that the number of partial cremations with sterna was very low. In fact, only one sternum was recovered. By contrast, the extremities, which include both hands and feet, exhibited a very high level of completeness when compared to the other skeletal-element types (see Figure 20). This pattern is perplexing, considering that the bones of the hands and feet are very small and often exhibit a moderate to low level of survivability (Waldron 1987:Table 6.1). Furthermore, a variety of factors, including loss during secondary deposition and destruction during cremation events, affect how much of the skeleton survives before entry into the archaeological record. However, when each partial cremation with associated extremity elements is considered individually, one finds that these elements are not evenly distributed (Table 11).

Approximately 46 percent of the total number of extremity elements found with partial cremations was associated with

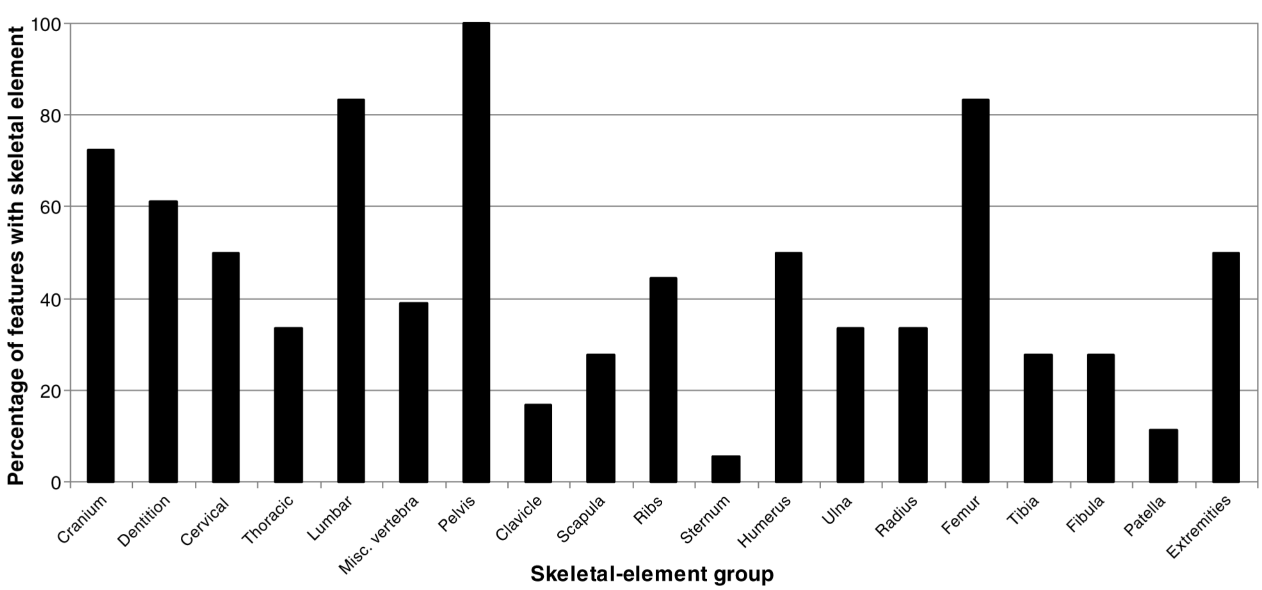

Figure 18. Graph of the distribution of element types in the partial cremations at LAN-62.

Figure 19. Distribution of the partial cremations at LAN-62.

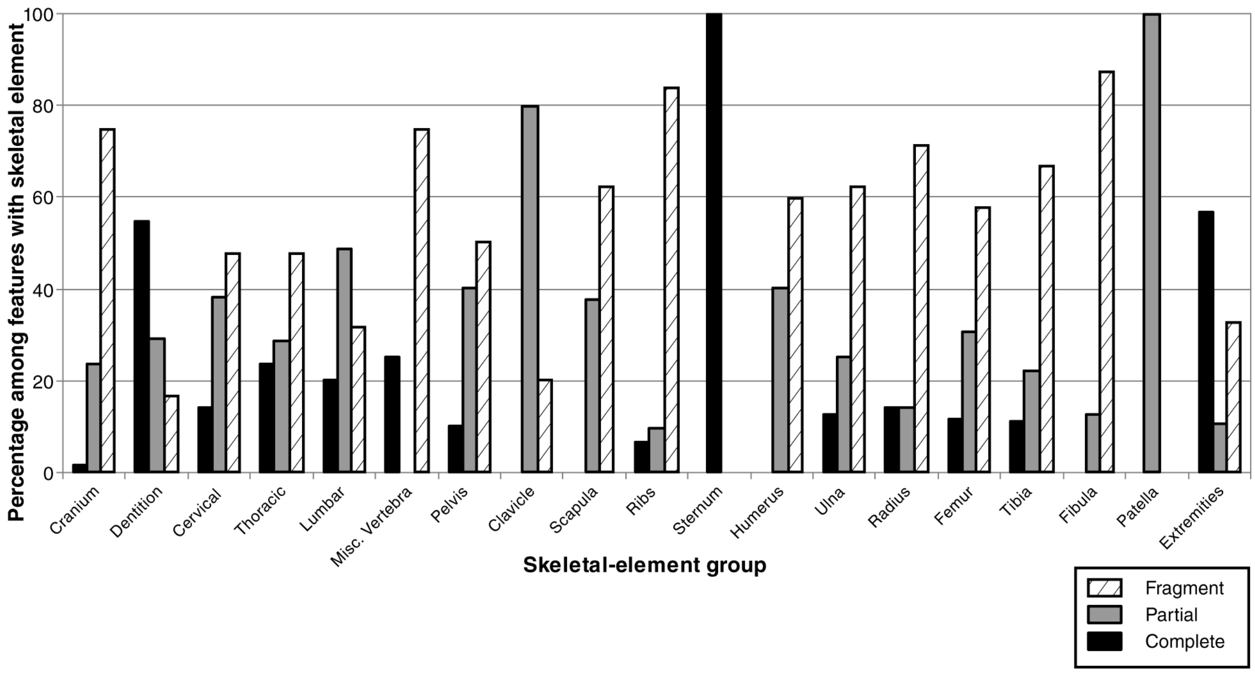

Figure 20. Graph of the levels of completeness for human-skeletal-element groups associated with the partial cremations from all groups at LAN-62.

Table 11. Distribution of the Bones of the Extremities Found in the Partial Cremations at LAN-62

Feature No.	Completeness						Total (n)	Total (%)
	Complete (n)	Complete (%)	Partial (n)	Partial (%)	Fragmented (n)	Fragmented (%)		
108	5	9.3	3	30.0	15	71.4	23	27.1
150	2	3.7	2	20.0	1	4.8	5	5.9
221	2	3.7	1	10.0	—		3	3.5
346	38	70.4	1	10.0	—		39	45.9
364	1	1.9	—		—		1	1.2
390	—		1	10.0	1	4.8	2	2.4
406	6	11.1	—		4	19.0	10	11.8
410	—		1	10.0	—		1	1.2
524	—		1	10.0	—		1	1.2
Total	54	100.0	10	100.0	21	100.0	85	100.0

one partial cremation, burial Feature 346. The mystery of why this burial feature contained more extremity elements that other partial cremations can be explained by its preservation.

Burial Feature 346 was slightly different from most other partial cremations, in that an articulated pelvis was not associated with the partial cremation, although pelvic fragments were. Also, both femora were complete and did not exhibit any postmortem fracturing of the femoral shafts. Furthermore, this burial consisted of several articulated segments of human-skeletal remains, including (1) articulated right forearm and hand; (2) articulated right tibia, fibula, and foot; and (3) articulated cranium, mandible, cervical spine, and first and second thoracic vertebrae. In this regard, burial Feature 346 was similar to burial Feature 108, though much less complete. In any case, it was the articulation and completeness of the right hand and foot, when compared to the other partial cremations, that increased the number of recoverable extremity elements for this burial feature. A similar situation can be attributed to burial Feature 108, which contained nearly 30 percent of all the extremities found in the partial cremations (see Table 11), albeit in a less-preserved state than burial Feature 346.

Of the skeletal remains found in partial cremations, approximately one-half exhibited some degree of burning, which ranged from partial blackening to complete calcination. The rest of the bone in the partial cremations was entirely unburned (Figure 21). Furthermore, when all degrees of thermal alteration were compared, including those with differential burning, the values were slightly skewed toward the lower end of the scale—i.e., toward unburned and partial and complete blackening (Figure 22). In Walker's analysis of human remains recovered from LAN-840, he described a similar range of colors and attributed them, especially the uniform black color, to temperatures of less than 800°C and a low-oxygen-reduction environment, such as when a cremation is covered by earth while the remains are still smoldering (Walker and Wheeler 1988). Additionally, Walker and his colleagues have found that color change has less to do with the duration of the cremation event than the actual environmental setting of the event. Because of the color-transformation properties of this sediment, remains burned in organic-rich sediments, such as a midden, could be expected to have a greater amount of darker-colored remains, possibly because of the excess availability of carbon in the sediment (Walker et al. 2008:7).

Additionally, a small quantity of a hard, dark, highly vesicular material was recovered from a small group of burned remains. Of the hundreds of individuals identified at LAN-62, the remains of only seven were described as having this material in association. These individuals consisted of three partial cremations, one cremation, and three individuals defined by isolated human remains found in other burials not associated with cremation events. Burial Feature 426, detailed in this chapter, was associated with some of the larger quantities of this material.

The inside surface of the vesicles was opalescent and glaze-like and closely resembled a substance—known as cremation slag, clinker, or *urnenharz* (literally, urn resin)—that has been found in funerary urns in Europe (Henderson et al. 1987:81–82; Wells 1960). Wells (1960:36) described this material, recovered from Anglo-Saxon cremation urns from a cemetery at Illington in Norwalk, England, as follows:

> It was brown, almost the same colour as the soil, and it never occurred in lumps much larger than the size of a hazel nut. It contained numerous small cavities, varying in size from a pinhead to a pea. The inner surface of some of these cavities, especially the larger ones, had a shiny, glazed appearance.

In a thorough examination of similar material by Henderson et al. (1987:91–93, 97), it was concluded that this substance is the result of a high-temperature (900°C or more) fusion of silica-bearing, sandy soils with materials from the cremation. Similarly, studies by the British Museum in 1962 indicated that the quartz form of silica had converted in the fused areas into the high-temperature form of cristobalite, which converts at 1,470°C in pure silica, although impurities would lower the temperature (Henderson et al. 1987:83). Furthermore, Henderson et al. suggested that the optimal conditions for the formation of this material occurred when "(a) the heat was sufficient for at least partial fusion to take place; (b) silica, phosphorus, calcium, manganese and iron were present (such as at the base of the pyre where the ash and sediment meet); and (c) the forming slag was not subject to pressure" (Henderson et al. 1987:95–96). As previously noted, Walker's findings from LAN-840 indicated that the partial cremations at LAN-62 might have been burned in a low-oxygen/low-temperature environment. However, based on the evidence provided by Henderson et al. (1987) and the British Museum, burials associated with this vesicular material were allowed to reach a higher temperature before being covered.

Few cultural materials were found with these partial cremations. In fact, the primary inhumation in burial Feature 426 was the only example of a partial cremation with any substantial mortuary accompaniments (Figure 23). As with many other partial cremations, this individual exhibited areas of burning that ranged from partial blackening to complete calcination, a pattern consistent with differential fuel load during the cremation event, possibly from an insufficient supply of fuel. Recovered skeletal elements for this individual consisted of a cranium, a partially articulated pelvis, a partial right femur, some vertebrae, and the remains of a left humerus and ulna. The superior one-third of the skull was truncated and redeposited approximately 12 cm northwest, ectocranial side down. The sacrum and part of the left innominate were found around the upper-chest/lower-neck region. The mandible was displaced, and approximately two-thirds was missing postmortem. The right femur, which maintained articulation during the disturbance, was missing the distal two-thirds of the shaft. The broken distal end, however, appeared beveled approximately three-fourths around the circumference of the shaft, and the final fourth appeared as though "snapped." The left distal humerus and proximal ulna appeared to be in the correct anatomical positions.

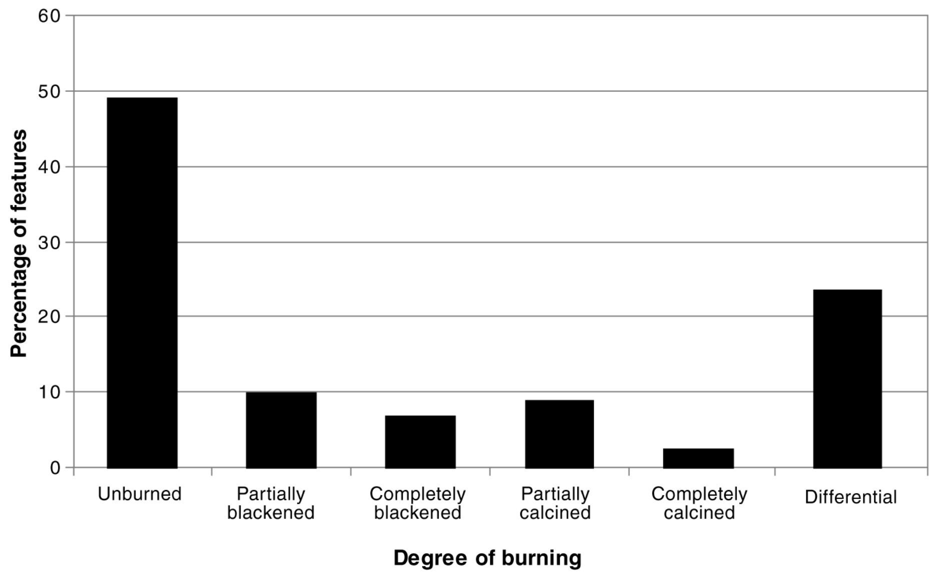

Figure 21. Graph of the distribution of degrees of burning for human-skeletal remains associated with the partial cremations at LAN-62.

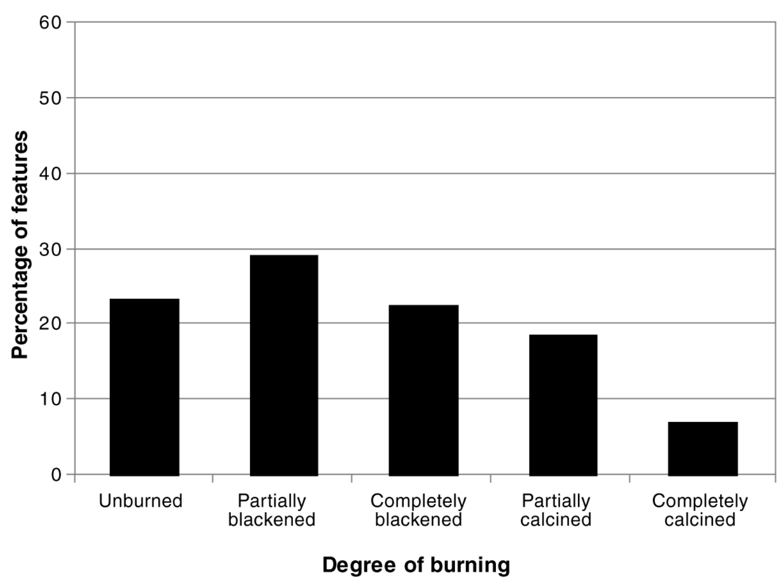

Figure 22. Graph of the distribution of differential burn patterns for the partial cremations at LAN-62.

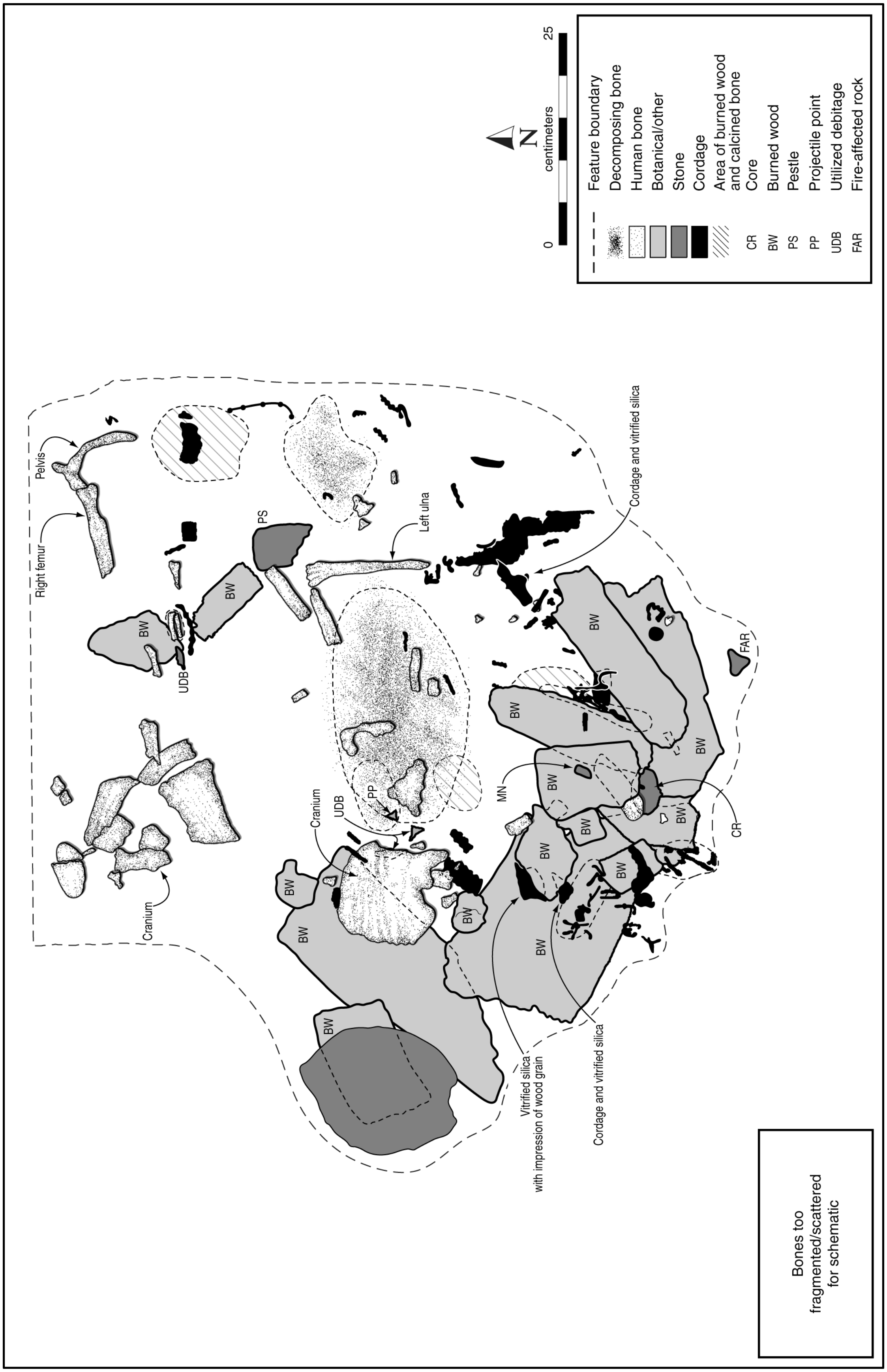

Figure 23. Illustration of burial Feature 426 at LAN-62.

As with burial Feature 108, several large pieces of burned wood covered the skeletal remains of this individual. Charred basket fragments were also recovered from the points around and on what would have been the torso of the individual, assuming that the individual was in the correct anatomical position, and charred remains of cordage were found throughout the burial. A substantial amount of "cremation slag" adhering to the skeletal remains and cordage indicated that the temperatures within the grave did reach high temperatures long enough to cause the fusion of the silica in the sediment. Because the remains were not completely incinerated, however, that temperature was not maintained. The femoral-shaft fractures associated with the primary inhumation in burial Feature 426, as well as in other partial cremations, are perplexing. In at least one instance, the fracturing occurred either prior to burning or during the thermal event, while the bone was still relatively green. The bone continued to burn, because a uniform burn pattern extended over the fractured and unbroken surface of the femur. Research by Hermann and Bennett (1999:466) has found that heat-related fractures that resemble traumatic fractures might be produced when heated gas and liquid rapidly expand in the medullary cavity of complete bones during a thermal event. The remains of the leg distal to the fractures were likely represented by numerous burned fragments of bone.

Most, if not all, of the partial cremations at LAN-62 were still covered with flesh where burned, to which the presence of vitrified sand and tissue, differential burn patterns, and large segments of articulated bone attest. Either these partial cremations were disarticulated prior to the cremation event or these individuals represent burials that were exhumed for ritual use. That exhumation would have taken place after a significant amount of time had passed but before complete skeletonization had occurred. Such activity would have resulted in the loss of the smaller skeletal elements, if disarticulated. The cut marks associated with these partial cremations might have been preparatory in nature, allowing articulated burials to be reduced to more-manageable components, for transportation or consolidation. Several of the partial cremations—burial Feature 108, for instance—appeared to have been disarticulated and burned in place, indicating that the remains had been uncovered for some graveside ritual.

Cremations

Only eight cremations were identified at LAN-62—six non–Mission period and two Mission period (see Tables 9 and 10). Although only small numbers of cremations were identified in either population, nearly 340 fragments of burned human bone—around 2 percent of the total number of human-skeletal remains not found in association with cremations, partial cremations, or incidentally burned inhumations—were found scattered throughout the burial area, suggesting that there was a likelihood that a greater number of disturbed cremations existed. These scattered remains were usually small and could have become dispersed within the sediments by any number of means, including bioturbation and mortuary activity.

The cremations were evenly split between juveniles and adults within the non–Mission period burial population, although the sex of only one adult, a female, could be estimated (see Table 9). Very little demographic information was available for the Mission period cremations (see Table 10). The cremations associated with LAN-62 were located in three clusters scattered throughout the burial area (Figure 24). The first concentration consisted of two cremations located in the north-central portion of the main burial concentration, immediately south of the historical-period trench (nonburial Feature 16). The second concentration consisted of three cremations located in the western portion of the main burial concentration. The two Mission period cremations were associated with this concentration. The final concentration was the most diffusely scattered of the three and consisted of three cremations located in the eastern portion of the burial area. This concentration consisted entirely of juveniles (two infants and one subadult). The locations of all these cremation concentrations generally overlapped with the locations of the partial cremations.

The eight cremations had varying but relatively low frequencies of associated artifacts, including shell beads, glass beads, projectile points, and carbonized plant remains. One cremation, burial Feature 587, had projectile points (three Cottonwood points), and another, burial Feature 273, had a ground stone vessel, along with carbonized seeds (n = 410) and a basketry fragment. Shell beads were recovered in low frequencies from five cremations, and only one cremation, burial Feature 363 had more than one shell bead (n = 24). Glass beads were recovered from the feature matrices of, but not directly associated with, burial Features 363 and 587. Carbonized seeds were found in burial Features 273 and 13.

The skeletal remains associated with the cremations recovered from LAN-62 exhibited all ranges of burn patterns, and much of the bone was skewed toward the upper end of the spectrum (i.e., greater than completely blackened) (Figures 25 and 26). Because of the small sample size, all eight cremations were included in Figures 25 and 26. The two Mission period burials did not exhibit one consistent burn pattern. All the burned bone from these burial features ranged from completely blackened to completely calcined.

As indicated by Walker's analysis of the human remains recovered from LAN-840, such a pattern likely occurred when the cremation was covered with sediment and forced to smolder in a low-oxygen environment in temperatures not exceeding 800°C (Walker and Wheeler 1988:7). Also, a fusion of vitrified silica and ash was found in association with a single cremation, burial Feature 91, suggesting that at least one cremation had reached temperatures of 900°C or more. The similarities between the partial cremations and cremations found at LAN-62 indicated that some variable was consistent across these mortuary behaviors. But why the disparity in the level of burning between these two apparently different cremation practices?

Figure 24. Distribution of the cremations at LAN-62.

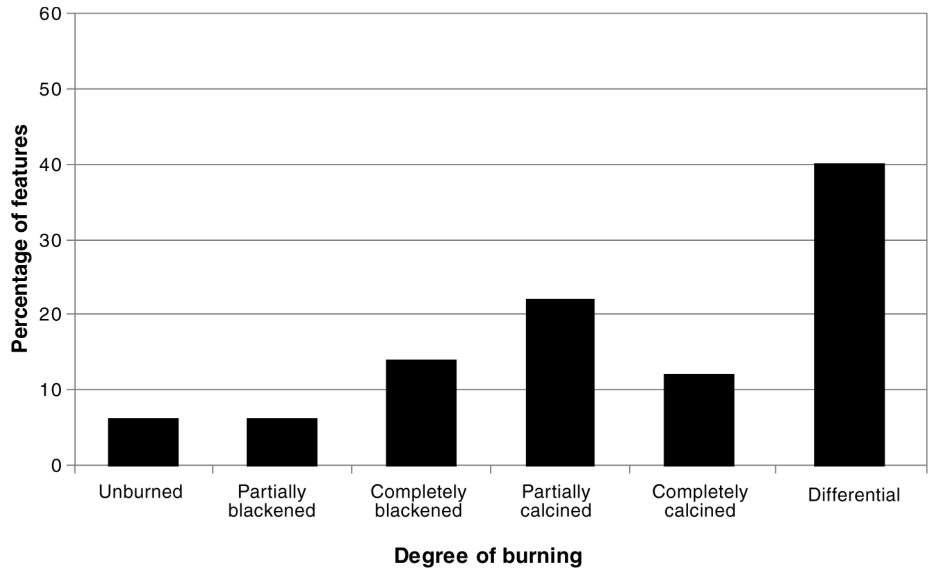

Figure 25. Graph of the distribution of burned human bone in the cremations at LAN-62.

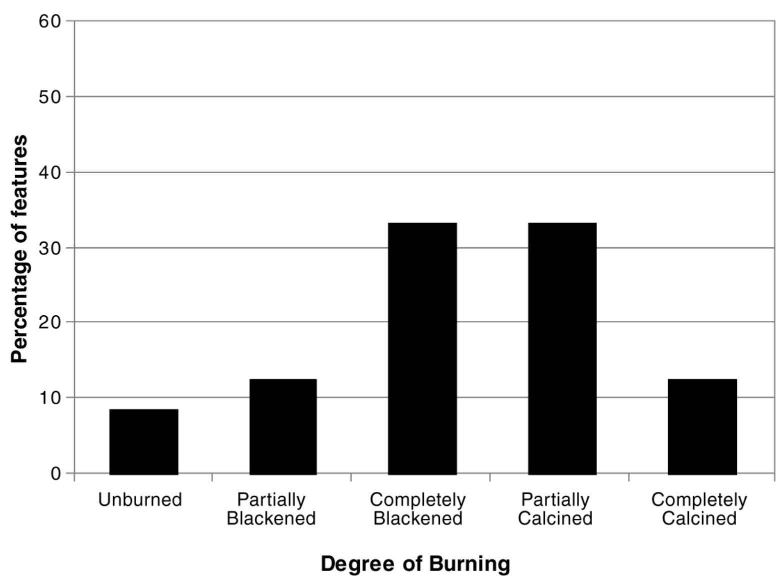

Figure 26. Graph of the distribution of differential burn patterns for the cremations at LAN-62.

One possibility is that there were differences in the amounts and types of fuel available for use at the time of the cremation events. LAN-62 is associated with the Coastal Sage Scrub plant community, and several additional ecosystems associated specifically with marsh and riparian systems are scattered about the area. Although multitudes of plant species were available for food and fuel (see Chapter 14, Volume 3, this series), these species might not have been the best choices for the high fuel requirements of cremations, partial or otherwise. Associated with this plant community were a variety of semishrub plants and grasses, as well as the occasional willow, cottonwood, and sycamore stands associated with riparian systems (Aschmann 1959:37; Philip Williams and Associates 2006:60–67). Driftwood associated with harder woods collected along the shoreline and river edge might also have been available. An exact amount of driftwood, however, would be difficult to gauge, and the availability was probably sporadic. In addition, the potential use of controlled burns in grasslands by native populations to create areas for more-useful plant species to flourish should also be considered (Timbrook et al. 1982). This behavior would have limited the amount of fuel available for cremations.

Large concentrations of charcoal were recovered from both complete and partial cremations. Burial Features 108 and 426, both partial cremations, had numerous fragments of large pieces of burned wood identified as willow, bigcone Douglas-fir, and California sycamore (see Chapter 14, Volume 3, this series). These wood types, as well as sagebrush, were also represented in burial Features 24, 91, 150, 181, 185, 223, 273, 285, 312, 363, and 364. Analysis of the burned wood identified the wood as either trunk or primary-branch wood, and the lack of weathering indicated that the wood had been burned relatively soon after it was cut, which does not support the theory that wood was primarily procured as driftwood. Although they burn quicker, which is compounded by the fact that the wood in question is also soft wood, branches and twigs are optimal for cremations, because they burn hotter than larger logs and would result in a partial or complete cremation in as little as 2–3 hours, under constant vigilance (Elayne Pope, personal communication 2008). John Marston of the Department of Anthropology at UCLA (see Chapter 14, Volume 3, this series) submitted that the activities resulting in the deposition of these burned-wood remains were fuel intensive and necessitated the importing of large pieces of wood from local mountain ranges. The authors would further submit that the nearby wetlands would have also provided access to the willow, California sycamore, and sagebrush identified in this analysis. Willow and bigcone Douglas-fir were the two most-common species identified in the burial features used in this study.

This split dependency on lowland and highland species is indicative of several possible behavioral patterns. Perhaps it suggests a seasonal use of resources or that overuse of local resources required the population to travel farther afield to gather the necessary provisions. Equally plausible is opportunism, wherein local wood was supplemented with wood that the Spanish found less desirable (e.g., branches) and with scavenged, unmilled building supplies (see Chapter 14, Volume 3, this series).

Preservation may have also played a role in degree of cremation. The large segments of bone observed in the partial cremations, likely with adherent tissue, especially in burial Feature 108, might have limited the effectiveness of the cremation event. Disarticulated and fragmented bone would have been more affected by the thermal event, because there are fewer shielded locations, such as joint surfaces.

Similarly, the basic demographic profile of the individual would have played a major role in the effectiveness of the cremation event. As previously mentioned, very young individuals were not represented in the partial cremations. The small, delicate, immature bones that compose the infant skeleton would have been less able to withstand the harsh conditions of a pyre—i.e., partial cremations would have become complete cremations. At least two infants were identified among the cremations.

Burial Treatment

"Burial treatment" describes the context of the burial—primary treatment (meaning the first context into which a body is placed) or secondary treatment (meaning the body was initially deposited in one location and intentionally transferred to a second location, such as an ossuary, after a culturally determined span of time had passed, often after the remains had sufficiently decomposed). Burial treatment also includes categorization of the posture of the burial (flexed, semiflexed, or extended). Eight different burial treatments were observed at LAN-62. These included primary extended inhumation, primary fully flexed inhumation, primary semiflexed inhumation, primary indeterminate flexed inhumation, primary partial cremation, secondary partial cremation, primary cremation, and secondary cremation. No burial treatments consisting of secondary inhumations were recovered at LAN-62. Although numerous disturbed inhumations (with both primary individuals and secondary/additional individuals or remains displaced through natural and cultural processes or subsequent placement of burials) were identified, there was no evidence of the intentional transfer of a particular burial to a second location that would define a secondary inhumation.

Although several-hundred individuals were identified at this site, an accurate assessment of burial treatment could only be recorded for 200 individuals for the non–Mission period burials and 45 individuals for the Mission period burials. Tables 12 and 13 show the distributions of burial treatments among these individuals, as well as the distributions of age and sex information for each type of burial treatment.

Table 12. Distribution of Burial Treatments in Non–Mission Period Burials at LAN-62

Burial Treatment	Fetus (n)	Infant (n)	Child (n)	Subadult (n)	Male (n)				Female (n)					Indeterminate Sex (n)					Total (n)	Frequency (%)
					YA	MA	OA	AD	YA	MA	OA	AD	Ind	YA	MA	OA	AD	Ind		
Extended inhumation	—	1	2	—	2	1	—	—	—	—	—	—	—	—	—	—	—	—	6	3.0
Fully flexed inhumation	—	—	3	6	12	15	2	3	42	24	6	—	1	14	3	1	5	—	137	68.5
Semiflexed inhumation	1	1	3	2	7	9	—	—	8	4	—	2	—	5	—	—	—	—	42	21.0
Indeterminate flexed inhumation	—	—	1	—	1	—	—	1	—	—	—	—	—	—	—	—	2	—	5	2.5
Primary cremation	—	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	0.5
Secondary cremation	—	—	—	1	—	—	—	—	—	—	—	—	—	1	—	—	—	—	2	1.0
Primary partial cremation	—	—	—	1	—	2	—	—	—	—	—	1	—	1	—	—	—	—	5	2.5
Secondary partial cremation	—	—	—	—	1	—	—	—	—	1	—	—	—	—	—	—	—	—	2	1.0
Total	1	3	9	10	23	27	2	4	50	29	6	3	1	21	3	1	7	—	200	100.0

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; OA = old adult; YA = young adult.

Table 13. Distribution of Burial Treatments in the Mission Period Burial Subset at LAN-62

Burial Treatment	Male (n)		Female (n)		Indeterminate Sex (n)				Total (n)	Frequency (%)
	YA	MA	YA	MA	YA	MA	AD	Ind		
Fully flexed inhumation	5	1	17	3	9	2	1	—	39	84.4
Semiflexed inhumation	2	—	—	—	1	—	—	—	3	6.7
Indeterminate flexed inhumation	—	—	2	—	—	—	—	—	2	4.4
Primary cremation	—	—	—	—	—	—	1	—	1	2.2
Secondary cremation	—	—	—	—	—	—	—	1	1	2.2
Total	7	1	19	3	10	2	2	1	45	100.0

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; YA = young adult.

Burial Treatment Associated with Inhumations

Nearly 69 percent of the inhumations associated with the non–Mission period burial population were fully flexed (see Table 12). Additionally, these fully flexed inhumations ran the demographic gamut, and with the exception of fetal and infant individuals, every age and sex category had at least one fully flexed inhumation associated with it (see Table 12). Nearly one-third of the fully flexed inhumations were young-adult females. At approximately 84 percent, the Mission period burials were fully flexed inhumations (see Table 13).

The second-most-common type of burial treatment for the non–Mission period and Mission period burial populations was semiflexed, although at approximately 21 and 6.7 percent, respectively, it was a distant second (see Tables 12 and 13). All major demographic groups were represented by this treatment, with the exception of old-adult males and females.

Roughly 3 percent of the burials in the non–Mission period population at LAN-62 were buried in an extended position. This burial treatment was found only among infants, children, and young- and middle-adult males (see Table 12). No Mission period burial was interred in this manner.

Finally, about 2.5 and 4.4 percent of the total burials associated with the non–Mission period and Mission period burial populations, respectively, were interred in flexed positions for which the degrees of flexure were unknown because of poor preservation. Demographically, these burials were represented by children, one young-adult male, one indeterminate adult male, and two adults of indeterminate sex for the non–Mission period population and by only young-adult females for the Mission period (see Tables 12 and 13).

Burial Treatment Associated with Partial Cremations

Treatment could be observed for only about 40 percent of an already small number of partial cremations: five primary partial cremations and two secondary partial cremations, or roughly 2.5 and 1 percent, respectively, of the burials for which burial treatment could be observed at LAN-62 (see Table 12).

Estimation of burial treatment for partial cremations was based on a combination of observations, including oxidation of sediment and burn patterns on the remains associated with the burial feature and those observed on skeletal remains in adjacent burial features. For instance, the partial cremation associated with both burial Features 61 and 216 appeared to have been primary partial cremation, because burning was noted on nearby skeletal remains associated with the primary inhumation in burial Feature 216. There, the partial cremation was located within 5 cm of some of the burned areas on the primary inhumation. The subsequent inhumation of the primary individual associated with burial Feature 61 disturbed the remains associated with the partial cremation. (Note that this individual is represented with burial Feature 61 in Figure 19.) By contrast, burned areas on the skeletal remains from burial Feature 108 were directly associated with large pieces of burned wood, indicating that these remains were likewise burned in place.

For the two partial cremations associated with burial Feature 24, estimation of burial treatment was more difficult. Extending through this burial feature was a fairly thick (0.5–3.0-cm-thick) layer of charcoal and burned bone. The thickest portion of this layer was directly beneath the remains associated with the first partial cremation and extended over the top of the left femur associated with the second partial cremation, as well as an isolated articulated left shoulder joint, which was not assigned to either individual. Because the burned surfaces for each partial cremation were in direct contact with this charcoal lens, the remains appeared to have been burned in place. However, a cranium associated with the burial feature was burned on two opposing surfaces and was located 5 cm below and 10 cm south of this lens. Thus, it is entirely possible that one individual represented an earlier burial event that was then disturbed during a subsequent partial cremation. Which individual represented the intrusive burial feature, however, could not be determined. It is equally likely that both were interred simultaneously.

Burial Treatment Associated with Cremations

Primary and secondary designations could be made for one and two non–Mission period cremations, respectively (see Table 12). These two types of burial treatments accounted for approximately 1.5 percent of the total non–Mission period burials recovered from LAN-62 for which burial treatment could be observed. One primary and one secondary cremation were associated with the Mission period (see Table 13). These two cremations accounted for approximately 4 percent of the total Mission period burials for which treatment could be observed. The differences between these two frequencies were likely because of different population sizes.

Although most of the cremations discovered at LAN-62 were represented by a concentration of burned human-bone fragments, burial Feature 273 was of special interest because of the pattern of burning (Figure 27). This burial feature, which was associated with the Mission period, consisted of a single primary cremation of an adult of indeterminate sex. The skeletal remains associated with this individual were highly fragmented, and the degrees of burning ranged from unburned to completely calcined. Only cranial and unidentified long-bone fragments were recovered. Interestingly, the burn patterns associated with the main concentration of remains exhibited concentric rings of differential burning. The center of the concentration was partially calcined, and each ring represented less-advanced stages, radiating outward

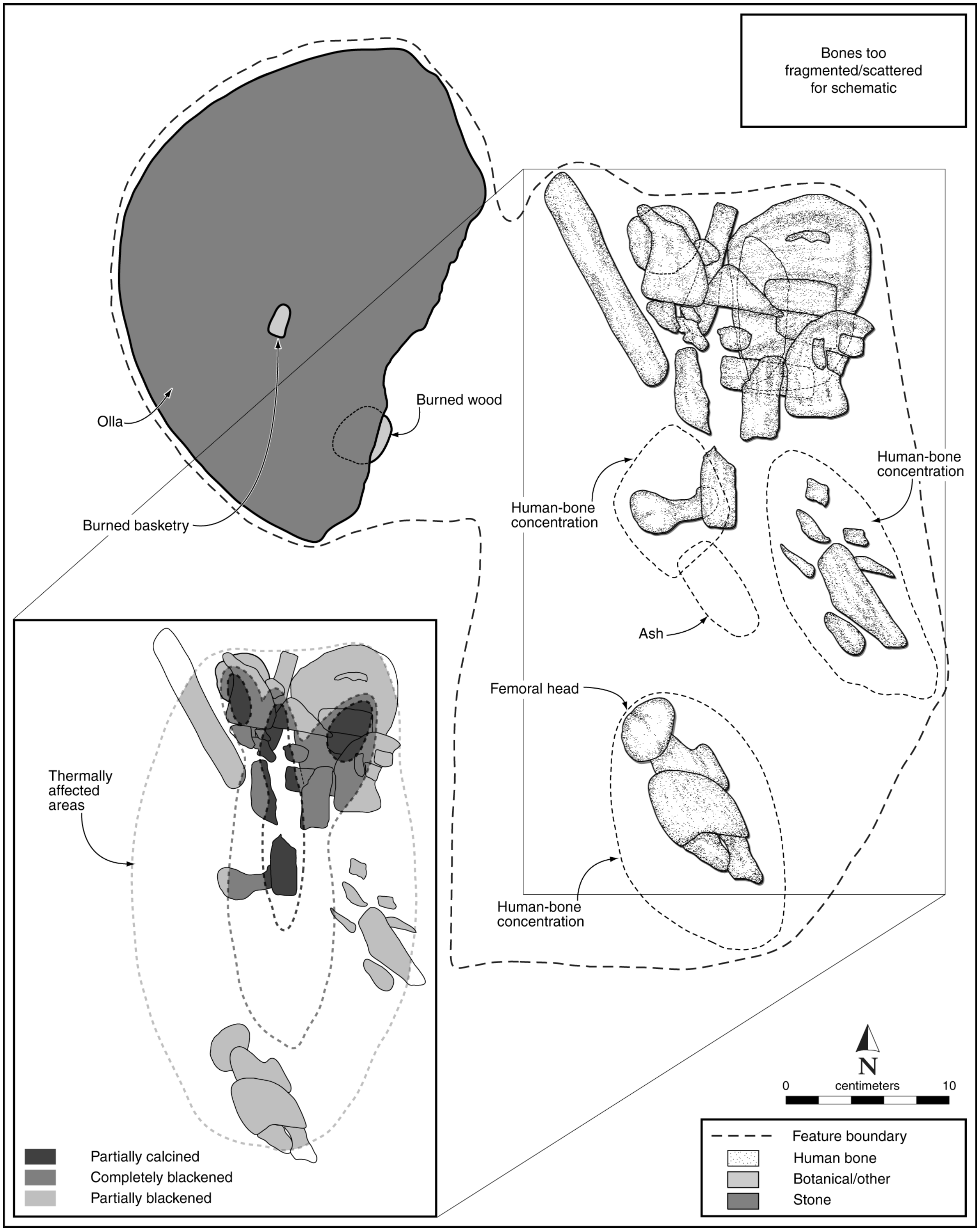

Figure 27. Illustration of burial Feature 273 at LAN-62, exhibiting radiating areas of thermal alteration.

from the center. The heat source was located in the center, where the more-advanced burning was noted.

The undisturbed nature of these rings indicated that the remains had been burned in place without much disturbance from those tending the fire. That static state, however, calls into question the nature of this cremation. Was it a true cremation or, instead, a cluster of human remains incidentally burned by a funeral fire located above?

As previously discussed, many of the partial cremations and cremations appeared to have been covered over by sediment while the remains were still smoldering, thus locking the remains in place while the fire burned. That would have allowed this continuum of burning stages to form across the burial feature without its being disturbed by fire tenders as they stoked the fire or added fuel. Conversely, the fire might have been placed some distance above the remains, resulting in incidental burning. Although it is conceivable that they might have been disturbed, the lack of thermal features above this burial suggests that the former hypothesis is the more likely of the two.

Burial Orientation

Burial orientation is the direction in which the major axis through the body, extending from rump to crown, was oriented. Eight different burial orientations following the cardinal (i.e., north, south, east, and west) and intercardinal (i.e., northwest, southwest, northeast, and southeast) directions were observed at LAN-62. Although several-hundred individuals were identified at this site, an accurate assessment of burial orientation could only be recorded for 204 non–Mission period burials and 48 individuals associated with the Mission period. Tables 14 and 15 show the distributions of burial orientations among these individuals, as well as the distributions of age and sex information for each burial orientation. Based on the information presented in Table 14, approximately half the burials were oriented to the southeast and east. Northeast was the next-most-common orientation for non–Mission period burials, at nearly 16 percent. The remaining cardinal and intercardinal directions were each represented by less than 10 percent of the non–Mission period burial population, and north was the least represented, at 2.5 percent. These observations suggest that the western and northern directions were the least favored for orienting an interment; many more burials were oriented in the southern and eastern directions, especially east and southeast.

When controlling for age and sex in this population, the favoritism toward the southern and eastern directions seemed to continue. The only notable deviation occurred in the juvenile subpopulation, among which more burials were oriented to the northwest than the northeast.

As mentioned above, burial orientation was recorded for 48 individuals associated with the Mission period burial subset (see Table 15). Unlike the non–Mission period burial population, wherein half the burials were oriented to the southeast and east, nearly two-thirds of the population of the Mission period burial subset were oriented to the southeast and south. None was oriented to the north.

Burial Position

Burial position identifies the surface of the body upon which an individual was laid to rest. Four different burial positions were observed at LAN-62, including left side, right side, prone, and supine. An option for a fifth burial position, seated, was provided, but no burial features recovered from any site during the PVAHP were interred in that manner.

An accurate assessment of burial position was recorded for 198 non–Mission period individuals and 46 Mission period individuals. Tables 16 and 17 show the distributions of burial positions among these individuals, as well as the distributions of age and sex information for each burial position. Roughly 44 percent of the non–Mission period individuals buried at LAN-62 were interred on their left sides, followed by approximately one-third on their right sides, around 16 percent in a prone position, and approximately 8 percent in a supine position (see Table 16). When subpopulations of juvenile and male and female individuals from the main population were individually examined, this pattern of descending frequency from left-sided burials to supine burials was mirrored among all three subpopulations, with one notable exception: for juvenile individuals, right-side burials were actually less frequent than prone or supine interments.

Burial positions among the Mission period burial population followed a similar pattern. Individuals tended to be interred on their left sides (approximately 61 percent), and right-side, prone, and supine burials occurred in decreasing order of frequency (see Table 17).

Direction of Head Facing

Direction of head facing details the direction in which the head of the individual was facing when the remains were interred. Ten different head facings were observed at LAN-62: the cardinal directions (north, south, east, and west), the intercardinal directions (northwest, northeast, southwest, and southeast), up, and down.

Although several-hundred individuals were identified at LAN-62, an accurate assessment of head facing could only be recorded for 174 non–Mission period individuals and 46 Mission period burials. Tables 18 and 19 show the distributions of directions of head facing among these individuals, as well as the distributions of age and sex information for each individual with an observable head facing. The most frequent direction of head facing observed for the non–Mission period burial population at LAN-62, at approximately 20 percent, was face down (see Table 18). At approximately 13 percent, north was the next-most-common direction. Furthermore, one finds that the westerly directions tended to be favored over the easterly directions for head facing. This particular

Table 14. Distribution of Burial Orientations in Non–Mission Period Burials at LAN-62

Burial Orientation	Fetus (n)	Infant (n)	Child (n)	Subadult (n)	Male (n)				Female (n)					Indeterminate Sex (n)				Total (n)	Frequency (%)
					YA	MA	OA	AD	YA	MA	OA	AD	Ind	YA	MA	OA	AD		
East	—	3	4	—	7	7	—	3	12	6	1	—	—	7	2	—	2	54	26.5
North	—	—	—	—	—	2	—	—	1	—	—	1	—	1	—	—	—	5	2.5
Northeast	—	—	—	1	4	4	1	—	8	8	2	—	—	2	—	1	1	32	15.7
Northwest	1	—	2	2	—	2	—	—	1	2	—	—	1	1	—	—	—	12	5.9
South	—	—	1	1	3	2	—	—	8	—	1	—	—	1	—	—	1	18	8.8
Southeast	1	—	2	3	5	6	1	1	12	7	1	1	1	5	2	1	2	51	25.0
Southwest	—	1	1	—	2	2	—	—	7	3	—	—	—	1	—	—	—	17	8.3
West	—	—	1	—	2	2	1	—	1	4	—	—	—	4	—	—	—	15	7.4
Total	2	4	11	7	23	27	3	4	50	30	5	2	2	22	4	2	6	204	100.0

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; OA = old adult; YA = young adult.

Table 15. Distribution of Burial Orientations for the Mission Period Burial Subset at LAN-62

Burial Orientation	Fetus (n)	Infant (n)	Male (n)		Female (n)		Indeterminate Sex (n)		Total (n)	Frequency (%)
			YA	MA	YA	MA	YA	MA		
East	—	1	2	—	2	—	2	—	7	14.6
North	—	—	—	—	—	—	—	—	—	
Northeast	—	—	—	—	—	—	2	—	2	4.0
Northwest	—	—	—	—	1	—	—	1	2	4.2
South	—	—	1	—	7	2	2	1	13	27.1
Southeast	—	—	4	1	7	2	4	—	18	37.5
Southwest	1	—	—	—	4	—	—	—	5	10.4
West	—	1	—	—	—	—	—	—	1	2.1
Total	1	2	7	1	21	4	10	2	48	100.0

Key: MA = middle adult; YA = young adult.

Table 16. Distribution of Burial Positions in the Non–Mission Period Burials at LAN-62

Position	Fetus (n)	Infant (n)	Child (n)	Subadult (n)	Male (n)				Female (n)					Indeterminate Sex (n)				Total (n)	Frequency (%)
					YA	MA	OA	AD	YA	MA	OA	AD	Ind	YA	MA	OA	AD		
Left side	—	—	4	6	4	12	2	2	17	15	2	—	1	13	3	2	5	88	44.4
Right side	—	1	2	—	13	7	—	2	22	5	1	1	—	7	—	—	2	63	31.8
Prone	—	1	2	1	5	8	—	—	7	3	2	—	—	1	1	—	—	31	15.7
Supine	1	—	2	—	1	1	1	—	4	4	1	1	—	—	—	—	—	16	8.1
Total	1	2	10	7	23	28	3	4	50	27	6	2	1	21	4	2	7	198	100.0

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; OA = old adult; YA = young adult.

Table 17. Frequency of Burial Positions in the Mission Period Burial Subset of LAN-62

Position	Fetus (n)	Infant (n)	Male (n)		Female (n)		Indeterminate Sex (n)		Total (n)	Frequency (%)
			YA	MA	YA	MA	YA	MA		
Left side	—	—	5	1	11	3	7	1	28	60.9
Right side	—	—	1	—	6	—	2	—	9	19.6
Prone	—	1	1	—	2	1	—	1	6	13.0
Supine	1	—	—	—	2	—	—	—	3	6.5
Total	1	1	7	1	21	4	9	2	46	100.0

Key: MA = middle adult; YA = young adult.

Table 18. Distribution of Directions of Head Facing in Non–Mission Period Burials at LAN-62

Direction of Head Facing	Fetus (n)	Infant (n)	Child (n)	Subadult (n)	Male (n)			Female (n)			Indeterminate Sex (n)			Total (n)	Frequency (%)
					YA	MA	OA	YA	MA	OA	YA	MA	AD		
East	—	—	—	—	4	2	1	5	—	—	—	—	—	12	6.9
North	—	1	1	—	5	4	—	6	2	1	3	—	—	23	13.2
Northeast	—	—	—	—	—	2	—	2	2	1	—	—	—	7	4.0
Northwest	—	—	—	2	2	1	—	9	4	—	1	1	—	20	11.5
South	—	—	1	—	—	3	—	4	6	—	3	—	1	18	10.3
Southeast	—	—	—	—	1	2	—	2	3	—	2	1	—	11	6.3
Southwest	—	1	2	1	2	5	—	2	4	—	3	—	—	20	11.5
West	—	—	1	2	1	—	1	7	4	—	1	3	—	20	11.5
Up	—	—	1	—	1	2	—	—	2	1	1	—	—	8	4.6
Down	—	2	1	3	4	8	—	9	4	1	2	1	—	35	20.1
Total	—	4	7	8	20	29	2	46	31	4	16	6	1	174	100.0

Key: AD = indeterminate adult; MA = middle adult; OA = old adult; YA = young adult.

Table 19. Distribution of Directions of Head Facing for Individuals in the Mission Period Burial Subset at LAN-62

Direction of Head Facing	Infant (n)	Child (n)	Male (n)		Female (n)		Indeterminate Sex (n)	Total (n)	Frequency (%)
			YA	MA	YA	MA	YA		
East	—	—	1	—	3	—	—	4	8.7
North	—	—	1	—	1	—	2	4	8.7
Northwest	—	—	4	—	2	1	—	7	15.2
South	—	—	—	—	4	—	1	5	10.9
Southeast	—	—	—	—	2	—	1	3	6.5
Southwest	—	—	1	1	1	—	1	4	8.7
West	—	—	1	—	6	—	4	11	23.9
Up	1	—	—	—	—	—	—	1	2.2
Down	1	1	—	—	2	1	2	7	15.2
Total	2	1	8	1	21	2	11	46	100.0

Key: MA = middle adult; YA = young adult.

point is understandable when one takes burial orientation and position into account. For example, when placing an individual in an easterly direction, it was likely easier to prepare a body such that the head was facing in generally the opposite direction to the orientation. In fact, twice as many individuals faced northwest, west, and southwest as faced northeast, east, and southeast (see Table 18). Northeast was the least-frequent direction of head facing.

When the non–Mission period burial population at LAN-62 was divided into subpopulations based on age and sex, some notable patterns were observed (see Table 18). Down was still the most frequent head-facing direction for males, females, and juveniles. No juvenile individual faced northeast, east, or southeast. Although similar numbers of individuals were represented in most cardinal and intercardinal directions for females and males, many more females faced south, west, and northwest than males. Finally, for adult males, the numbers of individuals facing directly west (n = 2) and directly east (n = 7) were inverted when compared to the entire population, among whom there were nearly twice as many people facing directly west as directly east.

As mentioned above, only 46 individuals associated with the Mission period burial subset were complete enough to yield information regarding head facing (see Table 19). The most discerning difference between that population and the non–Mission period burial population was the fact that the most-common direction of head facing was west. Northwest and down were the next-most-common directions of head facing, at approximately 15 percent each.

Other PVAHP Sites

This section details the mortuary observations for the burials recovered from other sites in the PVAHP project area: LAN-54, LAN-193, LAN-211, and LAN-2768. In contrast to LAN-62, only 12 burial features were recovered from these four sites. Therefore, a detailed intrasite analysis could not be conducted. Instead, overall mortuary trends are discussed here and compared to the trends observed in LAN-62. These data are presented in Table 20. Refer to Table 8 for the summary information associated with these PVAHP sites.

Like at LAN-62, there appeared to be a preference of inhumation over cremation. In fact, all burials from these four sites were identified as inhumations without burning. (Note, however, that scattered remains from other individuals were recovered at LAN-54, LAN-211, and LAN-2768 [see Chapter 6, this volume].) The trend in burial treatment, however, changed across these sites. Whereas the majority of the burials at LAN-62 were interred fully flexed, across these four sites, there appeared to be a slight preference for interring semiflexed over fully flexed. Of the eight burials for which burial treatment could be clearly observed, five of the individuals were interred semiflexed, and three were interred fully flexed.

In regard to burial orientation, of the 11 burials for which orientation could be observed, most were oriented to the northeast, west, and southwest; only one was oriented to the east. This pattern is different from the one observed at LAN-62, where burials oriented to the southeast and east were more numerous.

Table 20. Summary of Mortuary Observations of the Inhumations Recorded at LAN-54, LAN-193, LAN-211, and LAN-2768

Feature No., by Site No.	Individual	Burial Treatment	Burial Orientation	Burial Position in Grave	Direction of Head Facing
LAN-54					
3	P	fully flexed	southwest	left side	northwest
6	P1	semiflexed	southwest	supine	south
6	P2	semiflexed	west	prone	south
11	P	fully flexed	west	right side	south
LAN-193					
101	P	indeterminate	east	left side	west
214	P	fully flexed	northeast	left side	south
216	P	indeterminate	north	supine	up
LAN-211					
27	P	indeterminate	indeterminate	indeterminate	indeterminate
33	P	indeterminate	indeterminate	indeterminate	indeterminate
49	P	semiflexed	southwest	right side	south
LAN-2768					
108	P	semiflexed	southeast	supine	up
109	P	indeterminate flexed	southwest	right side	indeterminate
112	P	semiflexed	northeast	supine	southwest

Key: P = primary individual.

Unlike at LAN-62—where burials positioned on the left side were the most numerous, followed by those positioned on the right side, prone, and supine—for the remaining sites in the PVAHP project area, approximately one-third of the burials for which position could be observed were interred in a supine position, followed by interment on the right or left side. Few burials were interred in a prone position.

For burials associated with these four sites, south was the preferred direction of head facing; exactly half the burials for which this trait could be observed faced south. As previously mentioned, the more-frequent directions of head facing for burials at LAN-62 were down (overall population) and west (Mission period); for these four sites, no individual was facing down.

Although the burials associated with these sites were not elaborate, burial Feature 6 from LAN-54 was unique, in that it represented the only double burial outside LAN-62 in the project area (Figures 28 and 29). This burial was located in the northeastern portion of LAN-54 and consisted of two primary inhumations. The first primary inhumation was a 40–44-year-old female interred in a supine position, oriented to the southwest, with the head facing south. The skeletal remains associated with this individual were moderately preserved. The legs, and consequently the feet, inferior to the proximal one-third of the femora were missing postmortem, and the cranium was fragmented. Many of the bones of the hands were also missing postmortem. The angle of the remnants of the legs suggested that this individual had been interred semiflexed. The arms, on the other hand, were fully flexed, with the hands brought up to the shoulders, as if in a pugilistic position. The head had settled to the right. This individual was located immediately above the remains of the second primary inhumation, a 25–39-year-old female interred semiflexed in a prone position, oriented to the west, with the head facing south. For this individual, the right arm and knee were semiflexed and located immediately beneath the first primary inhumation. The left hand, curled as if clasping something, was located immediately next to the right humerus, indicating that the left arm had crossed the anterior thorax. The cranium had settled to the right side, with the chin over the right shoulder. Most of the thorax, pelvis, and legs were missing postmortem.

Because burial features outside LAN-62 were scattered, this unique association suggested a possible social connection between these two individuals. Furthermore, the relatively equal degree of preservation indicated that the individuals were probably interred at or around the same time.

Corbett (2007) conducted a regional analysis of mortuary practice among the Chumash of coastal central and southern California. His analysis was focused on 1,500 individuals from 50 assemblages dating to the Early (7500–2600 B.P.) and Middle (2600–800 B.P.) periods. He concluded that mortuary practices correlated with geography rather than time and that in this region, mortuary behavior does not support a cultural horizon resulting from population displacement by a foreign group. In addition, there was a shift from face-up to face-down about 2,000 years ago, and it convergence on flexed, face-down, western-oriented burial as the normative treatment by the end of the Middle period, approximately 1,000 years ago (Corbett 2007). Corbett's (2007) analysis and findings can be compared with the Intermediate period burials in the Ballona to discern similarities and differences between these two culturally distinct regions in coastal California. However, there are relatively few burials in the Ballona that date to the Intermediate period; the majority date to the Protohistoric to Mission period. This comparison is discussed in Chapter 6, Volume 5, this series.

Selected LAN-62 Burial Features

This section provides detailed descriptions of a selected group of 40 burial features recovered during the PVAHP. These features are predominantly from LAN-62 (39 of the 40 burial features) and were selected because they demonstrated unique spatial relationships, pathological conditions, morphological variants, cultural behaviors, artifact distributions, and taphonomic expressions (Figure 30). As always, for help with technical terminology, the reader is directed to the Glossary. Also, additional information for individuals identified in these burial features is found in the numerous appendixes associated with this volume, specifically Appendix B (osteometrics), Appendix C (age-related traits), Appendix D (sex-related traits), Appendix E (paleopathology and morphological variation), Appendix F (dental traits), Appendix G (overall dental data), Appendix H (dental attrition), Appendix I (epigenetics), and Appendix J (taphonomy). Descriptions of the remaining burial features can be found in Appendix M, this volume. Further information regarding artifacts recovered from these burial features can be found in the appropriate chapters in Volume 3, this series. Please refer to Appendix O, this volume, for detailed relationships among these 39 burials and others at LAN-62.

Burial Feature 13

Feature Age: Mission period (A.D. 1800–1816)
MNI: 4 (1 primary and 3 additional)
Primary Individual: female, 25–35 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: left side
  Burial Orientation: southeast
  Head Facing: west
Additional Individuals: (1) adult of indeterminate sex, (2) adult of indeterminate sex, and (3) individual of indeterminate age and sex
Burial Pit: unobservable

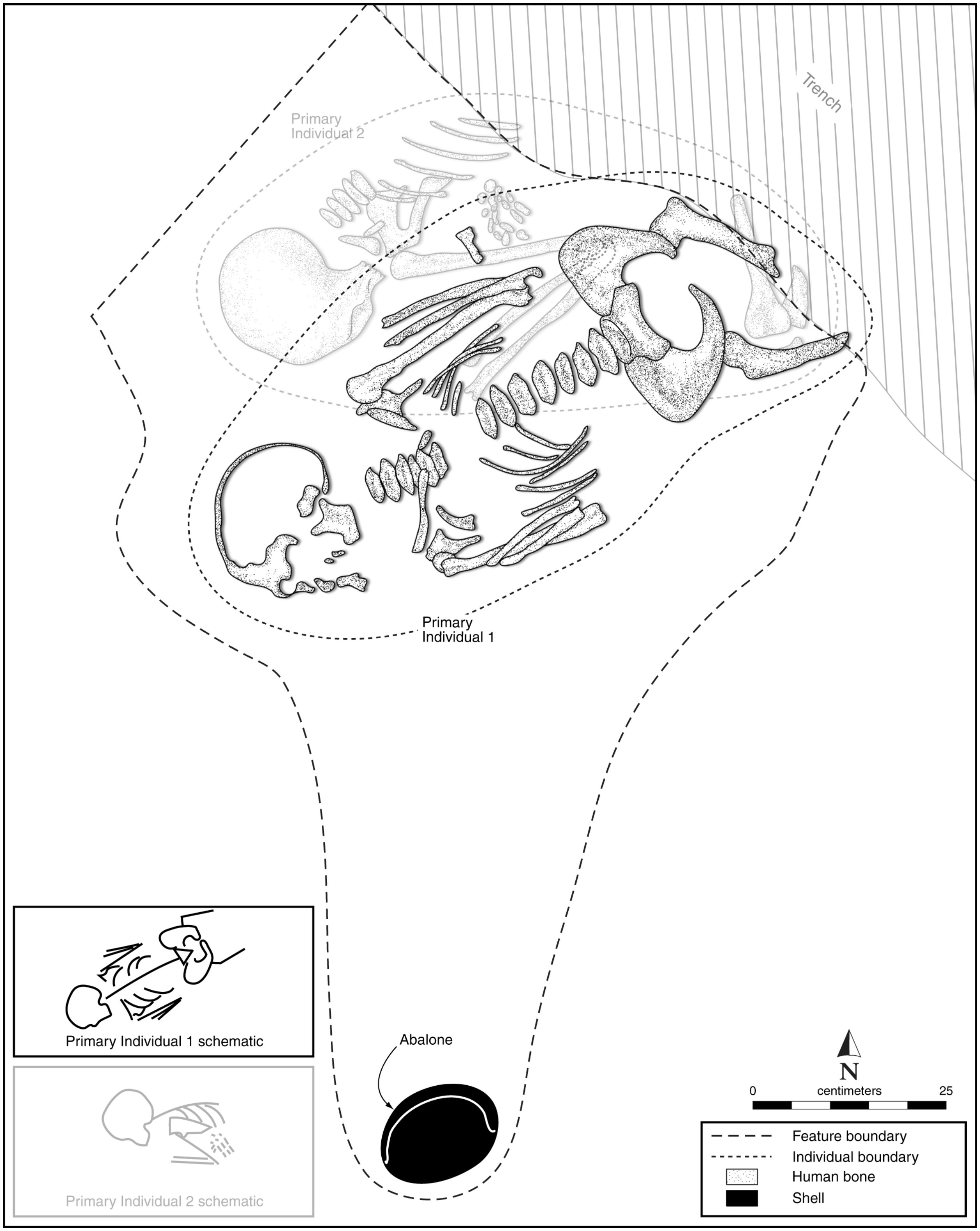

Figure 28. Illustration of Primary Individual 1 from burial Feature 6 at LAN-54.

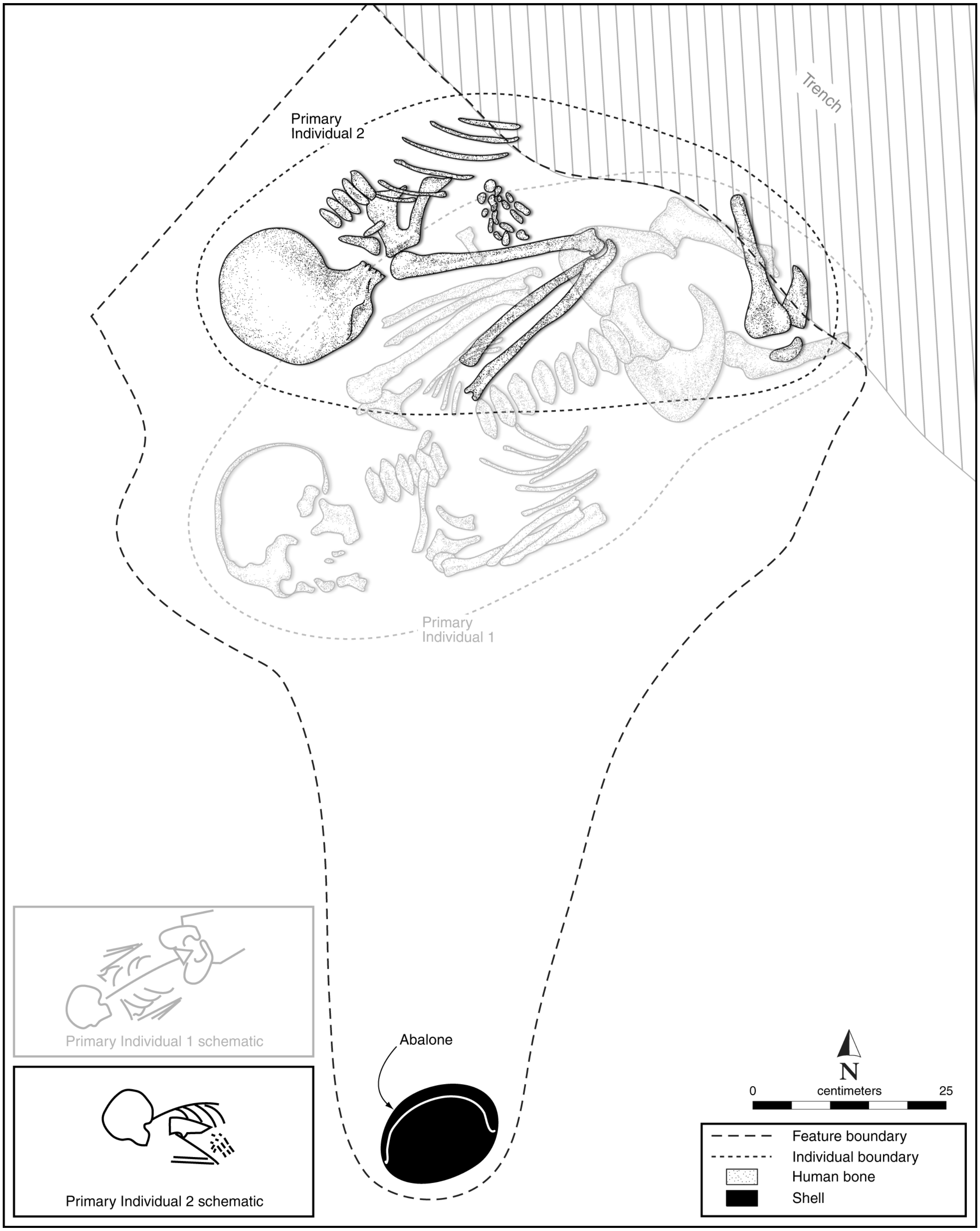

Figure 29. Illustration of Primary Individual 2 from burial Feature 6 at LAN-54.

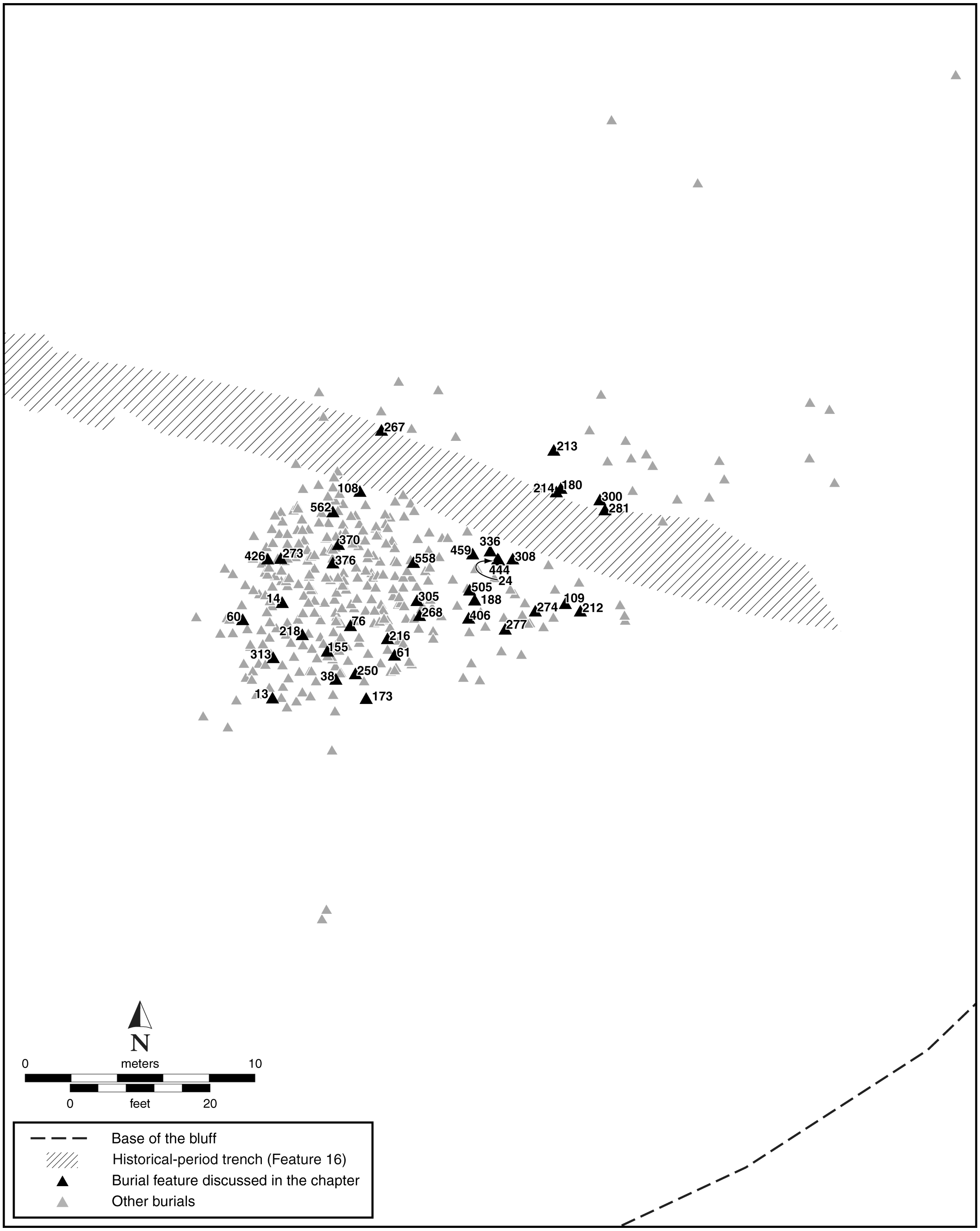

Figure 30. Distribution of the burials at LAN-62 selected for discussion in the chapter.

Feature Fill

The feature matrix consisted of loosely consolidated very dark-brown silty sand with a small component of shell, charcoal, faunal bone, and numerous cultural materials. Scattered human remains associated with at least three additional individuals were recovered from the feature matrix. Approximately 20 human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were also recovered. Although all regions of the skeleton were represented, more than half the remains were from the appendicular skeleton. Fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

The presence of numerous disarticulated human-skeletal remains from at least three other individuals and unidentifiable bone fragments indicated that the interment of the primary inhumation had impacted previously inhumed burials. Burial Feature 6, located directly east of burial Feature 13, may have been the source of several of these remains, and the remainder may belong to another burial that was completely disarticulated through the actions of those interring the dead. Rodent gnaw marks were observed on the anterior surface of the distal end of an unassociated left humerus. The calcined human bone found in this feature (Additional Individual 3) does not necessarily indicate the disruption of a cremation by this individual. Such material is highly transportable through bioturbation and was nearly ubiquitous throughout the burial area.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 60 cm; width, 72 cm; depth, 28 cm) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan view of the feature shape is ovate.

Feature Interpretation

This burial feature was located along the southwestern periphery of the main burial concentration and consisted of a single primary inhumation and scattered human-skeletal material associated with at least three additional individuals (Figure 31).

The primary inhumation was a 25–35-year-old female interred fully flexed on the left side, oriented to the southeast, and facing west. Using the maximum length of the left femur, the living stature of this individual was estimated to have been approximately 152.2–159.8 cm (59.9–62.9 inches). The skeletal remains associated with this individual were moderately preserved, and much of the cranial and appendicular skeleton was still present at the time of excavation. Most of the axial skeleton, as well as the bones of the extremities, was missing postmortem. A suite of dental observations were made concerning attrition, pathology, and variation. Several carious lesions and enamel hypoplastic defects were noted on the dentition of this individual. Additionally, two abscesses and marked alveolar resorption were observed on the mandible.

Of the remaining individuals, two (both indeterminate-sex adults) were based on pairs of femora that were found close to one another. The pair of femora located in the southern portion of the burial feature may have been originally part of the primary inhumation in burial Feature 6. The gracility of these femora was consistent with a female individual, the same sex as the primary inhumation in burial Feature 6. Although the primary feature from burial Feature 6 had an associated unsided femur, that femur was only partially complete and could conceivably be a fragment of one of the femora from either pair in burial Feature 13. Because of preservation issues, confirmation of this hypothesis is impossible. The final individual was based on the presence of a completely calcined fragment of an unidentifiable bone. The fragment was deemed a separate individual, based on differential treatment of the remains. Because of a lack of diagnostic criteria, no demographic information could be estimated for this individual. The remaining skeletal elements recovered from this burial could not be confidently associated with any of the individuals represented in this burial feature.

Associated Features

Burial Feature 13 was located directly west of burial Feature 6. The presence of numerous disarticulated remains from at least three additional individuals in burial Feature 13 suggested that the interment of the primary inhumation directly impacted earlier burials, possibly including burial Feature 6. Burial Feature 13 was also impacted by the interment of burial Features 152 and 153. Figure 32 illustrates these feature relationships.

Associated Artifacts

The primary inhumation from this burial feature was associated with numerous cultural materials. Three to four strands of nearly 1,000 shell beads were recovered from the mandibular/neck region. At least eight varieties of shell beads were represented on these strands. These included semiground olivella disk, ground olivella disk, semiground olivella lipped disk, olivella spire, olivella tiny saucer, olivella wall disk, and Pismo-clam tube. Nearly 450 of these beads could not be identified. Of the identified bead types, the semiground-olivella-disk bead type, at nearly 490, was the most represented. The combined date range associated with these shell beads was 600 B.C. to post–Mission period, but most of these beads were manufactured between A.D. 1800 and 1816. Two smaller groups, however, were manufactured between A.D. 1770 and 1800 and A.D. 1816 and 1834. These beads were ground olivella disk and olivella

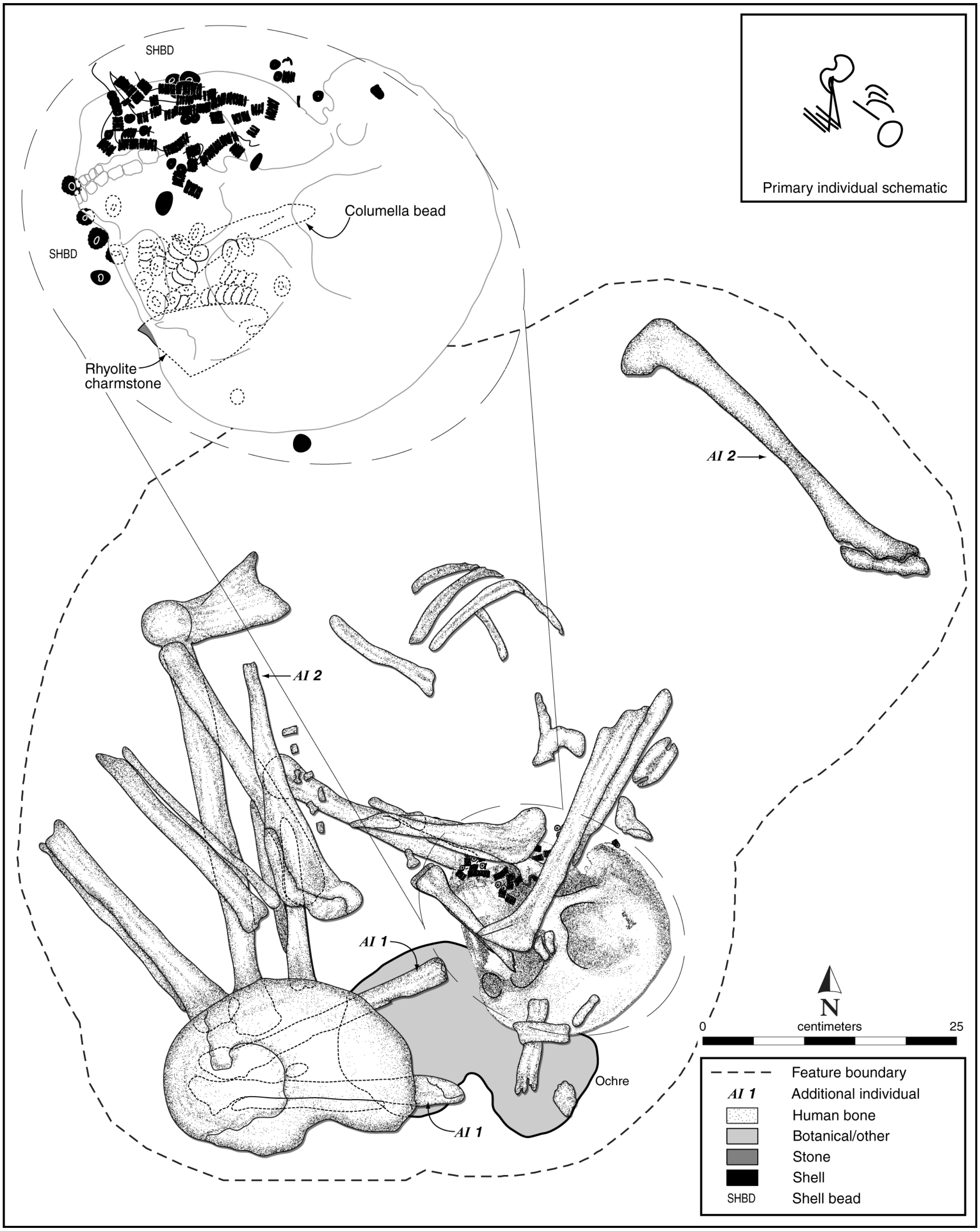

Figure 31. Illustration of burial Feature 13 at LAN-62.

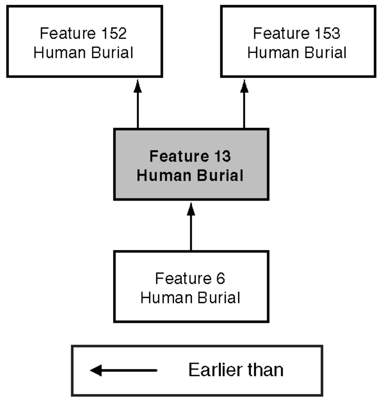

Figure 32. Chart showing the feature relationships associated with burial Feature 13 at LAN-62.

rough disk, respectively. (Bennyhoff and Hughes [1987:135] assigned dates of A.D. 1800–1816 and A.D. 1816–1834 to the ground olivella disk and olivella rough disk. Although these dates may be tightly defined, at this time, these are the only data available to distinguish the phases within the Mission period.)

In the southeastern portion of the burial feature, adjacent to the cranium, was a large (approximately 25-by-15-cm) concentration of red ocher. Nestled beneath the ocher concentration, bead cluster, and cranium was a lanceolate-shaped, plummet-like "charmstone" composed of red porphyritic rhyolite. The end of this charmstone appeared to have been battered. These types of artifacts date to as early as 4300 B.P. (Koerper, personal communication 2006), and this specimen might have been curated/heirloomed.

Possibly Unassociated Artifacts

Several artifacts could not be directly associated with any of the individuals represented in this burial feature. These artifacts consisted of nearly 60 historical-period glass beads and approximately 1,500 shell beads. The shell beads consisted of three varieties: semiground olivella disk, olivella tiny saucer, and red-abalone-epidermis disk. As with the associated shell beads, most (approximately 1,200) were semiground-olivella-shell disk beads. Though found in the feature matrix, the shell and glass beads associated with this burial can still provide some indirect chronometric data for this burial feature. The combined date range associated with the shell beads is 600 B.C.–A.D. 1816, and most were manufactured between A.D. 1800 and 1816. The glass beads were manufactured between A.D. 1770 and 1825. Judging from the similarity of these shell-bead types to those that were directly associated, the majority of the unassociated beads were likely originally from the strands of beads associated with the primary inhumation.

Burial Feature 14

Feature Age: Mission period (A.D. 1800–1816)
MNI: 4 (1 primary and 3 additional)
Primary Individual: possible male, 40–55 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: left side
Burial Orientation: southeast
Head Facing: southwest
Additional Individuals: (1) indeterminate sex, 2–4 years; (2) indeterminate sex, 15–25 years; (3) indeterminate sex, adult
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown to black silty sand with inclusions of shell fragments, faunal bone, approximately 1–2-cm-diameter charcoal pieces, and cultural materials. Scattered human remains associated with at least three additional individuals were recovered from the feature matrix. Additionally, at least 10 human-skeletal elements that could not be confidently associated with any individual were represented in this burial. These remains consisted of nearly equal amounts of appendicular, axial, and cranial bone, as well as teeth. Fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

A large rodent burrow extended through the burial in a northwest–southeast direction.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 75 cm; width, 60 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan-view feature shape is square or nearly square.

Feature Interpretation

This burial was located near the western periphery of the main burial concentration and consisted of a single primary inhumation and scattered human remains associated with at least three additional individuals.

The primary inhumation was a 40–55-year-old possible male interred fully flexed on the left side, oriented to the southeast, with the head facing southwest. Stature could not be estimated for this individual (Figure 33). The skeletal remains associated with this individual were poorly preserved

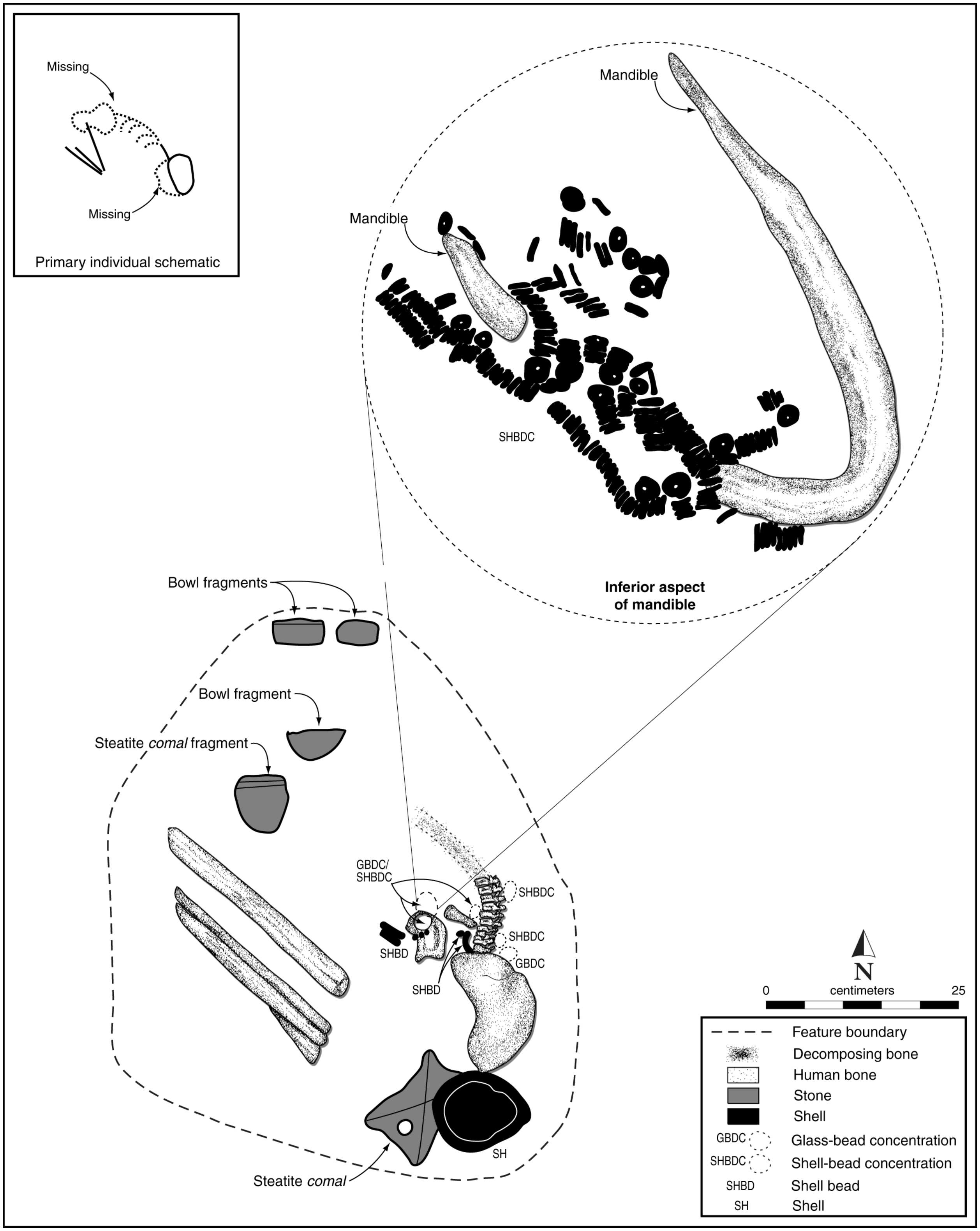

Figure 33. Illustration of burial Feature 14 at LAN-62.

and included only a partial cranium, a mandible, some thoracic vertebra, the cervical vertebrae, a right clavicle, an unsided humerus, a few ribs, a right femur, elements of the left and right lower legs, and a hyoid. Although the remains were poorly preserved, many additional observations could be made. Several teeth associated with this individual exhibited carious lesions and hypercementosis, or a thickening of the cementum layer of the root resulting from excessive attrition or periodontal disease. Furthermore, osteoarthritis was observed on the cervical vertebrae, and some osteophytic lipping was present on some cervical and thoracic vertebrae.

Scattered human remains associated with at least three additional individuals were also recovered. The first, a 2–4 year-old individual of indeterminate sex, was represented by an unidentified deciduous incisor, a left deciduous mandibular first molar, and a left deciduous maxillary lateral incisor.

The second, a 15–25-year-old individual of indeterminate sex, was represented by a right permanent maxillary first molar and a right permanent maxillary central incisor.

The final individual was represented by burned human-bone fragments, the most identifiable of which were two cranial fragments. Although most of these remains were partially or completely calcined, one of the cranial fragments was partially blackened. Because no diagnostic criteria were available, no demographic information could be recorded for this individual.

Associated Features

The legs and abdominal region of the primary inhumation in burial Feature 14 were located approximately 53 cm above the eastern cluster of long bones and the cranium associated with the 10–15-year-old individual in burial Feature 470. Additionally, the northern portion of burial Feature 14 was located approximately 120 cm above the southern portion of nonburial Feature 650. Furthermore, burial Feature 14 was located within 10 cm above nonburial Feature 252. Burial Feature 14 was also located immediately above nonburial Feature 68, which might contain several artifacts originally associated with, or disturbed by the interment of, the primary individual in burial Feature 14. The northern portion of burial Feature 14 was located approximately 60 cm above the southern portion of nonburial Feature 544. Finally, the feet associated with the primary inhumation in burial Feature 14 were located approximately 75 cm above nonburial Feature 450. The relationship between these nonburial and burial features is illustrated in Figure 34.

Associated Artifacts

Several artifacts could be directly associated with the primary inhumation. These consisted primarily of strands of nearly 4,500 shell beads, a steatite *comal* with an X-shaped incised design, and an intact abalone shell. The shell beads were recovered from around the neck and beneath the mandible and consisted of at least 10 varieties, including clam disk, ground olivella disk, black-abalone-epidermis disk, red-abalone-epidermis disk, semiground olivella disk, semiground olivella lipped, semiground olivella shelved disk, olivella spire, olivella thin lipped, and olivella tiny saucer. Approximately one-third of the beads associated with this individual were not identified by type; of the identified beads, most (approximately 2,500) were of the semiground-olivella-disk type. Burning was evident on some of the semiground-olivella-shell disk beads and an olivella-spire bead. Additionally, asphaltum was observed on a ground-olivella-shell disk bead. The combined date range associated with these beads was 600 B.C.–A.D. 1816, and a much narrower date range was associated with the ground- and semiground-olivella-shell disk beads, which ranged from A.D. 1800 to 1816. The *comal* and the abalone shell associated with the primary inhumation were located in a stack immediately southwest of the cranium.

Possibly Unassociated Artifacts

Several artifacts could not be directly associated with any individual represented in this burial. These consisted of about 250 glass beads, a large granite pestle midsection, 2 small steatite bowl fragments, a small steatite olla fragment, a *comal* fragment, and nearly 250 shell-bead fragments. The shell beads were of at least five varieties, including red-abalone-epidermis disk, olivella rough disk, semiground olivella disk, semiground olivella lipped disk, and olivella wall. Most of these beads, approximately 140, were of the semiground-olivella-disk variety.

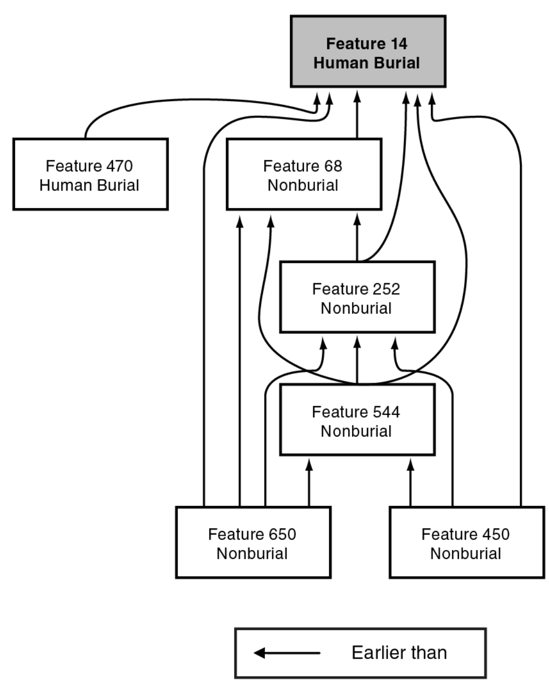

Figure 34. Chart showing the feature relationships associated with burial Feature 14 at LAN-62.

One of the steatite bowl fragments was decorated with a zigzag pattern on the exterior and a linear incision on the rim. An extremely thick layer of soot was observed on the exterior of the other bowl fragment. The *comal* fragment displayed decorative incisions. The unassociated lithic material was recovered from the northern portion of the burial.

Although they were recovered from the feature matrix, the shell and glass beads could provide some circumstantial chronometric data for this burial. The shell beads had a combined date range of 600 B.C.–post–Mission period, and a much narrower date range was associated with the olivella-rough-disk and semiground-olivella-disk bead types, which range from A.D. 1800 to 1834.

Burial Feature 24

Feature Age: indeterminate
MNI: 3 (2 primary and 1 additional)
Primary Individual 1: male, 28–78 years
Burial Type: partial cremation
Burial Treatment: indeterminate
Primary Individual 2: indeterminate sex, adult
Burial Type: partial cremation
Burial Treatment: indeterminate
Additional Individual: indeterminate sex, 6 months–1 year and 4 months
Burial Pit: unobservable

Feature Fill

The feature matrix was black silty sand with sparsely distributed shell fragments, faunal bone, and several cultural materials. Numerous fragments of human bone associated with at least three individuals were also recovered from the matrix. Furthermore, nearly 50 scattered human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were also recovered from the feature matrix. Although representative of all regions of the skeleton, approximately two-thirds of these remains were split between the appendicular skeleton and the dentition. Many fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

Some rodent disturbance was observed.

Burial Pit

No burial-pit boundary was observed. The dimensions (length, 59 cm; width, 108 cm; depth, 22 cm) of this burial were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan-view feature shape is irregular.

Feature Interpretation

This burial feature was located immediately south of the historical-period trench (nonburial Feature 16) in the eastern portion of the burial area, within the more diffusely organized burial concentration, and consisted of at least two partial cremations and the isolated skeletal remains of a third individual (Figure 35). Although a primary context was suspected, it was unclear whether these partial cremations were recovered from a primary or secondary context, because of limited information (see below).

The first partial cremation, Primary Individual 1, a 28–78-year-old male, was identified by an articulated left and right innominate, left and right femora, sacrum, and fifth lumbar vertebra. Stature could not be estimated. The anterior surface of the proximal femur shaft and head, the distal end of the right femur, and the anterior-superior iliac crests of the right ilium were blackened from burning. All of these surfaces were facing down. The proximal shaft of the left femur exhibited a postmortem spiral fracture, possibly indicating that the remains had been broken during the ritual process.

The second partial cremation, Primary Individual 2, an adult of indeterminate sex, was identified by another articulated left innominate and femur. Stature could not be estimated. The posterior surface (just inferior to the lesser trochanter, on the femur) was blackened from burning. Unlike with the first partial cremation, this burned surface was facing up.

Although unassociated, several articulated segments of human bone were found throughout the burial feature. First of all, a segment of four unburned, articulated cervical vertebrae were located approximately 3 cm west of the right femur of the first partial cremation. Additionally, about 5 cm beneath the southern end of the pelvis associated with the first partial cremation was a fragmentary cranium. This cranium had been heavily compressed from ground pressure and blackened on both lateral aspects. The medial aspect, however, was unburned. Finally, there was an articulated fragment of a left scapula (represented by an acromion and a glenoid fossa) and a proximal left humerus located directly above the distal end of the left femur of the second partial cremation. The scapula exhibited blackening along the acromion, whereas the humerus was burned on the posterior aspect of the proximal end. Both burned surfaces were oriented upward.

In addition to the above elements, there were several fragments of burned bone within this burial feature that could not be attributed to either individual, because of limited diagnostic information. These bone fragments exhibited a range of burning from partial blackening to complete calcination. Extending through the burial feature was a fairly thick (0.5–3.0-cm) layer of charcoal and burned bone. The thickest portion of this layer was directly beneath the remains associated with the first partial cremation and extended over the top of the left femur

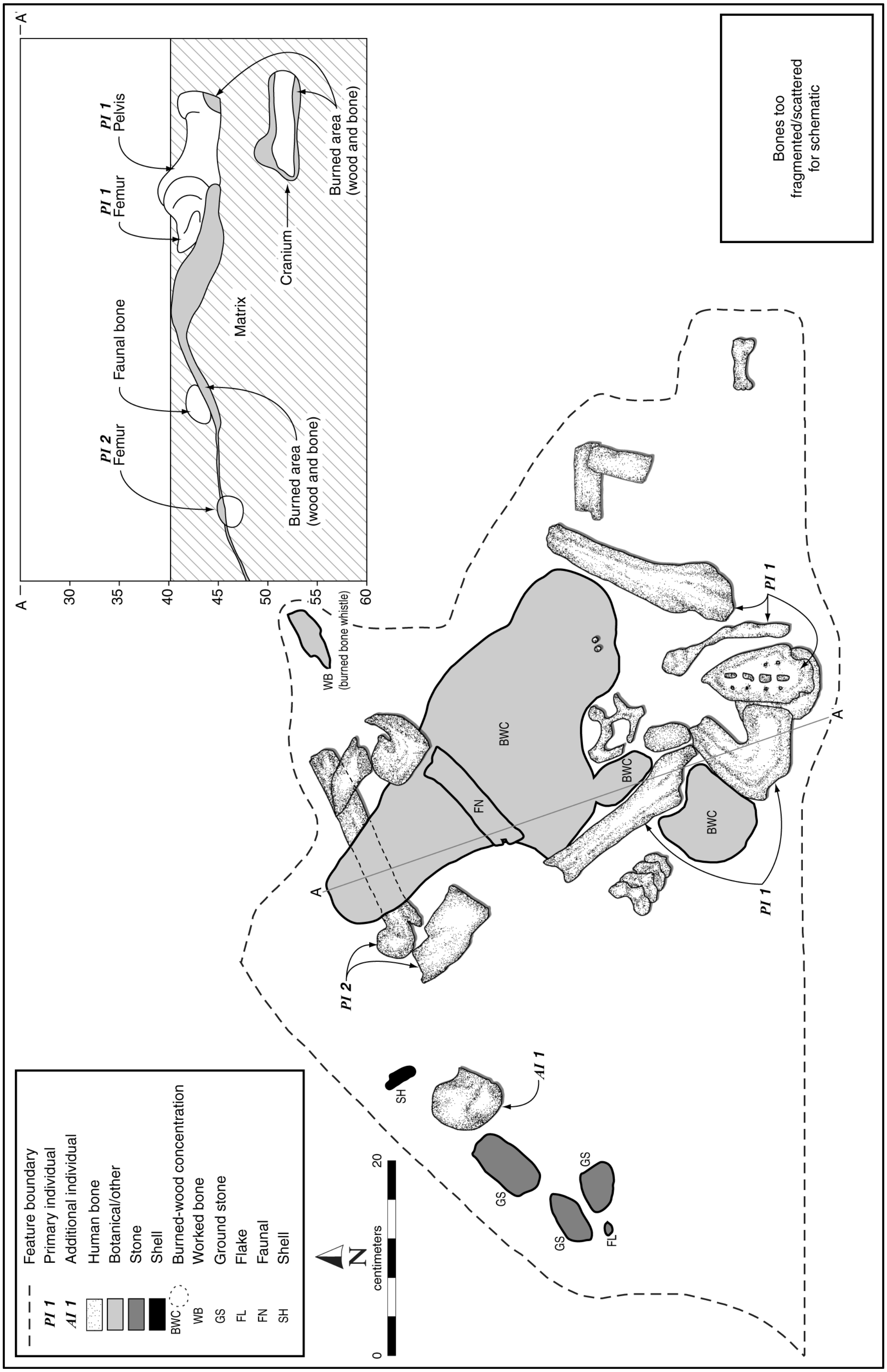

Figure 35. Illustration of burial Feature 24 at LAN-62.

associated with the second partial cremation and the articulated left shoulder joint. Because the burned surfaces for each partial cremation were in direct contact with this lens, it might be that the remains were burned in situ. However, the cranium mentioned above was burned on two opposing surfaces and was located 5 cm below and 10 cm south of this lens. Therefore, it is entirely possible that one individual represented an earlier burial event disturbed during the interment of a subsequent event. Which individual represented the intrusive burial feature, however, could not be identified. Conversely, it is equally likely that both were interred simultaneously.

The third individual represented in this burial feature was a 6-month–1-year-and-4-month-old infant of indeterminate sex. This individual was represented by several undeveloped human-bone fragments, including a lateral sacral element, a left and right maxilla, a sphenoid, and a petrous portion.

Associated Features

This burial feature was located 30 cm above burial Feature 444. Burned bone and a burned olivella-shell cupped bead found in burial Feature 444 might be associated with one of the partial cremations found in this burial feature. Burial Feature 24 was also located within 30 cm, directly above the left forearm associated with the primary inhumation in burial Feature 308. Although definitely occurring after the interment of these burials, the placement of burial Feature 24 did not appear to have disturbed either burial feature. Figure 36 illustrates these feature relationships.

Associated Artifacts

Because they were treated similarly to much of the human bone in this burial feature (i.e., burned), a bone-whistle fragment and four fire-affected-cobble fragments might represent mortuary accompaniments, although which of the partial cremations it may have accompanied is unknown.

Possibly Unassociated Artifacts

Several other cultural materials were also recovered from the feature matrix. These included a flake of debitage and four olivella-shell beads. These beads consisted of four different types, including bushing, full large lipped, oval thin lipped, and semiground disk. Although these beads could not be directly associated with any individual in this burial feature, they can still provide some circumstantial chronometric data. The combined date range associated with these beads was A.D. 1150–1816. Interestingly, many of these beads had conflicting date ranges when observed at an individual level. The semiground disk beads and bushing beads had an associated date range of A.D. 1800–1816, and the full large-lipped beads, though produced from A.D. 1770 to 1816, were intensively produced during the same time period as the semiground disk beads. The oval thin-lipped bead, however, was manufactured between A.D. 1500 and 1700.

Burial Feature 38

Feature Age: Mission period (A.D. 1800–1816)
MNI: 5 (2 primary and 3 additional)
Primary Individual 1: possible female, 20–30 years
 Burial Type: inhumation
 Burial Treatment: fully flexed
 Burial Position: left side
 Burial Orientation: south
 Head Facing: northwest
Primary Individual 2: indeterminate sex, 20–30 years
 Burial Type: inhumation
 Burial Treatment: fully flexed
 Burial Position: left side
 Burial Orientation: east
 Head Facing: south
Additional Individuals: (1) possible female, 20–30 years; (2) possible male, 16–22 years; (3) indeterminate sex, adult
Burial Pit: multiple

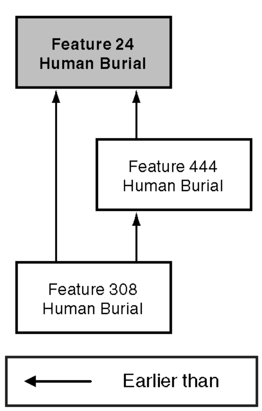

Figure 36. Chart showing the feature relationships associated with burial Feature 24 at LAN-62.

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of faunal bone, shell fragments, charcoal fragments, and numerous cultural materials. Fragments of human remains associated with at least three additional individuals were also recovered from the feature matrix. Nearly 20 fragments of human bone that could not be confidently associated with any individual represented in this burial feature were also recovered. Although all regions of the skeleton were represented, approximately half the skeletal remains were from the appendicular skeleton, and about one-quarter of the remains were from the axial skeleton. Furthermore, numerous fragments of human bone that could not be identified to the element level were also recovered. Most of the elements were found within the burial pit associated with the second primary individual.

Feature Disturbance

Minor rodent disturbance was observed throughout the burial feature. Numerous isolated and disarticulated human remains found in the feature matrix associated with the second primary inhumation indicated that a previously interred individual had been impacted by the interment of this individual.

Burial Pit

A burial pit was associated with each primary inhumation. Both pits were identified by the arrangement and orientation of the associated artifacts. Accompanying each primary inhumation was a series of broken ground stone artifacts. These fragments were located in rather tight clusters above and adjacent to their respective primary inhumations and were unique to each burial pit. There was no intermingling. Furthermore, in profile, these clusters of artifacts were oriented at an angle, as though placed on the sloping walls of a burial pit.

An upright, flat piece of whale bone had been placed between these pits, with the long axis oriented northeast–southwest. A complete set of individual measurements for each pit could not be recorded, because these artifacts were only located along one side of each pit. The feature measured 190 cm in length and 177.5 cm in width, and the depth was unknown. The plan-view shape of the feature was irregular. For the first primary inhumation, the artifacts were located along the southern wall. The artifacts for the second primary inhumation were more numerous and lined the northern half of the pit.

Feature Interpretation

This burial was located in the southern portion of the main burial concentration and consisted of two discrete primary inhumations and at least three additional individuals represented by scattered human-skeletal elements (Figure 37). The first primary inhumation was a 20–30-year-old possible female interred fully flexed on the left side, oriented to the south, and facing northwest (Figure 38). Stature could not be estimated. The skeletal remains associated with this individual were well preserved and missing few elements postmortem. Standard epigenetic traits and dental attributes were recorded, as were cranial and postcranial metrical data. No nondental pathological conditions or behavioral indicators were observed, although the right third cuneiform exhibited nonosseous tarsal coalition, a congenital defect of the tarsals and metatarsals. Although some versions of this condition can result in pain and impaired functionality, tarsal coalition between the third cuneiform and third metatarsal is usually asymptomatic.

The second primary inhumation was a 20–30-year-old adult of indeterminate sex interred fully flexed on the left side, oriented to the east, with the head facing south (Figure 39). Stature could not be estimated. Although found within half a meter of the first primary inhumation, the skeletal remains associated with this individual were very poorly preserved. In fact, the only remains associated with this individual were a cranium, a fragmented right leg, the first through third cervical vertebrae, an unidentified thoracic vertebra, a possible right clavicle, a right humerus, two unsided radius fragments, and a small number of unidentified long bones. Standard epigenetic traits and craniometric observations were recorded. No nondental pathological conditions, behavioral indicators, or dental attributes were observed.

Isolated human remains associated with at least three additional individuals were also recovered from the feature matrix. The first individual, a 20–30-year-old possible female, was represented by another partial cranium and associated dentition. The cranium was located along the southern edge, above the stacks of broken *comales*, within the burial pit associated with the first primary inhumation. Presence of enamel hypoplastic defects and hypercementosis was observed on the right second and third maxillary molars.

The second individual, a 16–22-year-old possible male, was also represented by another cranium, as well as a mandible, associated dentition, and an unidentified cervical vertebra. This cranium was located in the southwestern portion of the burial pit associated with the second primary individual. These remains were found close to one another but were not articulated. Carious lesions were observed on several of the teeth associated with this individual.

The final individual, an adult of indeterminate sex, was represented by a fragmented parietal and an unidentified cervical vertebra. These remains were located in the far-southwestern corner of this burial feature.

No nondental pathological conditions, behavioral indicators, morphological variants, or dental attributes (in the case of the third additional individual) were observed for these additional individuals.

The shaft of an indeterminate-side radius that was not associated with any of the individuals described above exhibited a cut mark running obliquely along the long axis of the bone. The defect measured 7.03 mm in length.

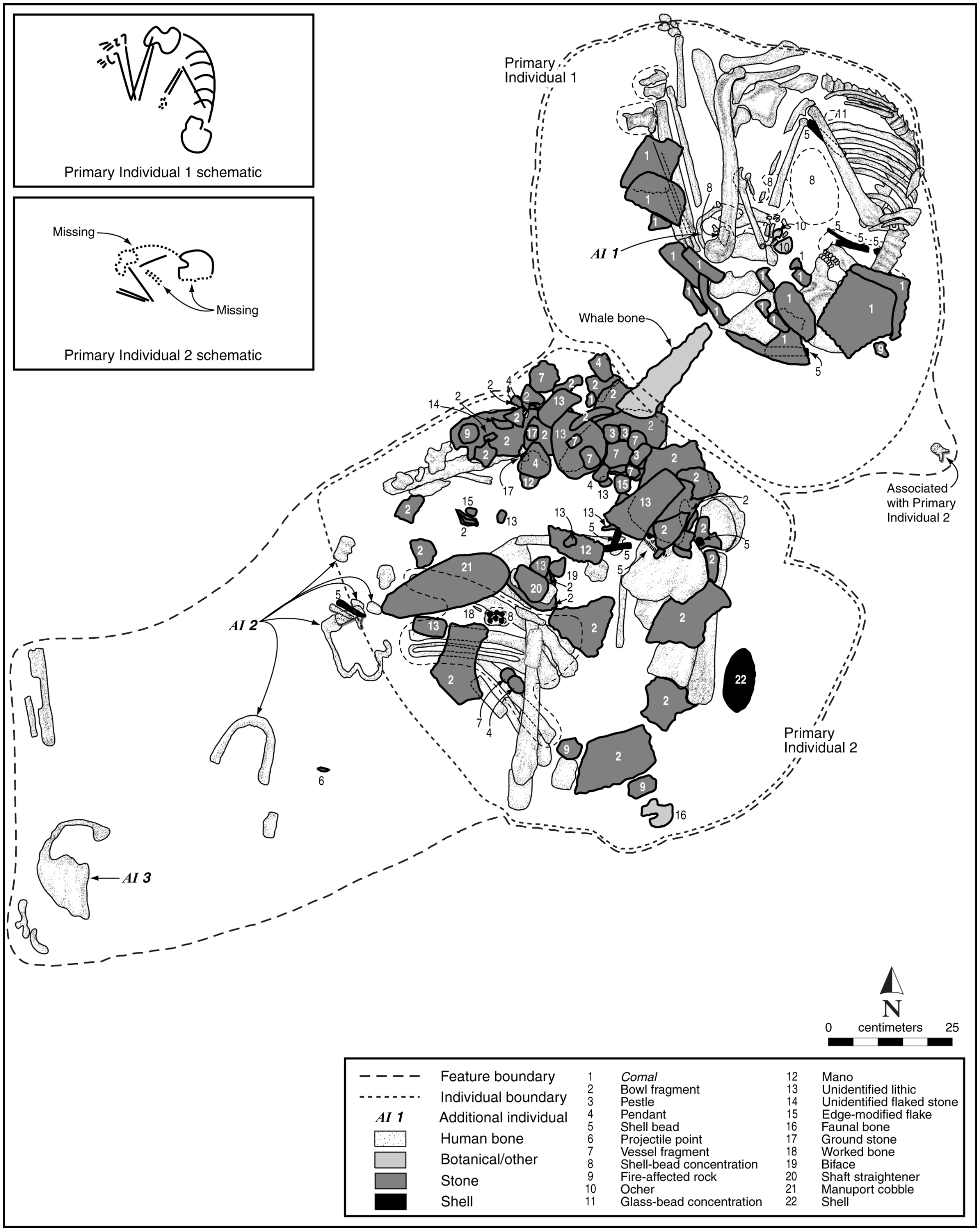

Figure 37. Illustration of burial Feature 38 at LAN-62.

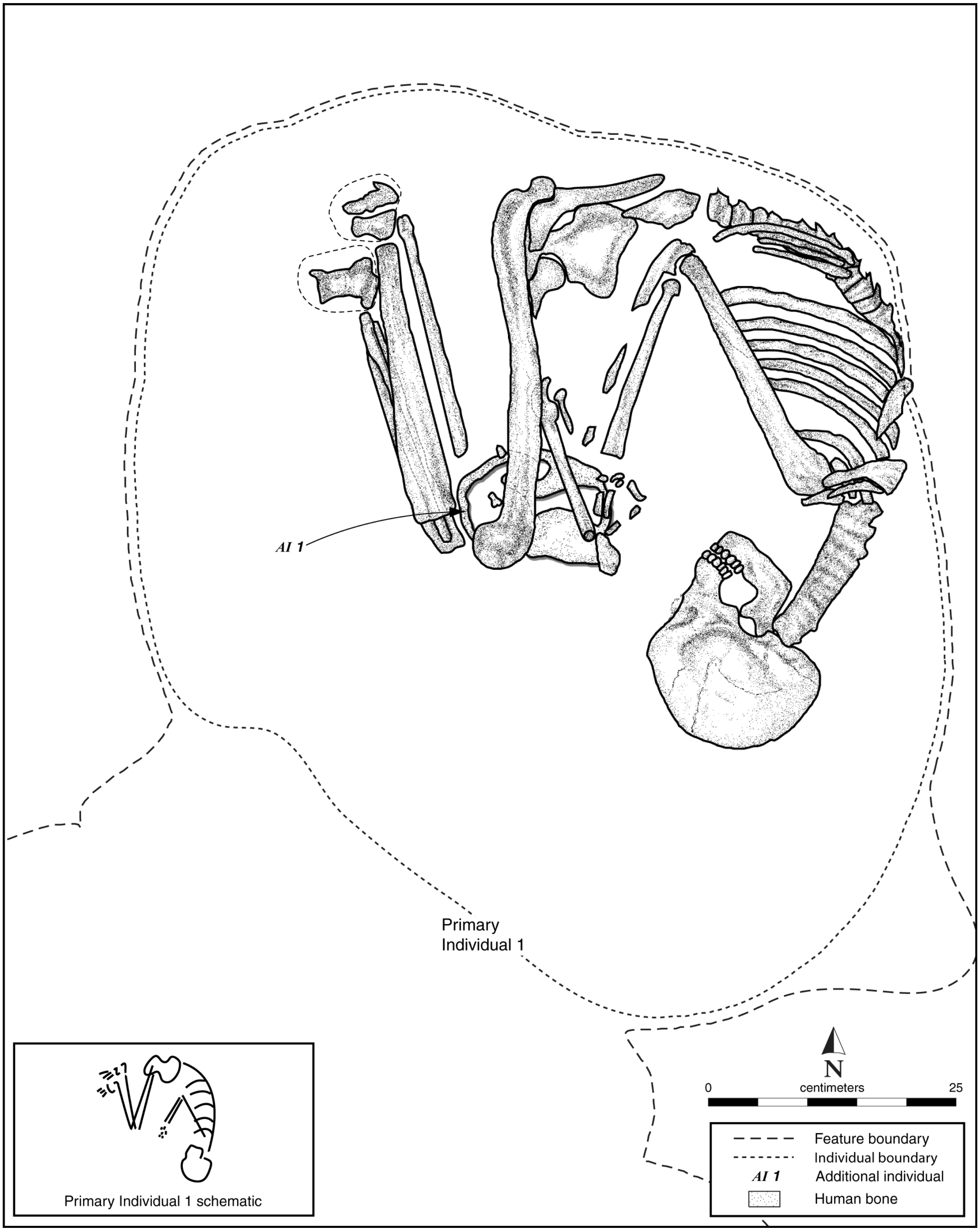

Figure 38. Illustration of Primary Individual 1 from burial Feature 38 at LAN-62.

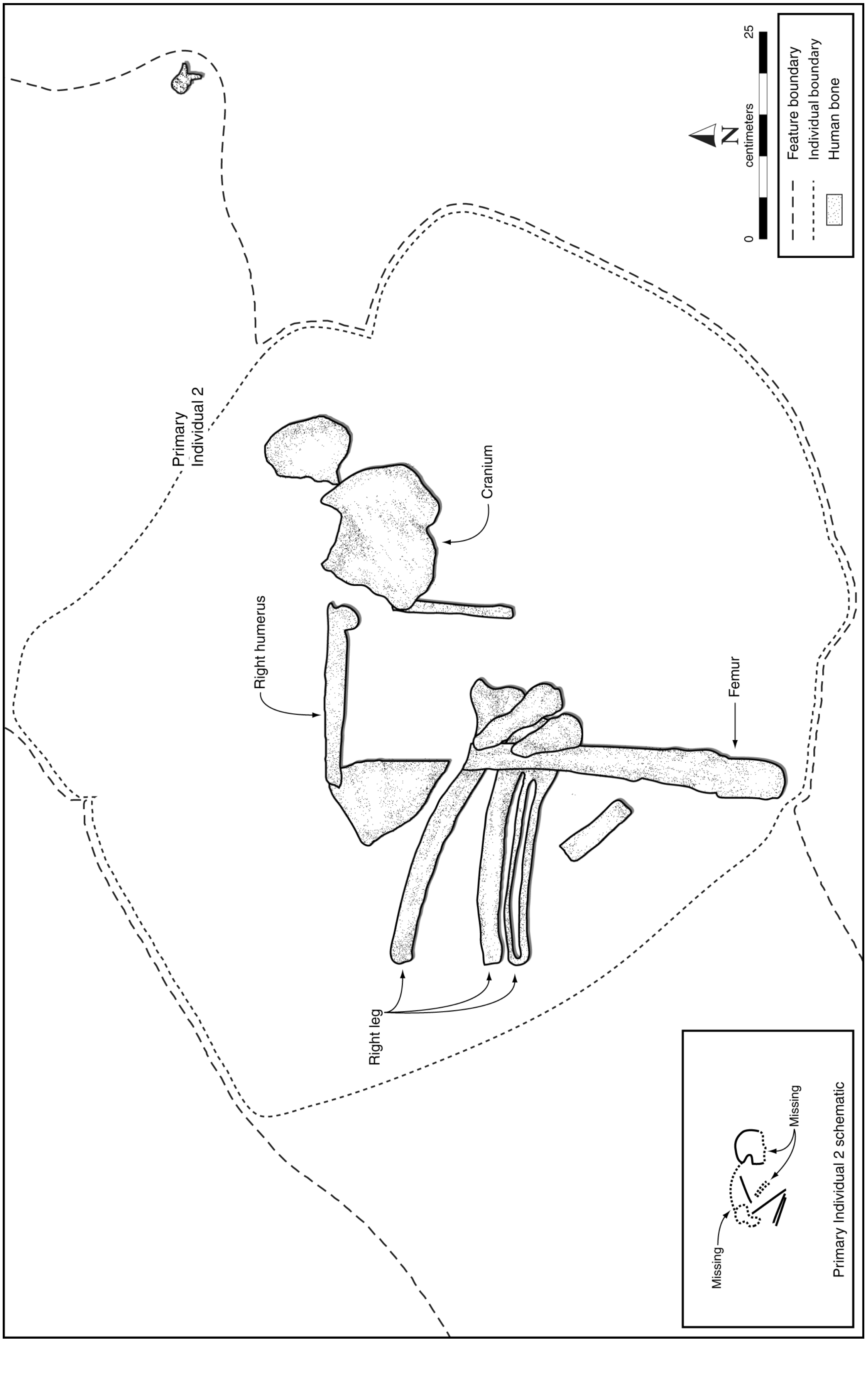

Figure 39. Illustration of Primary Individual 2 from burial Feature 38 at LAN-62.

Associated Features

Because of the large size of this burial feature, numerous other burial features shared unique spatial relationships with it. The concentration of human bone and artifacts associated with the second primary inhumation in this burial feature was located approximately 50 cm above the lower legs, ankles, and feet of the primary inhumation in burial Feature 261, and a scattering of isolated human bone and artifacts from burial Feature 38 extended to the west, approximately 50 cm above the pelvis, abdomen, lower thorax, and left forearm of the same individual. Furthermore, the skeletal remains and artifacts associated with the first primary inhumation in burial Feature 38 were located approximately 30 cm above the northern aspect of burial Feature 299, and the skeletal remains and artifacts associated with the second primary inhumation were found approximately 30 cm above the southern half of burial Feature 299. Also, the northern portion of the first primary inhumation in burial Feature 38 slightly overlapped the legs of the primary inhumation in burial Feature 344. These burials were separated by approximately 35 cm of sediment. The western side of the concentration of artifacts and remains associated with the first primary inhumation in burial Feature 38 slightly overlapped the eastern side of burial Feature 318. These two burials were separated by approximately 50 cm. The southeastern portion of the first primary inhumation associated with burial Feature 38 was located approximately 50 cm above the northwestern quadrant of burial Feature 250. The first primary inhumation associated with burial Feature 38 was also located approximately 20 cm directly above the second primary individual associated with burial Feature 144. The scattered human remains and artifacts in the southwestern portion of burial Feature 38 were located approximately 80 cm above the southern half of nonburial Feature 381. The southwestern portion of burial Feature 38 was also located nearly 210 cm above nonburial Feature 668. Finally, the first primary inhumation and associated artifacts as well as the northern portion of the second primary inhumation and associated artifacts for burial Feature 38 were all located completely over burial Feature 134. These two burial features were separated by approximately 10–15 cm of sediment (Figure 40).

Associated Artifacts

A large amount and variety of artifacts were recovered from this burial feature. Associated with the first primary inhumation were at least four *comales* that had been intentionally broken into multiple fragments. The fragments from these *comales* had been arranged along the southern end of the burial pit, adjacent to and above the skeletal remains of the first primary individual. Charring was evident on the fragments associated with these *comales*.

Examination of the feature illustration indicated that the fragments from the four *comales* had been stacked or placed next to each other in four clusters, from the head to the pelvis of the first primary inhumation. One *comal* cluster contained

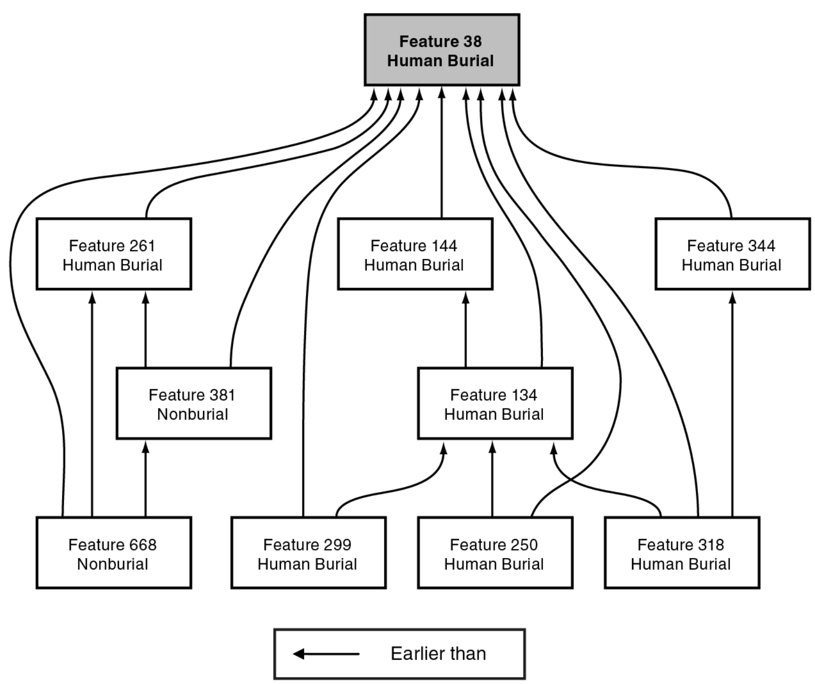

Figure 40. Chart showing the feature relationships associated with burial Feature 38 at LAN-62.

two pieces, another contained three, a third contained four, and the last contained five. It was unclear whether this pattern had any significance. No fragments from a single artifact adjoining the original *comal* (i.e., no conjoining pairs) were placed in the same cluster. It was clear that the people responsible had made an attempt to keep such items separate, although there had been no attempt to "mix and match" the fragments such that a "complete" *comal* was represented by any given cluster (except perhaps in one case, although an "extra" fragment was also present). Nor had there been any attempt to place all similar pieces in the same cluster, although at least three of the clusters were dominated by similar fragments (e.g., two proximals in one cluster, three right distal fragments in another, two or three left distal fragments in a third). Perhaps significantly, the centerpiece of *Comal* 4—which conjoined with all of the other fragments from that *comal*—was separate from the four clusters, again suggesting the apparent significance of keeping adjoining fragments separated. This piece was also placed over the heart/torso of the first primary inhumation. The sequence of breakage of individual *comales* seemed remarkably uniform (i.e., latitudinal split first, in all but one case), although splits varied from three to five.

In addition to these *comales*, the first primary inhumation had a large lump of red ocher in the hand region. This ocher might have been held by the individual. Furthermore, approximately 55 glass beads and around 2,600 shell beads were recovered with this individual. The glass beads were located in three regions. Approximately 7 glass beads were found in the hand/knee region, and roughly 30 blue-glass beads were found in the abdominal area. The rest of the glass beads were found in the head/neck region.

The shell beads consisted of 12 varieties, including olivella ground disk, olivella lipped ground disk, black-abalone-epidermis disk, red-abalone-epidermis disk, olivella rough disk, olivella semiground disk, olivella lipped semiground disk, olivella simple spire lopped, olivella spire, Pismo-clam tube, beveled Pismo-clam tube, and olivella wall. Most of the beads, approximately 1,500, were of the semiground-olivella-disk type. Approximately one-fifth of the shell beads could not be identified. Although the shell beads have a combined date range that stretches from 4550 B.C. to A.D. 1816, the majority of the beads were within the A.D. 1800–1816 date range. The shell beads, like the glass beads, were associated with three main locations: neck, abdomen, and hands/knees. The Pismo-clam tube beads were mostly associated with the neck, and several simple spire-lopped olivella-shell beads were found in a row beneath the mandible, probably indicating that these beads had been strung as a necklace. Beyond that, no specific pattern of shell-bead types were observed. These beads were relatively evenly distributed among these locations.

Associated with the second individual were the majority of the non-bead-related artifacts. First of all, three fragments of unidentified metal, numerous fragments of faunal bone, and a worked-bone pin were recovered with this individual. Additionally, a large, lanceolate biface was found in two pieces and measured 76.9 by 37.9 mm when intact. The tool had evidently been broken in about one-third and two-thirds portions. The proximal portion was covered with red ocher. The ocher did not seem to extend over the fractured surface, despite the fact that the artifact clearly had been broken before the ocher was applied. Additionally, an arrow-shaft straightener/grooved abrader and two steatite manuports, each broken into two pieces, were recovered. A pestle was also associated with the second primary inhumation. This was a complete (although broken into four pieces), small, gently tapering, conical, granite pestle that measured approximately 190 mm in length. It had been shaped by pecking and grinding, and the proximal and distal ends were defined by distinct, square shoulders. The maximum width at the distal end was 35.1 mm, whereas the width at the proximal end was 28.3 mm.

Three ground stone pendants were also recovered from the second primary inhumation. Two of the pendants were represented by multiple fragments. Pendant 1 had three associated fragments, and Pendant 2 was represented by five. Only one fragment defined the presence of Pendant 3.

Additionally, at least eight fragmented vessels were recovered from the space along the northern half of the burial pit.

Several shell beads, though far fewer in number than those recovered with the first primary inhumation, were found with the second primary inhumation. These beads, numbering approximately 50, consisted of at least three varieties: semiground olivella disk, Pismo-clamshell tube, and red-abalone-epidermis disk. As with the first primary inhumation, the semiground olivella-shell beads were most numerous. Additionally, the combined date range associated with these beads was A.D. 1150–1816, and the most-numerous semiground-olivella-shell disk beads were associated with a far-narrower range of A.D. 1800–1816. All of these shell beads were found in the neck region.

Possibly Unassociated Artifacts

Numerous cultural materials that could not be confidently associated with any individual represented in this burial feature were found in the feature matrix: approximately 200 glass beads, a shaped pestle fragment, red ocher, a leaf-shaped Cottonwood projectile point, a large contracting-stem projectile point, and several-thousand shell beads.

Of the shell beads found in this burial feature, approximately 1,000 were found in association with the feature matrix in the burial pit for the first primary inhumation. These beads consisted of numerous varieties, including semiground olivella disk, ground olivella disk, red-abalone-epidermis disk, olivella rough disk, semiground olivella-shell lipped disk, Pismo-clam tube, and olivella-wall disk.

Associated with the burial pit for the second primary inhumation and the southern portion of the burial feature were approximately 2,800 shell beads—far and above more beads than were actually found in direct association with this second primary inhumation and including a wide variety of beads. These varieties were chipped olivella disk, clam disk, ground olivella disk, black-abalone-epidermis disk, red-abalone-epidermis disk, California-mussel disk, olivella rough disk, olivella round thin lipped, semiground olivella disk, semiground olivella lipped disk, simple spire-lopped olivella, thick-lipped olivella, olivella wall disk, and olivella spire.

Because of the close spatial relationship between the primary inhumations in this burial share and the obvious disturbances associated with these burials, some degree of commingling between the feature matrices in each burial pit and the surrounding matrix most certainly occurred.

Additionally, a fire-affected-cobble fragment was found in the feature matrix for the first primary inhumation. Shell beads found in the feature matrices had a set of combined date ranges similar to those in association with each primary inhumation. Three types of beads, however, proved anomalous. The feature matrix associated with both primary individuals had olivella-shell rough disk beads, which have a combined date range of A.D. 1816–1834, and ground-olivella-shell disk beads, which have a date range of A.D. 1770–1800. Associated with the feature matrix of the second primary individual was the latest-dated shell bead for this feature, a chipped olivella-shell disk bead, which has a corresponding date range of A.D. 1834 to post–Mission period.

Burial Feature 60

Feature Age: Protohistoric through Mission period (A.D. 1700–1834)
MNI: 2 (1 primary and 1 additional)
Primary Individual: possible male, 20–30 years
Burial Type: inhumation
Burial Treatment: semiflexed
Burial Position: left side
Burial Orientation: south
Head Facing: northwest
Additional Individual: indeterminate sex and age
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with sparsely distributed shell fragments, faunal bone, and several cultural materials. Isolated human bone associated with at least one additional individual was also recovered from the feature matrix. At least six human-skeletal elements that could not be confidently associated with any individual represented in this burial were also recovered from the feature matrix. Half of these remains were associated with the appendicular skeleton, and the rest were divided between the axial skeleton and the extremities. Fragments of the human bone that could not be identified to the element level were also recovered.

Feature Disturbance

The skeletal remains associated with the primary individual were moderately preserved; roughly half the ribs were missing, and the ends of the long bones exhibited postmortem damage. Some bioturbation appeared to have possibly scattered shell beads associated with the primary inhumation throughout the feature matrix.

Burial Pit

No burial-pit boundary was observed. The dimensions of this burial (length, 77 cm; width, 64 cm) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan-view shape is ovate.

Feature Interpretation

This burial feature was located along the western periphery of the main burial concentration and consisted of a single primary inhumation and isolated human bone associated with at least one additional individual (Figure 41). The primary inhumation was a 20–30-year-old possible male interred semiflexed on the left side, oriented to the south, with the head facing northwest. Stature could not be estimated, because bone preservation did not allow for the intact removal and subsequent measurement of applicable long bones. Standard cranial epigenetic information and cranial and postcranial osteometric measurements were recorded.

Isolated human bone associated with at least one additional individual was recovered from the feature matrix. This individual was defined by the presence of a femoral-shaft fragment located 3 cm north of the primary inhumation. Identification of the individual was based on element duplication, because the femora of the primary inhumation were complete. Information on age and sex could not be estimated, because of a lack of diagnostic criteria.

Associated Features

The head, neck, and upper thorax of the primary inhumation in burial Feature 60 were located immediately above fragmented human bone and artifacts associated with burial Feature 178. Additionally, located within 20 cm beneath the legs of the primary inhumation in this burial feature were the upper thorax, distal arms, and knees of the primary inhumation associated with burial Feature 237. Finally, the cranium and neck of the primary inhumation in this burial feature were located within 23 cm above a dog burial, nonburial Feature 307 (Figure 42 shows the feature relationships).

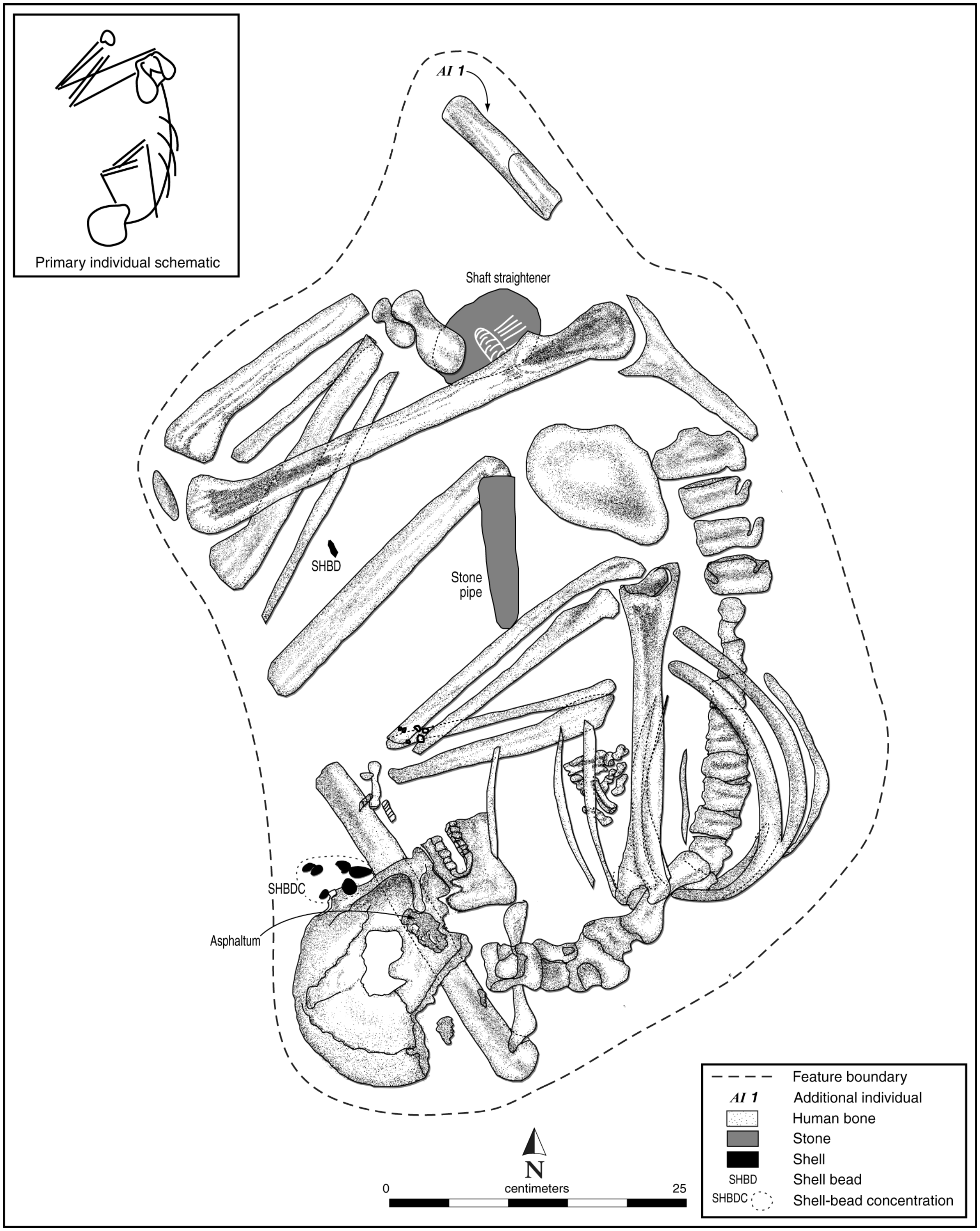

Figure 41. Illustration of burial Feature 60 at LAN-62.

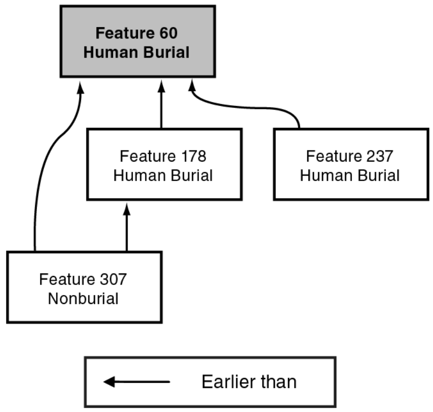

Figure 42. Chart showing the feature relationships associated with burial Feature 60 at LAN-62.

Associated Artifacts

Several artifacts were recovered with the primary inhumation. Approximately 70 olivella-shell beads were recovered from a concentration located on the cranium, immediately over the right orbit. Most of these beads, approximately 55, were olivella-shell disk beads, and around one-seventh were red-abalone-epidermis disk beads. The remaining beads were unidentified. These bead types correspond to a combined date range of A.D. 1150 to post–Mission period; A.D. 1700–1834 is the most likely age of this burial feature, based on the overlapping date ranges. A red-rhyolite tubular pipe was located directly anterior to the abdominal area, with one end resting above the left hip. Furthermore, a shaft straightener was located partially beneath the proximal right femur and the right foot. Finally, a large (11-by-5-cm) concentration of asphaltum was located on the right temporomandibular joint.

Possibly Unassociated Artifacts

Numerous artifacts that could not be associated with any individual represented in this burial feature were found in the feature matrix. These artifacts consisted of a biface, approximately 55 glass beads, and nearly 60 olivella-shell beads. These beads consisted of four identifiable variants, including disk, red-abalone-epidermis disk, ground disk, and tiny saucer. Approximately one-third of these beads were of the disk variety. Nearly half the beads were of an unknown type. The rest were divided among the other bead types. Many of the shell beads could have been originally from the concentration of beads associated with the primary inhumation, but because of bioturbation and other taphonomic processes, the beads became displaced.

Although these shell and glass beads were found in the feature matrix, they could still provide some indirect chronometric data for this burial feature. The shell beads have a combined date range of 600 B.C. to post–Mission period. Because of similar bead types, the same narrow date range associated with the shell beads found with the primary inhumation is also applicable to these beads. The only difference was the appearance of a single ground olivella-shell disk bead with an associated date range of A.D. 1770–1800. Historical-period glass beads found in the feature matrix were manufactured between A.D. 1770 and 1825.

Burial Feature 61

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: female, 40+ years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: prone
  Burial Orientation: southeast
  Head Facing: northeast
Additional Individual: possible male, 16–20 years
  Burial Type: partial cremation
  Burial Treatment: indeterminate
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with sparsely distributed shell and faunal materials. Numerous pieces of charcoal were found in the southwestern corner of the burial feature. Human bone associated with at least one additional individual was also recovered from the feature matrix. Additionally, approximately 10 fragments of human bone that could not be confidently associated with either individual in this burial feature were recovered. Although all regions of the skeleton were represented, roughly half the elements were from the axial skeleton. Finally, fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

There was extensive postmortem disturbance to the primary inhumation associated with this burial feature. The vertebral column was completely displaced, as though it had been intruded upon by subsequent interment events. The thoracic, lumbar, and sacral vertebrae were missing postmortem, and the cervical vertebrae was displaced to the area around the lower back. The left os coxa was rotated 90° laterally from anatomical position. The hands, right scapula, and right clavicle; most of the left ribs; and all of the right ribs were also missing postmortem. The knees and proximal right humerus had been damaged. Many displaced elements were articulated and shared characteristics that linked them to the primary inhumation. The cause of the disturbance is unknown. Certainly, such extensive disturbances have been associated with burial features impacted by human activity, but rodent activity could be responsible, although there was a lack of tangible evidence, such as gnaw marks, to associate rodents with the disturbance. No burial features in the vicinity appeared to have impacted this burial feature.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 75 cm; width, 67 cm) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan-view shape is irregular.

Feature Interpretation

This burial feature was located along the southern periphery of the main burial concentration and consisted of a single primary inhumation and human bone associated with at least one additional individual (Figure 43). The primary individual was an adult female, aged 40+ years. This individual was interred fully flexed in the prone position, oriented to the southeast, with the head facing northeast. Stature could not be estimated. Some postcranial osteometric observations were recorded for this individual.

Three cervical vertebrae exhibited advanced degeneration of the articular facets with extensive deformation of the points of articulation. The vertebral bodies of these three cervical vertebrae also demonstrated some compression, with moderate osteophytic lipping along the margins. Some osteophytic lipping was also associated with the odontoid process of the second cervical vertebra. Additionally, the fragmentary nature of the right femur, tibia, and fibula yielded evidence of advanced osteoporosis. The cortical bone was extremely thin (approximately 1 mm in thickness) with macroporosity.

On the cranium were several holes of unknown etiology. The margins of the holes were smooth and did not seem to be pathological or traumatic. The first was on the left side of the frontal, 71 mm superior to the porion. This hole was 8 by 4 mm and might have occurred postmortem, based on the damaged nature of the cranium. Additionally, four small (less than 1 mm in diameter) holes were located on the occipital, with one 12-by-8-mm hole on the nuchal crest. Another small (less than 1 mm in diameter) hole was observed on the left mastoid process. Macroporosity was also observed along the cruciform eminence.

A possible healed depression fracture was observed on the posterior surface of the right ilium, 35 mm superior to the greater sciatic notch. It measured 40 by 15 mm. A smaller, 15-by-6-mm fracture was located posterior to this possible depression fracture. A suite of dental observations was made concerning attrition, pathology, and variation. Hypercementosis was observed on the roots of the left maxillary third molar.

The skeletal remains associated with the primary individual exhibited a fair degree of preservation. As previously discussed, many of the skeletal elements were missing postmortem or thoroughly displaced. The skeletal elements that remained were well articulated.

Found immediately west of the proximal end of the right femur of the primary inhumation was the distal end of a right humerus; an articulated right innominate, a sacrum, lumbar vertebrae (first through fifth), and a right femoral head; a premolar root; and a long-bone fragment. These skeletal remains, from a 16–20-year-old possible male, exhibited evidence of burning. The humerus displayed a burn pattern ranging from partial to complete blackening. The articulated pelvic girdle was mostly unburned but had small patches of complete blackening. The articulated nature of these remains indicated that they were likely burned while tissue was still on the remains. The premolar and long-bone fragment were completely blackened and partially calcined, respectively. These skeletal remains were located in a small (13-by-14-cm) cluster of charcoal and were likely from an individual in burial Feature 216, located 20 cm directly north (see Figure 43). This individual shared a similar demographic profile and was likewise partially burned. The skeletal remains associated with the primary inhumation of burial Feature 61 in direct contact with these thermally affected remains were not burned. Quite possibly, these remains (and those in burial Feature 216) represented the disturbed remnants of a partial cremation, likely interred after burial Feature 216 and then subsequently impacted by the interment of the primary inhumation associated with burial Feature 61. This is supported by the fact that bone associated with the primary individual in burial Feature 216 in contact with the burned remains was also burned. This pattern was not observed in burial Feature 61, indicating that the primary inhumation associated with burial Feature 61 was interred after the partial cremation. Some postcranial osteometric observations were recorded for this individual.

Several fragments of human bone that could not be associated with either individual in this burial feature were recovered from the feature matrix. These elements included an unsided fourth metacarpal, a patella fragment, pelvic fragments, an unsided tarsal sesamoid, an unidentified vertebra, a cranial fragment, and several rib fragments. Osteophytic lipping was observed on the unidentified vertebra.

Associated Features

This burial feature was located directly over the primary inhumation in burial Feature 174. The pelvis of the primary inhumation was 12–18 cm above the cranium for the primary inhumation in burial Feature 174. The distal end of the left femur associated with the primary inhumation in burial Feature 174 was located 19 cm beneath the first and second lumbar vertebrae associated with the second individual in burial Feature 61. Burial Feature 216 was located

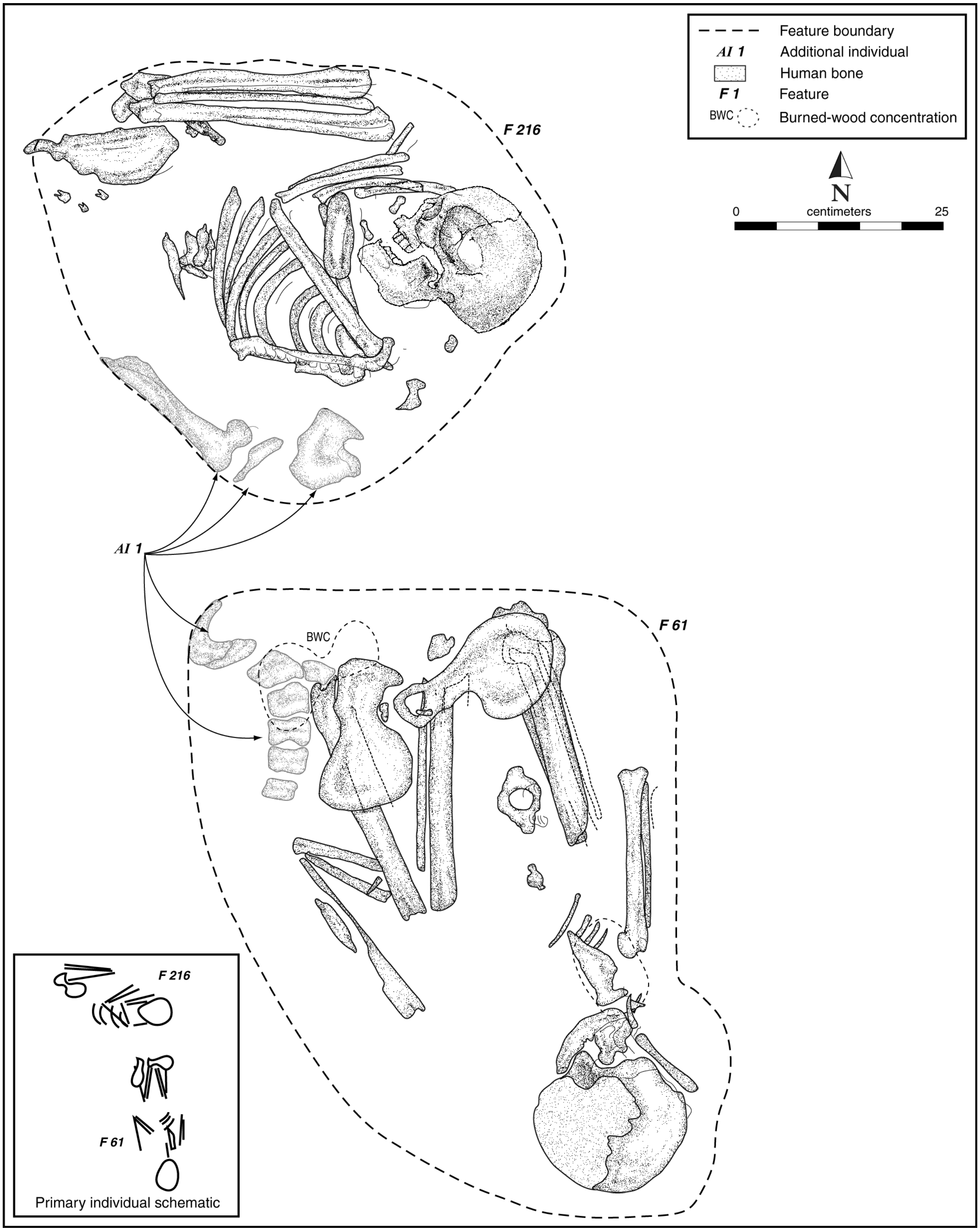

Figure 43. Illustration showing the relationship between burial Features 61 and 216 at LAN-62.

20 cm directly north. Partially burned human remains found in burial Feature 216 were likely associated with the second individual recovered from burial Feature 61.

Associated Artifacts

No artifacts could be directly associated with any individual represented in burial Feature 61.

Possibly Associated Artifacts

Several cultural materials were recovered from the feature matrix. These included 3 ground stone disk beads and approximately 10 shell beads. The beads consisted of four varieties, including olivella bushing, olivella cylinder, olivella rough large lipped (small variant), and semiground olivella disk. Most were of the bushing or cylinder type.

Although these beads were not found in direct association with any individual represented in this burial feature, they still might provide some circumstantial chronometric data. The combined date range associated with these beads is A.D. 1150–1816. The semiground olivella-shell disk bead and the olivella-shell rough large-lipped (small variant) bead are associated with a much narrower date range. The semiground-disk-bead type was manufactured between A.D. 1800 and 1816. The rough-large-lipped (small variant) type, though continually manufactured between A.D. 1542 and 1816, had an intensification of manufacture between A.D. 1800 and 1816.

Burial Feature 76

Feature Age: Mission period (A.D. 1770–1816)
MNI: 3 (1 primary and 2 additional)
Primary Individual: possible male, 23–30 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: left side
  Burial Orientation: east
  Head Facing: northwest
Additional Individuals: (1) indeterminate sex, 20–25 years; (2) female, 20–30 years
Burial Pit: unobservable

Feature Fill

The feature matrix was black silty sand with inclusions of a small amount (less than 5 percent) of less-than-1–5-cm-diameter rounded clasts, faunal bone, shell fragments, and numerous cultural materials. Skeletal remains associated with at least two additional individuals were also recovered from the feature matrix. In addition, approximately 12 scattered human-skeletal elements were recovered from the feature matrix. Most of the elements were related to the feet and lower limbs. Several of these skeletal elements were also found articulated. These articulated elements consisted of two additional right legs, one that included a right tibia, fibula, and foot and another that included a femur, tibia, and fibula. Numerous skeletal remains that could not be identified to the element level were also recovered.

Feature Disturbance

Although no burrows were observed, the fourth thoracic vertebra and several elements in the lower thorax were displaced. The presence of multiple additional individuals and several disturbed, but articulated, human remains indicated that one or more preexisting burials had been disturbed by the interment of this individual.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 77.5 cm; width, 77.5 cm) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan-view shape is ovate.

Feature Interpretation

This burial was located in the southern portion of the main concentration of burials and consisted of a single primary inhumation and isolated human remains associated with at least two additional individuals (Figure 44). The primary inhumation was a 23–30-year-old possible male interred fully flexed on the left side, oriented to the east, with the head facing northwest. Stature could not be estimated for this individual. Standard epigenetic traits and cranial and postcranial osteometric data were also recorded.

A small enthesophytic growth was observed on the anterior surface of the hyoid, and femoral buttressing was observed on the lateral proximal end of the left femoral shaft. Numerous carious lesions, slight hypercementosis, and dental crowding of the anterior maxillary and mandibular dentition were observed. The right maxillary canine exhibited a localized enamel hypoplastic defect. The lack of other enamel hypoplastic defects on the dentition of this individual is suggestive of localized trauma that occurred during the development of the tooth.

Isolated human remains associated with at least two additional individuals were recovered from the feature matrix. The first additional individual was 20–25 years old and of indeterminate sex and was represented by a mandible and associated dentition. Furthermore, there was an irregular, possibly pathological or epigenetic opening on the medial surface of the mandibular body posterior/inferior to the right second molar. The smooth surface and defined opening suggest that

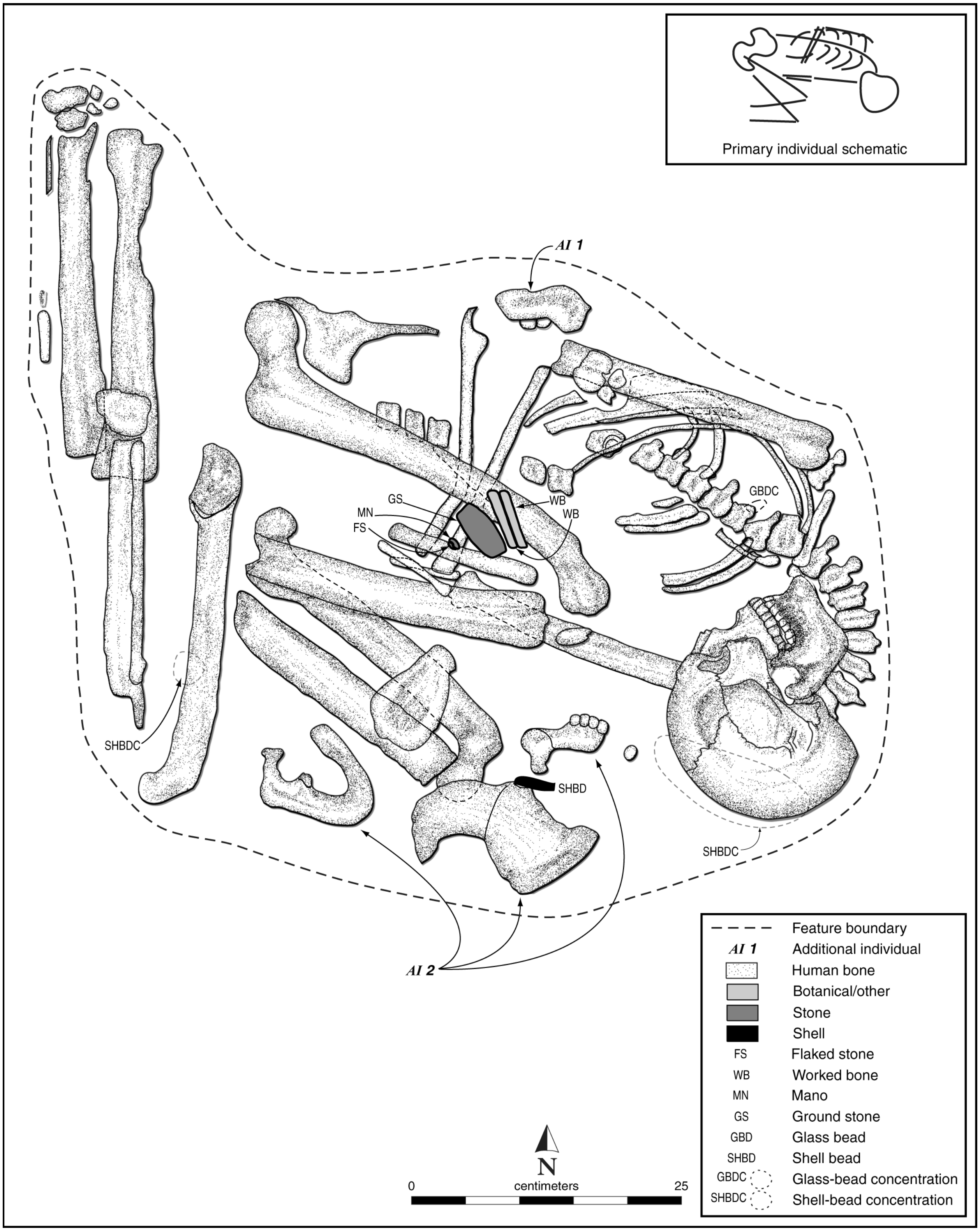

Figure 44. Illustration of burial Feature 76 at LAN-62.

it was not the result of taphonomic processes. This may be a morphological variation known as a Stafne defect, in which a depression is created by ectopic salivary-gland tissue associated with the submandibular gland.

The second additional individual, a 20–30-year-old female, was represented by a cranium, mandible, and associated dentition. The mandible and cranium were not in articulation and were found approximately 5 cm from one another. A large carious lesion had obliterated much of the crown of the left third mandibular molar.

Osteometric information was also recorded for an unassociated right femur.

Associated Features

The cranium associated with the primary inhumation in burial Feature 76 was located approximately 25 cm above the northern portion of burial Feature 239. Immediately southeast of this area of overlap was a line of disarticulated bone oriented northeast–southwest. This cluster was reminiscent of clusters of bone created when the remains of preexisting burials are pushed to the side during the subsequent inhumation of other individuals. Vertically, these two burials were separated by a fairly large amount of sediment, and the possibility for direct intrusion is low.

The primary inhumation and isolated human remains associated with burial Feature 76 were located around 25 cm above the primary inhumation in burial Feature 263. The northern portion of burial Feature 76, which consisted of the legs of the primary inhumation and several isolated human remains, was located immediately beneath the southwestern portion of burial Feature 41. Additionally, a disarticulated right femur from burial Feature 76 might belong to the individual represented in burial Feature 41. The isolated right lower leg found in the western portion of burial Feature 76 was located approximately 10 cm above the cranium of the primary inhumation in burial Feature 227. The isolated skeletal remains found in the western portion of burial Feature 76 were located approximately 40 cm above the cranium of the primary inhumation in burial Feature 499. Finally, the legs of the primary inhumation associated with burial Feature 76 were located approximately 60 cm above nonburial Feature 450 (Figure 45).

Associated Artifacts

Several artifacts were found in association with the primary inhumation. The most numerous of these artifacts were shell beads, which numbered nearly 4,400. These beads, like those found in the feature matrix, were represented by numerous varieties, including ground olivella disk, red-abalone-epidermis disk, normal olivella saucer, olivella rough disk, semiground olivella disk, lipped semiground olivella disk, shelved semiground olivella disk, olivella spire, and olivella wall disk. Although most of the beads were unidentified disk beads, the most numerous of the identified beads were the semiground olivella disks. Two ground-olivella-shell disk beads exhibited some asphaltum staining. The combined date range associated with these shell beads is 600 B.C.–A.D. 1816, and many of the beads exhibited a most likely date range of A.D. 1770–1816.

The shell beads associated with the primary inhumation were recovered from three locations. Atop the cranium was the largest concentration of beads associated with this individual. In fact, nearly 4,000 of the 4,400 beads were found there, piled in strands. Approximately 13 historical-period glass beads were also found in this area. The second location was above the chest. It was the smallest of the three concentrations and consisted of only about a dozen shell and glass beads strung together in a strand. The beads on this strand were strung so that a shell bead started and followed a series of 5 glass beads that alternated red and blue. The red beads were ovoid in shape, and the blue beads were barrel shaped. The final location was near the left foot and beneath the isolated, but articulated, right femur, tibia, and fibula. The historical-period glass beads were manufactured between A.D. 1770 and 1825.

Located in the abdominal region and beneath the right femoral midshaft was a small concentration of artifacts covered with a thin layer of brown material, possibly the remnants of hide. The contents were two bone whistles found side by side; a small, waterworn pebble; a clear quartz flake; and a barrel-shaped steatite tablet. The remnants of a perforation at one end indicated that the tablet was originally used as a pendant. Furthermore, each of the large, flat surfaces of the tablet was incised with a zoomorphic figure. On one face was a lizard design, and a headless quadruped was displayed on the other.

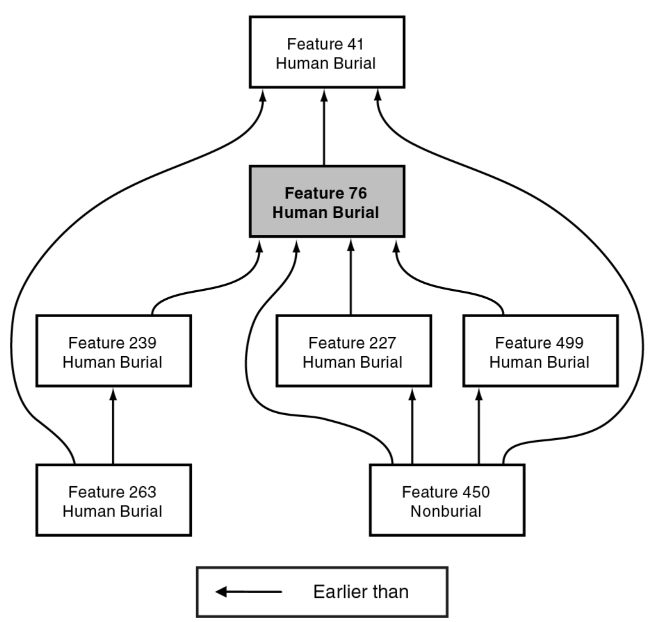

Figure 45. Chart showing the feature relationships associated with burial Feature 76 at LAN-62.

Possibly Unassociated Artifacts

Several artifacts that could not be directly associated with any individual represented in this burial were found in the feature matrix. These included a flake of debitage, 2 fire-affected-cobble fragments, nearly 80 glass beads, and nearly 2,000 shell beads. The large number of shell beads found in the feature matrix included ground olivella disk, red-abalone-epidermis disk, olivella rough disk, olivella rough large lipped, semiground olivella disk, lipped semiground olivella disk, olivella spire, Pismo-clam cylinder, Pismo-clam tube, olivella wall disk, and olivella wide sequin. Although most of the beads were unidentified disk beads, the most numerous of the identified beads were the semiground olivella disks and red-abalone-epidermis disks. Asphaltum staining was observed on a semiground-olivella-shell disk bead. Three ground-/semiground-olivella-shell disk beads, a red-abalone-epidermis disk bead, and an olivella-shell rough large-lipped bead displayed red-ocher staining. These beads have a date range similar to that of the beads found in direct association with the primary inhumation. Judging from the similarities in the types of beads found in the matrix and those found in association with the primary inhumation, it is conceivable that most of the beads loose in the matrix were originally associated with the primary inhumation but had become scattered from disturbance, possibly rodent disturbance. One of the fire-affected-cobble fragments exhibited extensive asphaltum splattering.

Burial Feature 108

Feature Age: indeterminate
MNI: 4 (1 primary and 3 additional)
Primary Individual: male, 30–45 years
Burial Type: partial cremation
Burial Treatment: primary
Burial Position: prone
Burial Orientation: west
Head Facing: up
Additional Individuals: (1) possible female, adult; (2) indeterminate sex, 7–12 years; (3) indeterminate sex, 2–3 years
Burial Pit: single

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, very large fragments of charcoal (5–42.5 cm long and 3.75–18.75 cm wide), shell fragments, faunal bone, and several cultural materials. Additionally, scattered fragments of human bone from at least three additional individuals were recovered from the feature matrix. Nearly 40 human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were also recovered from the feature matrix. Although all regions of the skeleton were represented, most (approximately 20) of these elements were from the extremities. Fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

A rodent burrow extended through the center of the burial feature, in an east–west direction. Additionally, small roots were observed.

Burial Pit

A single 155-by-115-by-16-cm burial pit was observed. The pit was fairly irregular in shape, and a rodent burrow extended in an east–west direction through the center of the burial feature. The pit was identified because of a distinct change in the color of the sediment from dark brown to grayish brown. Burned-wood sections also helped to delineate the boundary of the burial pit.

Feature Interpretation

This burial feature was located along the northern periphery of the main burial concentration, immediately south of the historical-period trench (nonburial Feature 16), and consisted of a single primary partial cremation and numerous scattered fragments of human bone associated with at least three additional individuals (see Figure 17). The primary partial cremation was a 30–45-year-old male. Furthermore, the burial was very complete, unlike other partial cremations, and was interred extended in a prone position and oriented to the west. The cranium was disarticulated and facing up and was located immediately to the north of the lumbar vertebrae and right innominate. Stature could not be estimated. Some craniometric measurements were also recorded. A single medium-sized carious lesion was observed on the right maxillary third molar.

Several cut marks were observed on two ribs. The left first rib exhibited 12 shallow incisions consistent with defleshing over a 6-cm area on the visceral aspect of the superior side. Additionally, the left second rib displayed 4 cut marks on the superior surface of the body. The 4 cut marks were relatively obliquely angled toward the sternal end. The fourth (most laterally located) cut mark had removed a thin sliver of bone from the superior surface of the rib.

The skeletal remains associated with the primary partial cremation were arranged in a rather unusual array. Above the main portion of this burial feature, an articulated left humerus and scapula, an articulated right radius and ulna, an articulated right foot, and a right tibia were recovered. With the exception of the humerus and scapula, all of the remains exhibited some areas of partial or complete blackening. These areas included the distal right radius and anterior tibial shaft.

Beneath these skeletal remains were large pieces of charcoal that covered sections of the primary partial cremation. Like the skeletal remains observed above the charcoal layer, the remains beneath the charcoal exhibited well-articulated segments. These included the cranium and mandible; the left tibia and fibula; the left ulna and radius; and the thorax, pelvis, and proximal left femur. The skeletal elements that were in direct contact with the charcoal exhibited partial blackening. These surfaces included the anterior mandible, superior-anterior frontal, posterior pelvis, proximal left radius, proximal left ulna, and posterior right femoral shaft.

The strong correlation between the burned areas of the skeletal remains and the direct association of the charcoal indicated that the remains were likely burned in situ. Furthermore, the burning and partial disarticulation occurred while the remains were still covered with flesh, to some degree. It is also likely that the thermal event that caused the burning did not last long enough or was not hot enough to cremate the remains completely. Although far more complete, the mortuary practices that produced this pattern (partially disarticulated remains with relatively minor burning) were similar to other partial cremations found throughout the burial area.

In addition to the primary inhumation, at least three additional individuals were identified from the scattered bone found throughout the feature matrix. The first individual, a possible female adult, was represented by a left femur and innominate. Not only did these remains have a different demographic profile than the primary partial cremation, but the elements associated with this individual also exhibited a greater range of burn patterns, from unburned to partially calcined. These remains might be associated with another cremation. Postcranial osteometric measurements were recorded for this individual.

The second additional individual identified from the scattered skeletal remains was a 7–12-year-old child of indeterminate sex. This individual was defined by the presence of a femur fragment with a stage of development consistent with this age range. The final individual, a 2–3-year-old child of indeterminate sex, was represented by a single vertebral neural arch.

Associated Features

Within 5 cm beneath the left side of the thorax and pelvis of the primary partial cremation were the right humerus and ribs of the primary inhumation from burial Feature 209 (Figure 46).

Associated Artifacts

No artifacts were found in direct association with any individual represented in this burial feature.

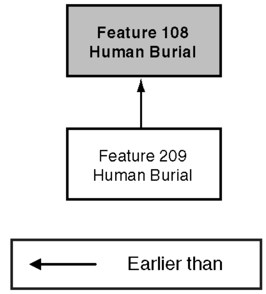

Figure 46. Chart showing the feature relationships associated with burial Feature 108 at LAN-62.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix. These included a fire-affected-cobble fragment, four pieces of debitage, and a rough olivella-shell large-lipped bead. The bead has a corresponding date range of A.D. 1542–1816.

Burial Feature 109

Feature Age: indeterminate
MNI: 4 (1 primary and 3 additional)
Primary Individual: male, 20–30 years
Burial Type: inhumation
Burial Treatment: extended
Burial Position: supine
Burial Orientation: east
Head Facing: up
Additional Individuals: (1) indeterminate sex, 12–18 years; (2) indeterminate sex, 6–9 months; (3) indeterminate sex, 3–4 years
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, faunal bone, shell fragments, and numerous cultural materials. Additionally, several isolated human-skeletal remains associated with at least three additional individuals were recovered from the feature matrix. Nearly 30 scattered human-skeletal elements that could not be confidently associated with individuals represented in this burial were also recovered. These remains were nearly equally divided among the appendicular and axial skeleton, as well as the bones of the extremities. The remaining fragment was a cranial fragment. Finally, fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

Extensive rodent activity had removed the lumbar vertebrae, part of the left scapula, the distal half of the right ulna and radius, the left clavicle, the left arm, and the left hand.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 49 cm; width, 159 cm) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan-view shape is ovate.

Feature Interpretation

This burial feature was located along the eastern periphery of the burial area associated with the diffusely scattered burials and consisted of a single primary inhumation and several isolated human-skeletal remains from at least three additional individuals (Figure 47). The primary inhumation was a 20–30-year-old male interred extended in a supine position, oriented to the east, with the head facing up. The neck was hyperflexed so that the skull was lying on the upper occipital and parietals. Based on the approximated maximum length of the right femur, the living stature of the individual was 157.2–164.0 cm (61.9–64.6 inches). Although the remains were well preserved, several elements were missing postmortem because of rodent activity.

A 9.56-by-4.43-cm healed lesion of unknown etiology was observed above the left orbit on the frontal bone. The right fifth proximal tarsal phalanx had a healed fracture on the medial-plantar portion of the distal head. The alveolar crypt for the right maxillary lateral incisor appeared to have an accessory channel, possibly for a supernumerary tooth. A suite of dental observations were made concerning attrition, variation, and pathology. Standard cranial and postcranial epigenetic traits and osteometric measurements were recorded. A large lesion, which might be an abscess, was observed above the right lateral maxillary incisor.

In addition to the primary individual, skeletal elements from no less than three additional individuals were recovered from the feature matrix. The first individual, represented by a sacral fragment, was 12–18 years old and of indeterminate sex.

The next individual was a 6–9-month-old infant of indeterminate sex identified based on several elements, including a neural arch, a left deciduous maxillary lateral incisor, a left deciduous mandibular first molar, and cranial and long-bone fragments.

The final individual was a 3–4-year-old child of indeterminate sex identified based on a first cervical vertebra, a right maxilla fragment, and an unidentified cranial fragment.

The articular surface for the capitate on an unassociated right lunate displayed a possible lesion. The edges of the defect were smooth, and the floor of the lesion displayed macroporosity. The lesion was approximately 6.7 mm in length, 4.4 mm in width, and 1 mm in depth.

Associated Features

No features were in direct association with this burial feature.

Associated Artifacts

No artifacts could be directly associated with any of the individuals represented in this burial.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix. These included a leaf-shaped Cottonwood projectile point, a Cottonwood Triangular projectile point, a ground stone disk bead, fragments of botanical material, and approximately six shell beads. There were five varieties of shell beads, including clam disk, red-abalone-epidermis disk, giant-rock-scallop disk, olivella thick lipped, and olivella tiny saucer. Although found in the feature matrix, the shell beads might still provide some indirect chronometric data. The combined date range associated with these beads is 600 B.C. to post–Mission period, and dates associated with the red-abalone-epidermis disk beads and olivella-shell thick-lipped beads range from A.D. 1650 to 1834.

Burial Feature 155

Feature Age: Mission period (A.D. 1800–1816)
MNI: 4 (1 primary and 3 additional)
Primary Individual: female, 30–45 years
- **Burial Type**: inhumation
- **Burial Treatment**: fully flexed
- **Burial Position**: left side
- **Burial Orientation**: southwest
- **Head Facing**: down

Additional Individuals: (1) indeterminate sex, 3.75–6.25 years; (2) indeterminate sex, 7 months in utero to 6 months; (3) indeterminate sex, adult
Burial Pit: unobservable

Feature Fill

The feature matrix consisted of brown silty sand with an ashy content and inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, faunal bone, and numerous cultural materials. Scattered human remains associated with at least three additional individuals were also

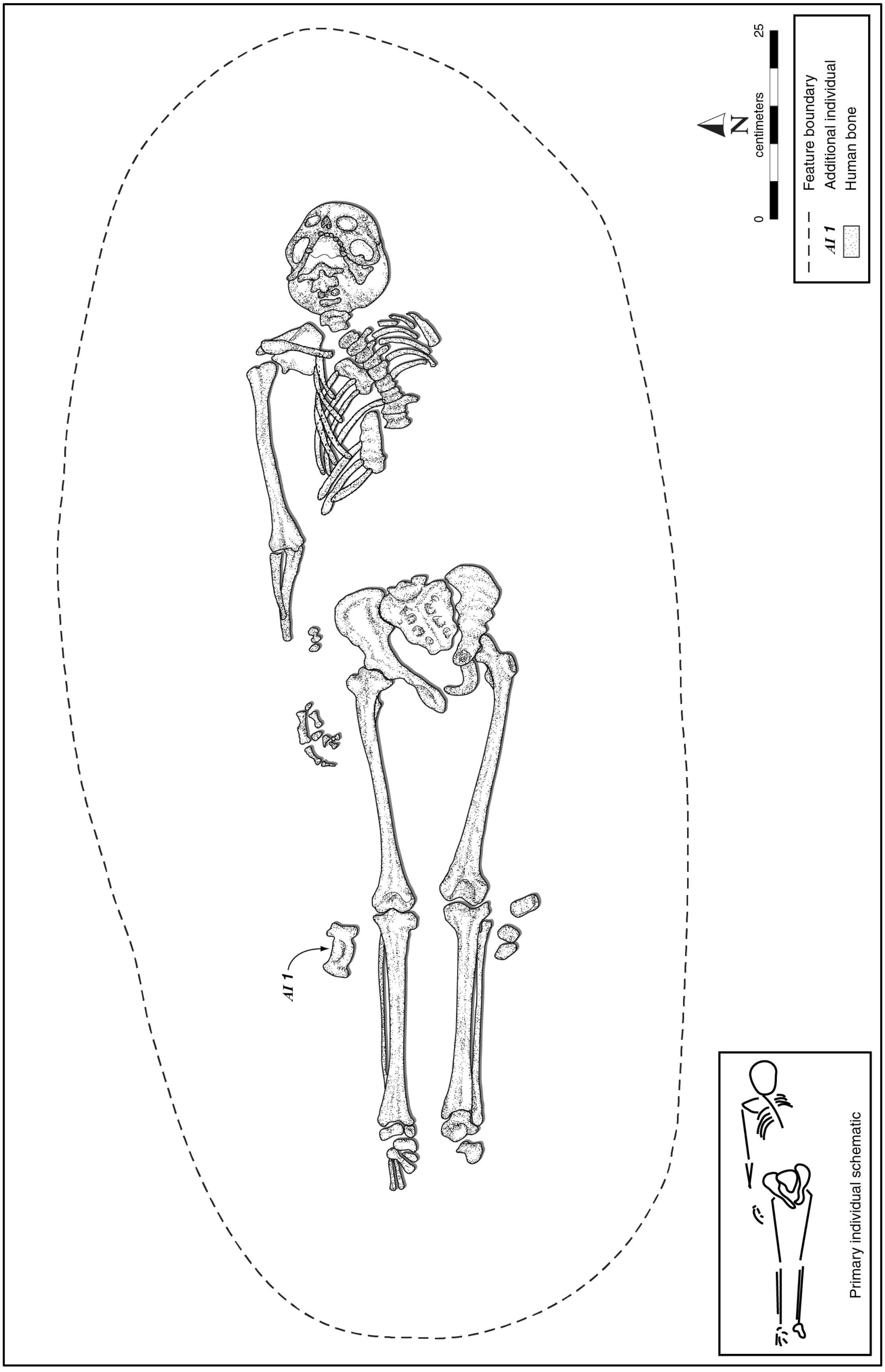

Figure 47. Illustration of burial Feature 109 at LAN-62.

recovered from the feature matrix. In addition, some isolated human remains could not be confidently associated with any individual defined in this burial: a right permanent maxillary central incisor, a cranial fragment, and an unidentified metatarsal. Finally, fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

Minor rodent activity was observed, and rodent gnaw marks were observed on the right femoral shaft associated with the primary inhumation.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 100 cm; width, 55 cm) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan-view shape is rectangular or subrectangular.

Feature Interpretation

This burial was located in the southern portion of the main burial concentration and consisted of a single primary inhumation and isolated human remains associated with at least three additional individuals (Figure 48). The primary inhumation was a 30–45-year-old female interred fully flexed on the left side, oriented to the southwest, with the head facing down. The living stature of this individual was estimated using the approximated length of the right femur. This individual stood 139.3–146.9 cm (54.8–57.8 inches) in height. The skeletal remains were poorly preserved, with most of the thorax, pelvis, extremities, and the proximal end of the left femur missing postmortem. Standard cranial epigenetic traits and cranial and postcranial osteometric information were recorded. Overall dental attrition was minimum to moderate; however, exceptional wear and crown reduction for the mandibular incisors and uneven occlusal surfaces for the upper corresponding teeth may be related to occupational activities or consumption of particular foods. Several carious lesions were also observed on the dentition associated with this individual.

Isolated human remains associated with at least three additional individuals were also recovered from the feature matrix. The first individual, a 3.75–6.25-year-old child of indeterminate sex, was represented by a cranium, mandible, associated dentition, a rib, and two cervical vertebrae. The rib of this individual exhibited evidence of sharp-force trauma. There are two distinct cut marks present on the inferior border of the rib fragment, in addition to at least three chatter marks (marks produced by vibration of the cutting tool) between the cut marks, measuring 5.9 mm total. The device used to create these cut marks likely originated on the lateral inferior side of this element and moved in a posterior–superior, left to right direction.

The second individual, a 7-month-old in-utero to 6-month-old infant of indeterminate sex, was represented by two unidentified vertebrae, cranial fragments, and an unidentified tooth. These remains were likely from the primary inhumation in burial Feature 105 and were reassociated with this individual. The cranial fragments exhibited areas of woven bone that might be indicative of some infectious condition.

The final individual, an adult of indeterminate sex, was defined by the presence of a tibia. Although this tibia could not be sided, the primary inhumation had the full complement of tibiae.

Associated Features

This burial feature shared unique spatial relationships with several other burial features. The primary inhumation associated with burial Feature 155 was located immediately (within 5 cm) beneath the primary inhumation associated with burial Feature 105, a fetus. The boundary of burial Feature 105 was completely encompassed by burial Feature 155. Because of the close spatial relationship between these burial features, the fetal remains found in burial Feature 155 (see Figure 48) were likely intrusive, having been carried down through the sediment from burial Feature 105. The skeletal remains in burial Feature 155 were reassociated with the primary individual in burial Feature 105. The western portion of burial Feature 155 was located approximately 50 cm above nonburial Feature 450. The eastern portion of burial Feature 155 was located 15–20 cm beneath the western portion of burial Feature 144. Additionally, the eastern side of the primary inhumation in burial Feature 155 was located immediately (within 5 cm) and directly beneath the primary inhumation associated with burial Feature 143. Approximately 20 cm beneath the right humerus of the primary inhumation associated with burial Feature 155, an unsided femur associated with the primary individual in burial Feature 359 was located. Furthermore, burial Feature 155 was located 10 cm beneath burial Feature 175, and the upper thorax of the primary inhumation associated with burial Feature 155 was located above the cranium of the primary inhumation in burial Feature 344. The primary inhumation associated with burial Feature 155 was also located immediately above the primary inhumation in burial Feature 319. Interment of burial Feature 155 might have resulted in disruption of the remains associated with the primary inhumation in burial Feature 319. However, poor preservation and the lack of additional skeletal remains in burial Feature 155 with a similar demographic profile as the primary individual in burial Feature 319 limits an assessment. Finally, the cranium associated with the primary inhumation in burial Feature 155 was located approximately 27 cm above the ribs associated with the primary inhumation in burial Feature 318 (Figure 49).

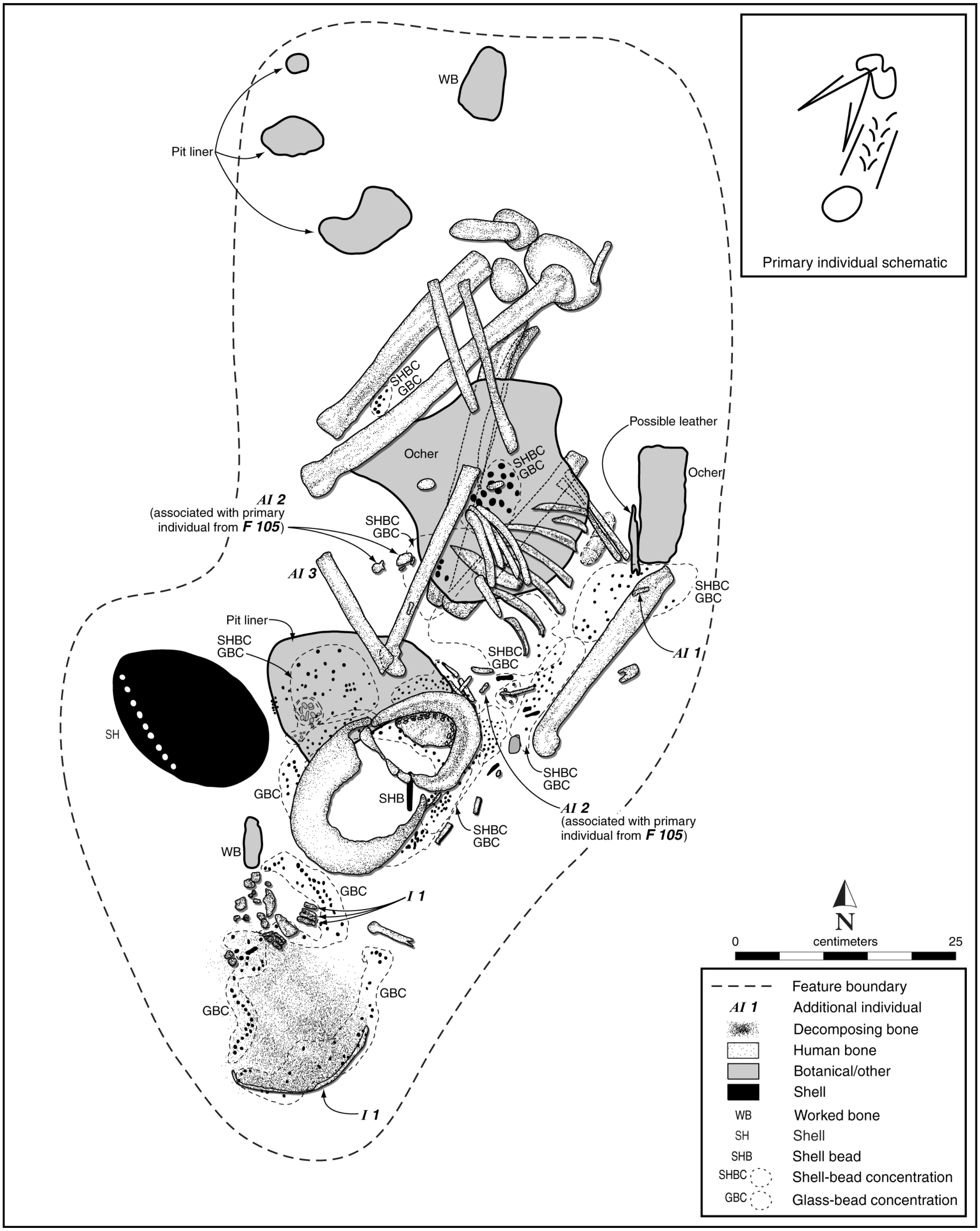

Figure 48. Illustration of burial Feature 155 at LAN-62.

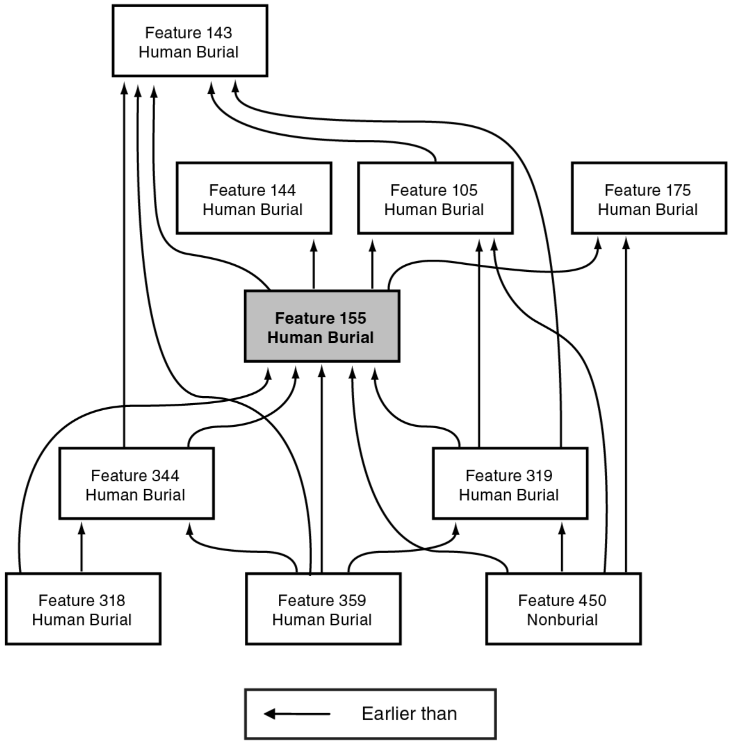

Figure 49. Chart showing the feature relationships associated with burial Feature 155 at LAN-62.

Associated Artifacts

Numerous artifacts were found in direct association with the primary inhumation. Shell and glass beads, by far the most abundant artifacts, were found in the thorax, beneath the face and neck, above the right humerus, and on either side of the cranium. These beads consisted of approximately 2,100 glass beads and nearly 1,350 shell beads. Nearly 1,100 of these shell beads were crafted from olivella shell and represented a wide range of bead types, including appliqué spire lopped, large appliqué spire lopped, disk, ground disk, semiground disk, rough large lipped, round thin lipped, lipped semiground disk, shelved semiground disk, tiny saucer, large simple spire lopped, medium-sized simple spire lopped, spire, and wall disk. Nearly half of the shell beads were of the disk variety. The remaining shell beads were spread among the other bead types. California-mussel, Pismo-clam, and red-abalone beads were also represented, each by a single type: cylinder, tube, and epidermis disk, respectively. Of the non-olivella varieties, the California-mussel cylinder was the most plentiful, numbering around 200. An olivella appliqué spire lopped bead, a round thin-lipped olivella-shell bead, and a red-abalone-epidermis disk bead exhibited some asphaltum staining.

Several patterns were noted in regard to these beads. First of all, the primary inhumation appeared to have been wearing a necklace composed of approximately 20 Pismo-clam tube beads. Several of these beads were found near and below the chin, with at least 3 of them in end-to-end alignment. A fairly compact cluster of blue-glass beads was also recovered from the left side of the cranium and mandible. The beads located beneath the face were predominantly purple in coloration. Although shell beads were recovered with the glass beads, there appeared to be some isolated shell beads on the left side of the skull and upper-left chest area. Finally, a few blue-glass beads were recovered between the left and right femur and tibia beneath the red-ocher mass.

Because of similarities in the types of beads represented in the fill and in direct association, it is reasonable to assume that the beads—both glass and shell—found in the matrix should be associated with the primary individual, especially because many of the beads were recovered from large clusters that could easily have been impacted by the ubiquitous rodent activity.

The combined date range for the shell beads associated with the primary inhumation extended over a rather long period of time, from 4550 B.C. to A.D. 1816. Several beads, however, were associated with a significantly narrower date range. The most likely date range was attributed to the approximately 60 semiground-olivella-shell disk beads. These beads have a corresponding date range of A.D. 1800–1816. Incidentally, a round thin-lipped olivella-shell bead with an associated date range of A.D. 1400–1500 was recovered from the feature matrix. This bead, with a rather conflicting date range, might represent an intrusive bead type. The glass beads were manufactured between A.D. 1770 and 1825.

A large concentration (20 by 15 cm) of a botanical material with a woven appearance was recovered from immediately northwest of the cranium. This material might represent a portion of clothing or perhaps burial-pit liner. Nearly 500 glass beads and approximately 125 shell beads of indeterminate type were found above this concentration.

A second material was noted during the excavation, near and around the pelvic region. This material was observed as having a loose, fibrous consistency. Additionally, a yellowish brown, thin layer of decomposing organic material, perhaps the remnants of leather, was located near the left elbow.

Two masses of red ocher were also associated with the primary inhumation. The smaller concentration was a 12.5-by-5-cm, relatively thin, flat area located immediately east of the left elbow. The major portion of red ocher, however, was located in and near the mid-chest area of the primary inhumation. The body appeared to have been wrapped around the large ocher mass, with the right arm at rest atop the mass. The skeletal elements in contact with the ocher were discolored red. Finally, an intact abalone shell was located immediately west of the cranium.

Possibly Unassociated Artifacts

Several artifacts found with this burial feature could not be directly associated with any individual represented in this burial feature. These cultural materials consisted of a cobble manuport, two fire-affected-cobble fragments, two metal fragments, three fragments of red ocher, three concentrations of a fibrous botanical material, a fragment of worked whale bone, and a Gifford-type worked Pismo-clamshell ornament. One of the metal fragments was found in the thorax region of the primary inhumation. Poor preservation of the remains prevented observation of the relationship between this artifact and the skeletal remains. The worked whale bone was located approximately 10 cm north of the primary inhumation, and the three concentrations of a fibrous botanical material with a woven appearance were recovered from an area approximately 5 cm northwest of the legs of the primary inhumation. As mentioned above, a much larger concentration was found in direct association with the primary inhumation. These smaller deposits might represent the continuation of a pit liner or clothing.

Burial Feature 173

Feature Age: indeterminate
MNI: 2 (2 primary)
Primary Individual 1: female, 40–55 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: prone
  Burial Orientation: east
  Head Facing: down
Primary Individual 2: female, 35–50 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: left side
  Burial Orientation: west
  Head Facing: northeast
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of charcoal flecks, faunal bone, marine-shell fragments, and numerous cultural materials. At least six human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were recovered from the matrix. These elements consisted predominantly of bone from the feet, as well as a single unidentified vertebral fragment. Furthermore, numerous fragments of human bone that could not be identified to the element level were also recovered from the matrix.

Feature Disturbance

Postmortem damage from rodent activity was observed on the posterior aspect of the cranium for the first primary inhumation and the facial region of the second. Furthermore, gnaw marks from rodents were observed on the shaft of the right tibia for the first primary inhumation and on the head of the right humerus and the shaft of the left femur for the second primary inhumation.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 82.5 cm; width, 85 cm) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan-view shape is circular.

Feature Interpretation

This burial feature consisted of two primary inhumations located in the southern periphery of the main burial concentration (Figure 50). The first primary inhumation was a 40–55-year-old female interred fully flexed in a prone position, oriented to the east, with the head facing down. Stature could not be estimated. Standard cranial epigenetic traits and cranial and postcranial osteometric observations were recorded.

This individual exhibited osteophytic lipping along the margins and articular surfaces of the lumbar and cervical vertebrae, as well as enthesophyte (ossified tissue at the site of ligament or tendon attachment) formation on the superior aspect of the left patella and near the attachment site of the costoclavicular ligament on both clavicles. The vertebral osteophytosis was slightly more advanced on the lumbar than on the cervical vertebrae. The transverse processes of the second through fourth lumbar vertebrae were free floating and unfused to the neural arches. The left capitate exhibited a protrusion on the articular surface of the trapezoid. A 5-by-1-by-1-mm groove on the articular surface of the capitate on the trapezoid accommodated this protrusion. Several abscesses and carious lesions

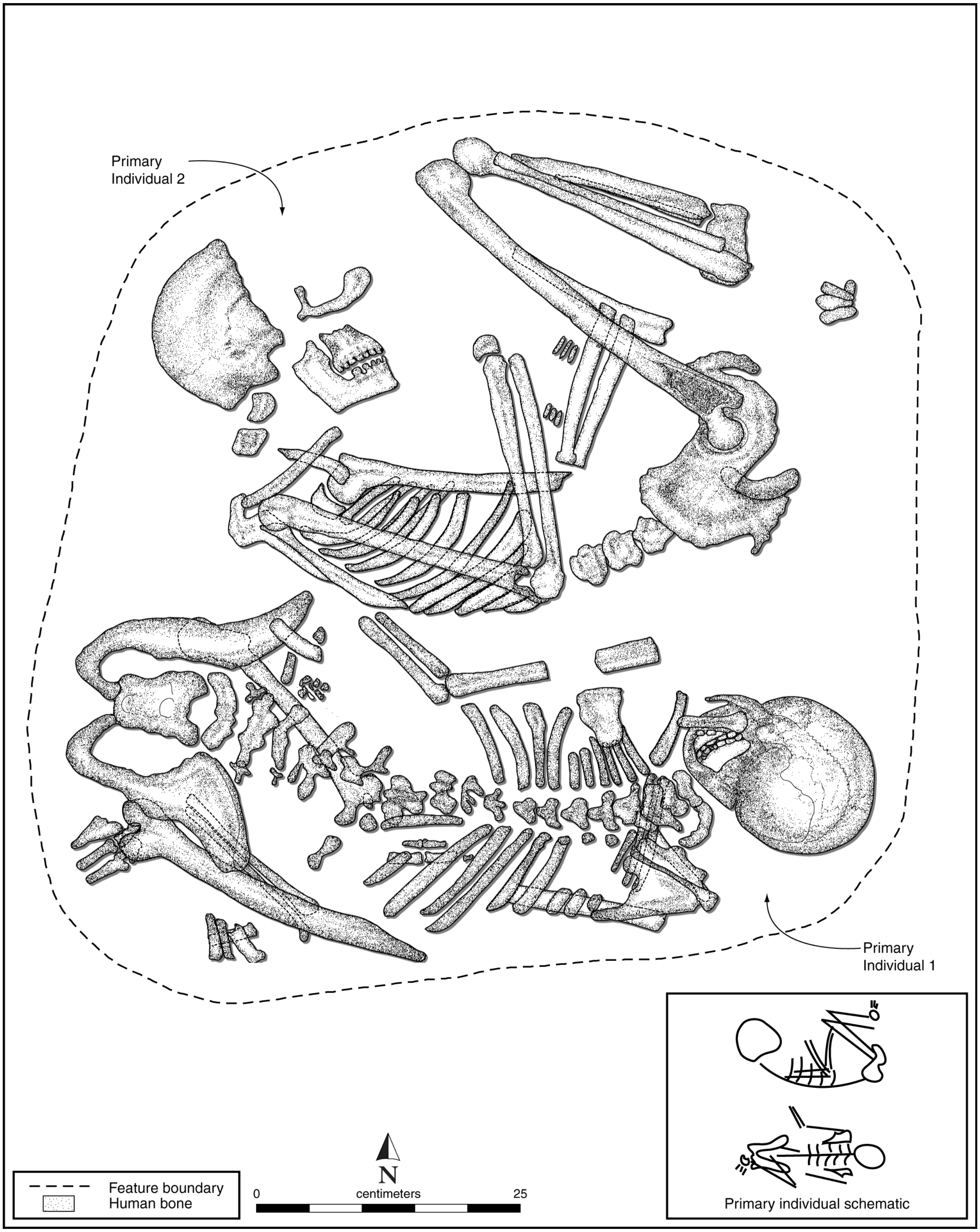

Figure 50. Burial Feature 173 at LAN-62.

were associated with the maxillary and mandibular dentition. Periodontal disease was associated with abscesses on the maxilla.

The second primary inhumation was a 35–50-year-old female interred fully flexed on her left side, oriented to the west, with her head facing northeast. Stature could not be estimated. Enthesophyte formation was observed on the proximo-lateral aspect of the diaphysis, at the level of the lesser trochanter for the left femur, and a possible squatting facet was noted on the left tibia. Hypercementosis, or thickening of the cementum layer of the root, was observed on the right maxillary third molar. This condition, which is a biological response to prevent tooth loss, is often associated with dental disease or heavy attrition.

The remains associated with both individuals exhibited a fair to moderate degree of preservation. The second primary inhumation was the better preserved of the two; most of the long bones were missing one or both ends, and the right humerus and the extremities were missing postmortem for the first primary inhumation. Although slightly better preserved, the second primary inhumation displayed postmortem destruction of the facial region and the ends of many of the long bones. Like the first primary inhumation, most of the extremities were absent postmortem for the second primary inhumation. Both individuals were well articulated.

These individuals appeared to have been either interred together in the same pit or buried within a short interval of time of one another. The thorax of the second primary inhumation was located directly above the left forearm of the second primary inhumation, indicating that, of the two individuals, the second primary inhumation was placed in the pit last.

Associated Features

No other features were found associated with burial Feature 173.

Associated Artifacts

No mortuary offerings were found in direct association with either primary inhumation.

Possibly Unassociated Artifacts

Numerous artifacts were recovered from the feature matrix. These consisted of a worked-bone barb, two glass beads, a ground stone disk bead, nearly 10 olivella-shell beads, a fire-affected-mano fragment, and a fire-affected-cobble fragment. The olivella-shell beads consisted of three varieties, including cylinder, ground disk, and semiground disk. The cylinder and semiground disk beads, represented in equal amounts, were the most frequent varieties of shell beads found in this burial feature. Although found in the feature matrix, these shell beads still could provide some indirect chronometric information for this burial feature. The date range associated with these beads extends from A.D. 1500 to 1816. The ground- and semiground-olivella-shell disk beads exhibited much narrower date ranges of A.D. 1770–1800 and 1800–1816, respectively.

Burial Feature 180

Feature Age: indeterminate
MNI: 1 (1 primary)
Primary Individual: indeterminate sex, 32–36 weeks in utero
Burial Type: inhumation
Burial Treatment: semiflexed
Burial Position: supine
Burial Orientation: northwest
Head Facing: northeast
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown sandy loam with inclusions of charcoal flecks, small (1–5-cm-diameter) subangular clasts, and fragments of shell and faunal bone. Some fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

Although the remains are slightly disarticulated, the cause of the disturbance is unknown. It should be noted that small skeletal elements, especially those of the very young, can be dramatically affected by taphonomic forces.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 24 cm; width, 23 cm) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan-view shape is square or nearly square.

Feature Interpretation

This burial feature consisted of a single primary inhumation centrally located in the diffusely organized burial concentration in the eastern portion of the site, approximately 1 m north of the historical-period trench (nonburial Feature 16) (Figure 51). This individual was a 32–36-week-old in utero fetus or infant of indeterminate sex interred semiflexed in a supine position, oriented to the northwest, facing northeast. Cranial and postcranial osteometric data were recorded.

Considering the age of the individual, this burial was very well preserved; most of the skeletal elements, including the

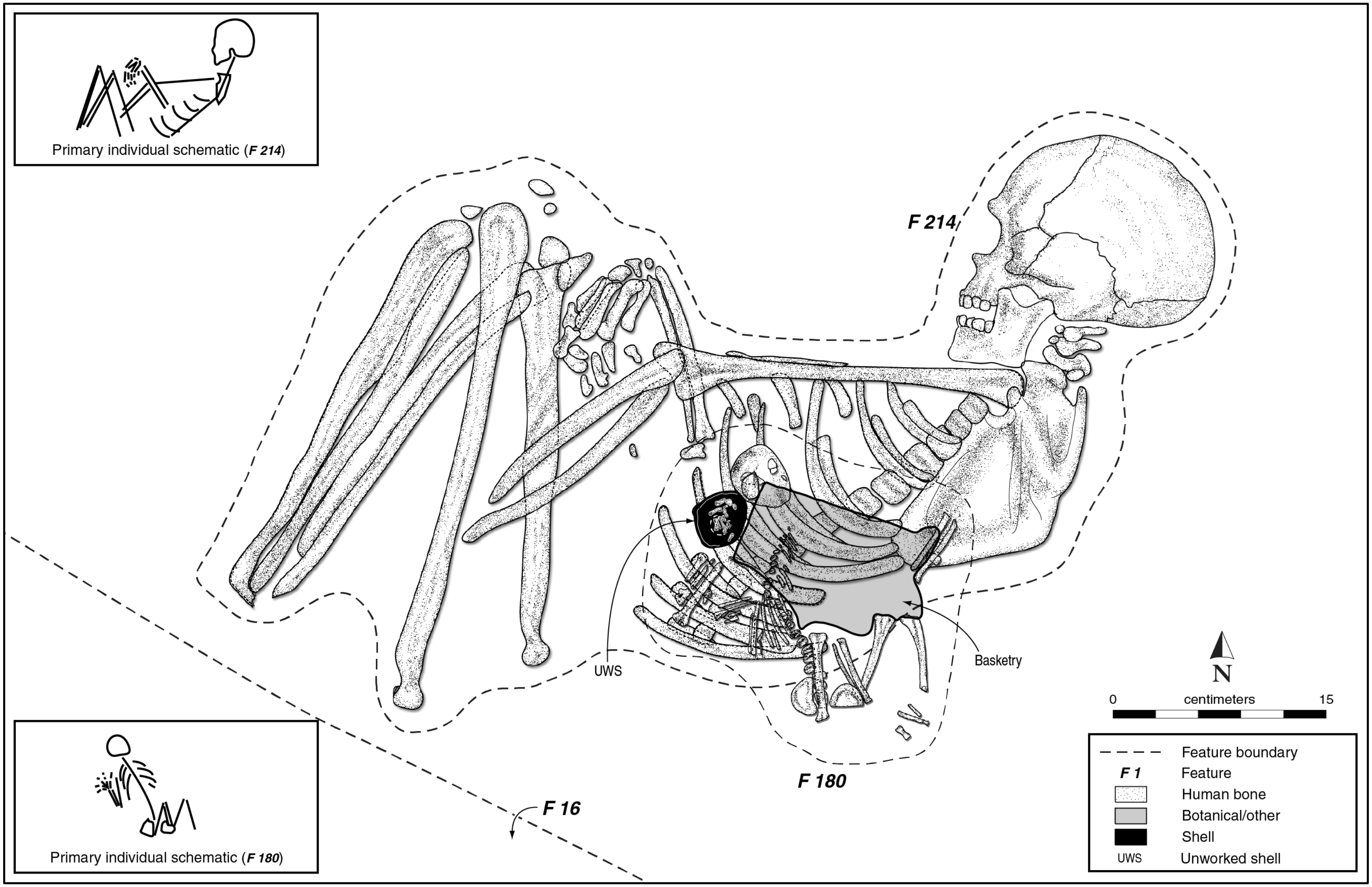

Figure 51. Illustration showing the relationship between burial Features 180 and 214 at LAN-62.

smaller bones of the hands and feet, were still present and relatively articulated. This individual was discovered directly beneath an asphaltum-lined basket, 1–2 cm above the anterior thorax/abdomen and left arm of the primary inhumation in burial Feature 214, which consisted of a 17–24-year-old female (see Figure 51). Fetal-skeletal elements were recovered from burial Feature 214. Because of the proximity and the highly transportable nature of the fetal remains, it is reasonable to infer that these skeletal elements were from the primary inhumation represented in burial Feature 180. Additionally, the right hand of this individual was found in a chione shell. Whether the shell was intentionally placed with the burial or was merely an inclusion in the fill is unknown.

Associated Features

The primary inhumation in this burial feature was 1–2 cm above the anterior thorax/abdomen and left arm of the primary individual from burial Feature 214. Because the primary individuals were in proximity to one another and did not appear to have disturbed one another, they were most likely interred at the same time or after only a very short amount of time had elapsed between burials. Figure 52 is a diagram of the relationship between the features.

Associated Artifacts

This individual was discovered directly beneath an asphaltum-lined basket. No other artifacts were found in direct association with the burial matrix.

Burial Feature 188

Feature Age: indeterminate
MNI: 3 (1 primary and 2 additional)

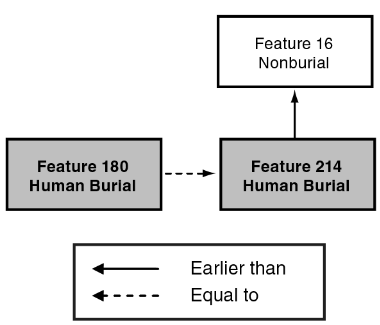

Figure 52. Chart showing the feature relationships associated with burial Features 180 and 214 at LAN-62.

Primary Individual: female, 35–40 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: prone
Burial Orientation: northeast
Head Facing: southwest
Additional Individuals: (1) indeterminate sex, birth to 1 year; (2) indeterminate sex and age
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, charcoal, shell fragments, and faunal bone. Scattered human bone associated with at least two additional individuals was also recovered from the feature matrix. Furthermore, several fragments of human bone that could not be identified to the element level were recovered.

Feature Disturbance

The primary inhumation in this burial feature was missing most of the skeletal elements of the extremities. This was most likely from extensive rodent activity.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 46 cm; width, 52 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan-view shape is ovate.

Feature Interpretation

This burial feature was located in the eastern portion of the burial area, among the scattered burials, and consisted of a single primary inhumation and scattered human bone associated with at least two additional individuals (Figure 53). The primary inhumation was a 35–40-year-old female interred fully flexed in a prone position, oriented to the northeast, with the head facing southwest. The living stature of this individual, based on the approximate maximum length of the left femur, was between 137.08 and 141.71 cm (52.8–55.8 inches). A suite of dental observations concerning attrition and pathology and several cranial and postcranial osteometric measurements were made. Osteophytic lipping was observed on several skeletal elements, including the margins of the bodies of at least five unidentified thoracic vertebrae and the heads and tubercles on one left rib and five right ribs. Osteoarthritic activity was observed on the vertebral ends of

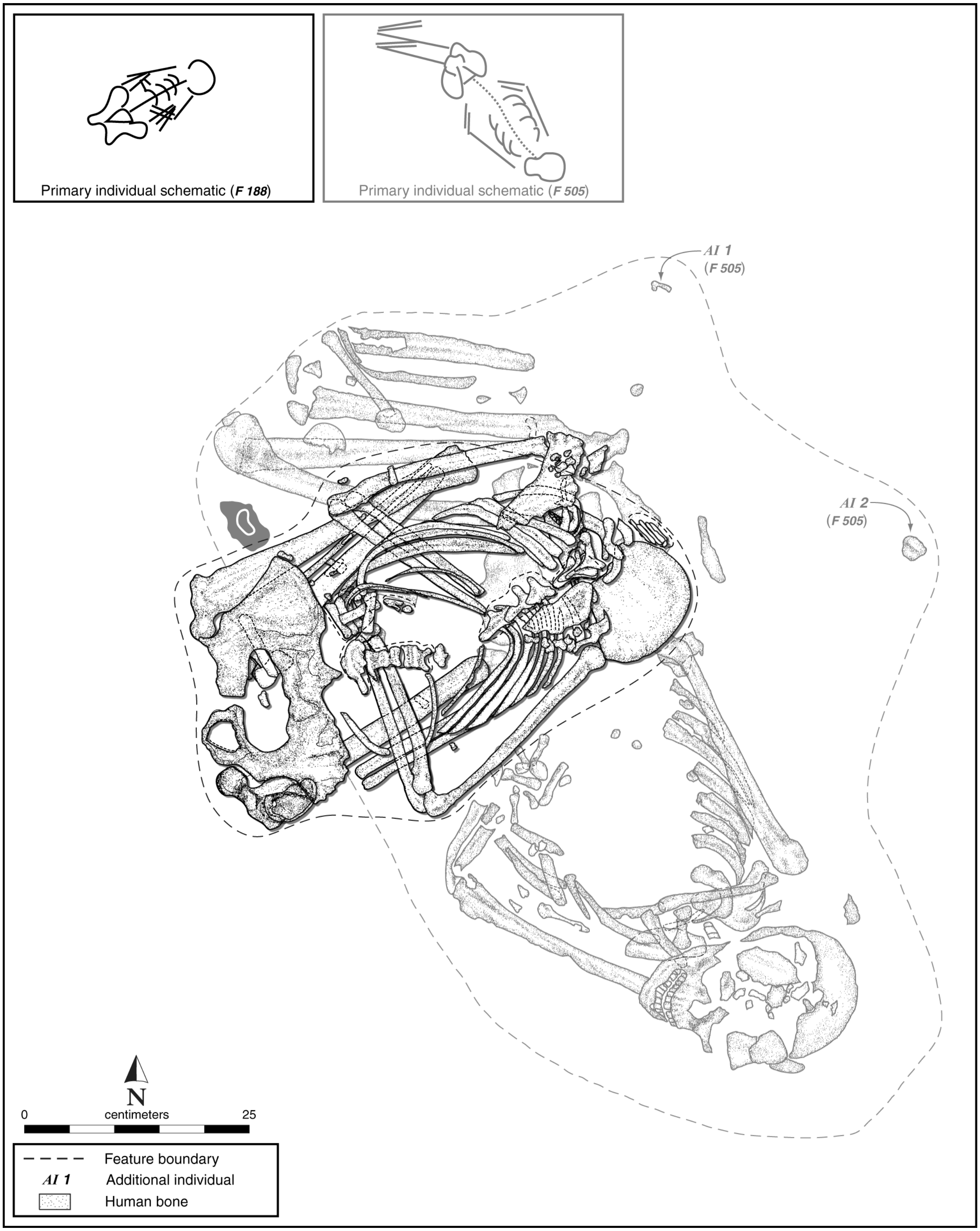

Figure 53. Illustration of burial Feature 188 at LAN-62.

eight left ribs and one right rib. The right sacroiliac joint was ankylosed. The epiphysis on the vertebral end of the right first rib exhibited delayed fusion. Active porotic hyperostosis was observed on the occipital and left parietal. Finally, a concave surface was observed on the anterior portion of the greater trochanter of the left femur. The medial surface of this concavity displayed some minor osteophytic lipping. Because of breakage, the exact measurements of the surface are unknown, but estimated dimensions are 17.40 by 16.20 mm. At least six carious lesions were associated with the dentition of this individual. Hypercementosis was observed on the roots of the right mandibular and maxillary third molars.

The primary inhumation exhibited fair to moderate preservation; the most notable elements missing postmortem were the skeletal elements of the hands and feet. The cranium was not articulated with the cervical vertebrae. Instead, it rested beneath the right shoulder. This was likely the result of decompositional slumpage when the soft tissue that maintained articulation deteriorated.

Several fragments of scattered human remains were found in the feature matrix. These fragments were associated with at least two additional individuals. The first individual, an infant of indeterminate sex, aged between birth and 1 year, was defined by the presence of an unfused left part of the neural arch of a cervical vertebra. The second individual was of indeterminate age and sex and was represented by fragments of burned human remains consisting of an unidentified rib and an unsided innominate. The degrees of burning on these remains ranged from partial blackening to complete calcination.

Associated Features

Inhumation of the primary individual in this burial feature directly impacted burial Feature 505. The primary inhumation in burial Feature 188 was perpendicular to the primary inhumation in burial Feature 505, with the upper thorax and cranium of the primary inhumation in burial Feature 188 located within the abdomen/pelvis of the primary inhumation in burial Feature 505. Because burial features in the vicinity, such as burial Features 91 and 412, were partial cremations, it is likely that the burned bone fragments from those features were transported, possibly through rodent disturbance, into the matrix of this burial feature (Figure 54).

Associated Artifacts

No artifacts were in direct association with the primary inhumation in this burial feature or recovered from the feature matrix.

Burial Feature 212

Feature Age: indeterminate
MNI: 4 (1 primary and 3 additional)
Primary Individual: female, 35–50 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: supine
Burial Orientation: northeast
Head Facing: up
Additional Individuals: (1) indeterminate sex, 12–17 years; (2) indeterminate sex, adult; (3) indeterminate sex and age
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, faunal bone, and several cultural materials. Additionally, several scattered human-skeletal remains associated with at least three additional individuals were recovered from the feature matrix. Furthermore, a distal carpal phalanx and an indeterminate thoracic vertebra, which could not be confidently associated with any individual represented in this burial feature, were also recovered, as were fragments of human bone that could not be identified to the element level.

Feature Disturbance

A large rodent burrow extended obliquely through the right side of the cranial vault, removing much of the right parietal, right temporal, and frontal bones. The cervical and first through third lumbar vertebrae likewise appeared to have been disturbed by rodent activity.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 42.5 cm; width, 61.25 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan-view shape is ovate.

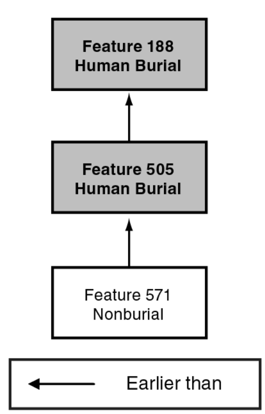

Figure 54. Chart showing the feature relationships associated with burial Features 188 and 505 at LAN-62.

Feature Interpretation

This burial feature was located along the eastern periphery of the burial area and consisted of a single primary inhumation and several scattered human-skeletal remains associated with at least three additional individuals (Figure 55). The primary inhumation was a 35–50-year-old female interred fully flexed in a supine position, oriented to the northeast, with the head facing up. The degree of flexure for this individual was exceedingly great when compared to other fully flexed burials at the site. Additionally, the left arm was placed across the face, over the bridge of the nose, as though shielding the eyes. Stature could not be estimated. Although the remains were well preserved, several elements were missing postmortem because of rodent activity.

Minor vertebral osteophytic lipping was observed along the margins of the bodies of the middle to lower thoracic vertebrae. Osteophytic activity was also noted along the rim of the left acetabulum and at the apexes of the auricular surfaces of the sacrum. Osteoarthritis in the form of eburnation of the proximo-lateral articular surface of the left tibia and deterioration of the olecranon fossa of the right humerus were also observed. The posterior half of the lateral end of the left clavicle was macroporotic and might likewise be associated with osteoarthritis. Compression fractures were observed on the bodies of the fourth and fifth lumbar vertebrae. The posterior surface of the sternum was excessively pitted. The etiology of this condition is unknown. A small pebble was embedded in the bone of the mandible, flush with the root of the left first molar. This stone appears to have become embedded antemortem. At least two abscesses were observed in association with the mandible. Standard cranial and postcranial epigenetic traits and osteometric measurements were also recorded.

In addition to the primary inhumation, skeletal elements from no less than three additional individuals were recovered from the feature matrix. The first individual was a subadult of indeterminate sex, aged 12–17 years, identified by a left fibula fragment, four left rib fragments, and a right pubis. The second individual was an adult of indeterminate sex identified by a left mandibular premolar of indeterminate order and an unknown-order premolar. The final individual was identified based on the presence of a burned human-bone fragment of indeterminate age and sex. The bone fragment exhibited a range of burning, from completely blackened to completely calcined, but a lack of diagnostic traits prevented accurate age and sex estimation.

Associated Features

No other features, burial or otherwise, were associated with this burial feature.

Associated Artifacts

No artifacts were found in direct association with these skeletal elements.

Possibly Unassociated Artifacts

Numerous cultural materials were recovered from the feature matrix: a worked-bone fragment of indeterminate type, two bifaces, a ground stone disk bead, an olivella-shell bushing bead, an olivella-shell cupped bead, and a California-mussel disk bead. The combined date range associated with these shell beads stretches from A.D. 900 to 1816 and provides little insight as to the age of this interment.

Burial Feature 213

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: male, 30–40 years
Burial Type: inhumation
Burial Treatment: semiflexed
Burial Position: left side
Burial Orientation: east
Head Facing: south
Additional Individual: possible male, 25–50 years
Burial Pit: unobservable

Feature Fill

The feature matrix was very dark-brown silty sand with inclusions of shell, faunal bone, a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, and numerous cultural materials. An isolated human cranium associated with one additional individual was also recovered. Ten scattered human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were recovered from the feature matrix. Although a small component of axial skeletal elements were represented, most of these remains were from the extremities, especially the feet. Several fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

A poorly delineated area of light-tan sand covering at least 35–50 cm^2 near the midsection of the primary inhumation indicated minor rodent disturbance. The apparent rodent

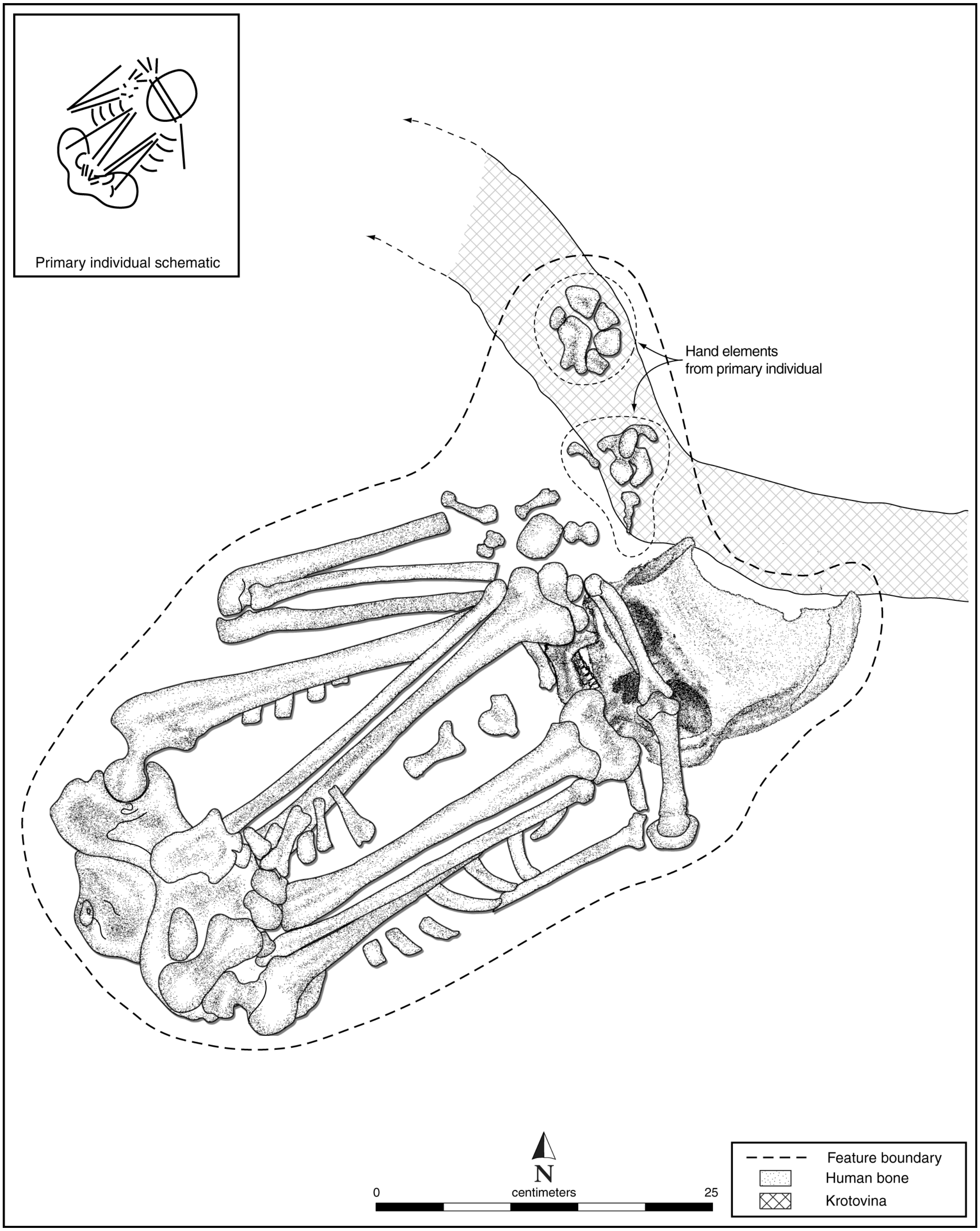

Figure 55. Illustration of burial Feature 212 at LAN-62.

burrow had damaged both the hands; removed most of the metacarpals, carpals, and phalanges; and disarticulated many of the remaining hand elements.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 67 cm; width, 16 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan-view shape is ovate.

Feature Interpretation

This burial feature was centrally located in the eastern portion of the site, approximately 1 m north of the historical-period trench (nonburial Feature 16). It consisted of a single primary inhumation and a second individual represented by an isolated cranium (Figure 56). The primary inhumation was a 30–40-year-old male interred semiflexed on the left side, oriented to the east, with the head facing south. Using the maximum length of the right femur, the living stature of this individual was estimated to be 150.9–157.7 cm (59.4–62.1 inches). The skeleton was lying with the thorax prone, legs tightly flexed on the left side, head on the left side. The arms were to the sides of the thorax, with forearms angled toward the midline such that the hands were below the pelvis. The ribs on the left side were tightly compressed against the thorax, being pushed caudally and toward the midline. In contrast, the right ribs were spread out in more of a natural anatomical position. Perhaps this indicated that there was a pit edge directly north of the skeleton and the body was pushed tightly up against the pit wall. Although exhibiting some rodent disturbance, the vast majority of skeletal elements associated with this individual were well preserved and articulated.

The primary inhumation exhibited a large variety of noteworthy pathological conditions and morphological variations. First of all, minor to moderate vertebral osteophytosis was observed along the margin of the body of the second and fifth lumbar vertebrae, as well as along the margin of the body of an unidentified thoracic vertebra. Furthermore, both clavicles exhibited lesions on the inferior aspects of the sternal ends at the attachment sites for the costoclavicular ligaments, a condition referred to as costal syndesmosis, believed to be associated with repetitive lifting of heavy objects. Additionally, an unidentified cervical vertebra exhibited a cervical rib and the distal and middle phalanx of two pedal digits were fused to one another at the distal interphalangeal joint, a condition referred to as pedal symphalangism. A possible fracture was observed on the blade of the right ilium. Standard cranial and postcranial epigenetic and osteometric observations were recorded. Slight periodontitis was observed on the maxilla of this individual, with at least one abscess observed on the maxilla and mandible. A small carious lesion was noted on the left mandibular third molar, and two enamel hypoplastic defects were found on each of the maxillary canines.

The second individual recovered from this burial feature, a 25–50-year-old possible male, was represented by a second cranium located directly south and immediately adjacent to the left elbow of the primary individual. During excavation, the possibility was raised that this cranium was a "trophy skull" that was buried with the primary individual. The proximity of the cranium to the primary individual suggested that both sets of remains were buried at the same time and in the same pit. Unlike many other burial features associated with LAN-62, this burial feature was relatively isolated from the commingling of remains common in the main burial area. Furthermore, the difference in the general appearance of the cranial shape for both the primary inhumation, whose cranium exhibited a relatively high vault with shorter cranial length, and this second individual, whose cranium exhibited a lower vault profile with a longer cranial length, further suggested that the second individual was from another group. Unfortunately, because of localized postmortem damage, cranial dimensions could not be directly compared to those of the primary inhumation. This individual exhibited the most-extreme dental wear observed for any individual analyzed in this burial population. This individual also exhibited possible porotic hyperostosis on the occipital and both parietals. A large, active abscess was observed on the maxilla. Some craniometric information was also recorded for this individual.

Associated Features

No other features were discovered in proximity to this burial feature.

Associated Artifacts

No artifacts were associated with the individuals represented in this burial feature.

Possibly Unassociated Artifacts

Two bifaces, a ground stone disk bead, and approximately 15 olivella-shell beads were recovered from the feature matrix. The shell beads consisted of three varieties, including bushing, cupped, and full lipped. The majority of the shell beads consisted of the cupped variety. The combined date range associated with these beads is A.D. 1150–1816, and a slightly narrower date range (A.D. 1600–1816) is associated with the full-lipped bead type. These provided little insight into the age of the interment.

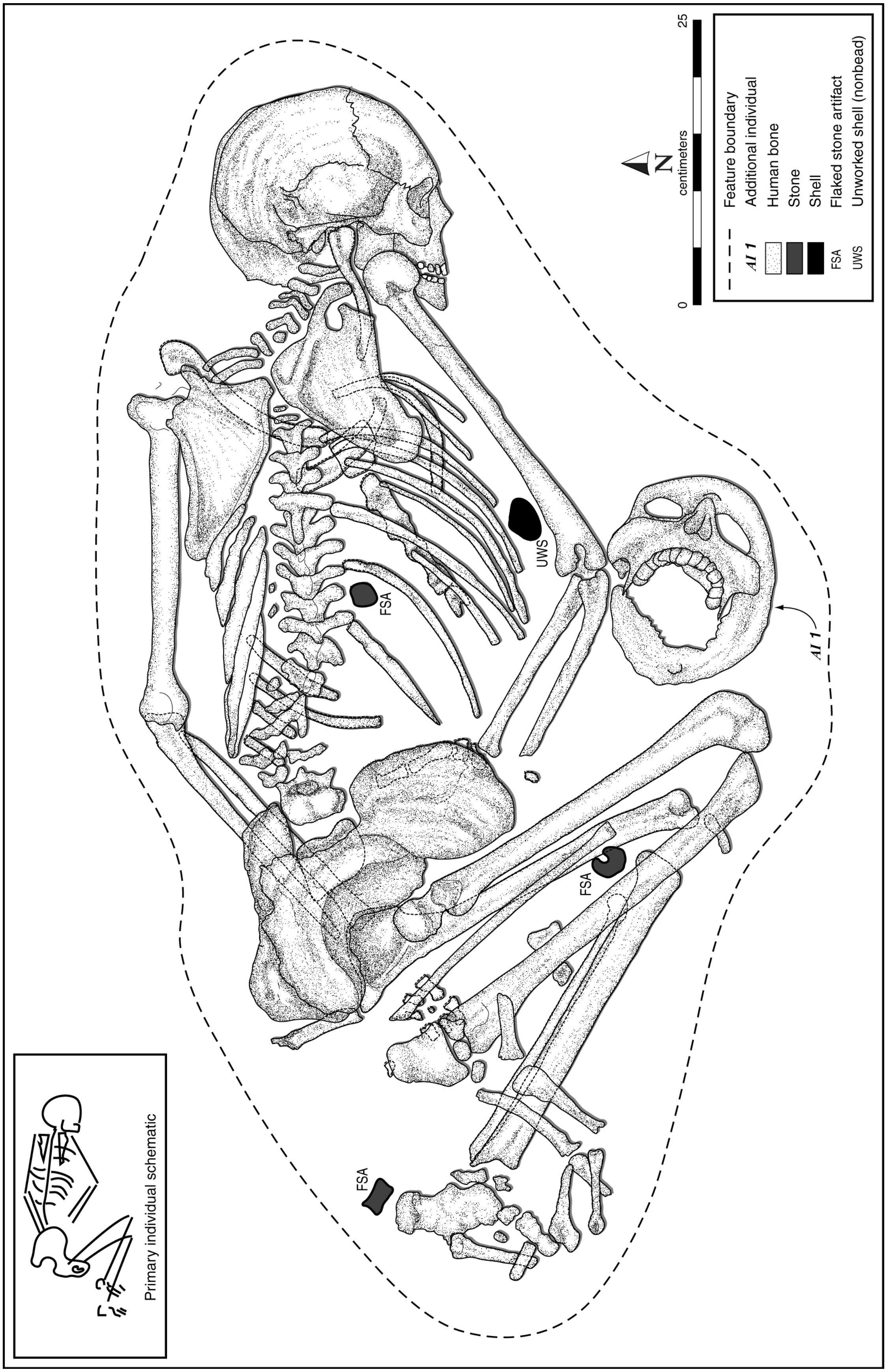

Figure 56. Illustration of burial Feature 213 at LAN-62.

Burial Feature 214

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: female, 17–24 years
Burial Type: inhumation
Burial Treatment: semiflexed
Burial Position: right side
Burial Orientation: east
Head Facing: west
Additional Individual: indeterminate sex, 32 weeks in utero
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of charcoal flecks, shell, faunal bone, a small amount (less than 5 percent) of subangular clasts 1–5 cm in diameter, and a small amount of cultural materials. Additionally, isolated fetal-skeletal material associated with at least one additional individual was recovered from the matrix. Furthermore, rib and cranial fragments that could not be confidently associated with any individual represented in this burial, as well as fragments of human bone that could not be identified to the element level, were recovered from the feature matrix. The fill in the historical-period trench (nonburial Feature 16) that cuts through the southern portion of the burial feature was lighter-brown sand.

Feature Disturbance

Nonburial Feature 16, a historical-period trench, cut through the lower portion of this burial feature, resulting in the postmortem loss of the pelvis and feet of the primary inhumation.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 42.5 cm; width, 72.5 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan-view shape is ovate.

Feature Interpretation

This burial feature was centrally located in the eastern portion of the site, approximately 1 m north of the historical-period trench (nonburial Feature 16). It consisted of a single primary inhumation and isolated human-skeletal material associated with at least one additional individual (see Figure 51). The primary inhumation was a 17–24-year-old female interred semiflexed on her right side, oriented to the east, facing west. Based on the length of the left femur, the estimated living stature of this individual was 138.91–141.5 cm (54.7–55.7 inches). Additionally, standard cranial epigenetic traits were recorded, as were observations on the incomplete formation of one of the articular surfaces on the right trapezoid. Postcranial osteometric data were also recorded. Although the pelvis and feet of the primary inhumation were missing postmortem, most of the skeleton was well preserved and maintained articulation.

The second individual recovered from this burial feature, a 32-week-old (in utero) fetus, was only represented by two metatarsals and rib fragments. Based on proximity and age, these remains were associated with the primary individual in burial Feature 180, a fetus of similar age (see Figure 51).

Associated Features

A trench (nonburial Feature 16) cuts through the southern portion of this burial feature. Although several skeletal elements, such as the distal ends of the tibiae and fibulae and the proximal ends of the femora, fell within the boundaries of nonburial Feature 16, most of the elements impacted by nonburial Feature 16 were missing postmortem, having been either removed during construction of the trench or eroded out of the sidewalls of the trench while it was in use. The relationship between the features is shown in Figure 52.

The anterior thorax/abdomen and left arm of the primary inhumation from burial Feature 214 were located 1–2 cm beneath the primary inhumation in burial Feature 180. Because the primary individuals were so close together and did not appear to have disturbed one another, they were most likely interred at the same time or after only a very short amount of time had elapsed between burials.

Associated Artifacts

No artifacts could be directly associated with any individual represented in this burial feature.

Possibly Unassociated Artifacts

Four olivella-shell beads and a fire-affected-cobble fragment were recovered from the feature matrix. The beads were of four distinct varieties, including cupped, normal saucer, round thin lipped, and small normal saucer. The combined date range associated with these beads is 600 B.C.–A.D. 1816. Although found in the feature matrix, these beads provide little direct evidence regarding the age of the interment. Asphaltum was found in the feature matrix but was likely part of the basket removed with burial Feature 180.

Burial Feature 216

Feature Age: indeterminate
MNI: 6 (1 primary and 5 additional)
Primary Individual: possible female, 35–45 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: right side
Burial Orientation: southeast
Head Facing: northwest
Additional Individuals: (1) possible male, adult; (2) indeterminate sex, 3–5 years; (3) indeterminate sex, 6 months to 1 year; (4) indeterminate sex, 10–12 years; (5) indeterminate sex, 30–32 weeks in utero
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter angular clasts, faunal bone, and several cultural materials. Scattered human bones associated with at least five additional individuals were also recovered from the feature matrix. Also, nearly 45 human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were recovered from the feature matrix. These remains were relatively evenly distributed among the regions of the human skeleton. Finally, numerous fragments of human bone that could not be identified to the element level were recovered from the feature matrix.

Feature Disturbance

A large rodent burrow extended in a northwest–southeast orientation through the cranium of the primary inhumation. The mandible, right innominate, sacrum, and right scapula were also affected.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 58 cm; width, 63 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan-view shape is circular.

Feature Interpretation

This burial feature was located near the southern periphery of the main burial concentration and consisted of a single primary inhumation and human bone associated with at least five additional individuals (see Figure 43). The primary inhumation was a 35–45-year-old possible female interred fully flexed on her right side, oriented to the southeast, with the head facing northwest. Stature could not be estimated. Some cranial and postcranial osteometric observations and standard cranial epigenetic traits were recorded for this individual. Though well articulated, the skeletal remains associated with the primary individual had been severely impacted by rodent activity. Furthermore, the right scapula, the sternum, and part of the right femur exhibited small areas of incidental burning. All were partially blackened.

The sternal end of the right clavicle exhibited pitting and osteophytic activity, traits suggestive of osteoarthritic activity. Furthermore, minor vertebral osteophytosis was observed along the margins of vertebral bodies of four indeterminate-order thoracic vertebrae and on the coronoid of the right ulna. Possible costoclavicular syndesmosis, a well-developed area of attachment for the costoclavicular ligament on the clavicle often associated with repetitive heavy-lifting activities, was observed on the left clavicle. An area of porotic hyperostosis was observed on the left and right parietals.

A suite of dental observations were made concerning attrition and pathology. A large abscess was observed on the left side of the maxilla associated with the canine and first premolar, with a second large abscess noted on the mandible near the left lateral incisor, canine, and first premolar. Numerous carious lesions were also observed.

Numerous human-skeletal remains associated with at least five additional individuals were recovered from the feature matrix. The first additional individual, an adult possible male, was represented by a left ilium and left femur located within 5 cm south of the posterior thorax of the primary inhumation. These remains displayed evidence of burning. By and large, the remains were unburned, with small, localized areas of partial or complete blackening. Twenty centimeters directly south of these remains, in burial Feature 61, are the partially burned remains of an individual that match the demographic profile and degree of burning (see Figure 43). These two individuals are very likely the same person, and the remains recovered from this burial feature were associated with those in burial Feature 61 to reflect that.

Although the sediment associated with this individual was not oxidized, bone associated with the primary inhumation was slightly burned, possibly indicating incidental burning during the thermal event that burned these remains and those of the additional individual in burial Feature 61. The left femur associated with this individual had a postmortem fracture across the proximal shaft. The fracture appeared to have occurred while the bone was still relatively green. Such fractures were commonly associated with the partial cremations recovered from LAN-62, possibly indicating that these remains (and those in burial Feature 61) represented the disturbed remnants of a partial cremation.

Whether the skeletal remains of this individual were disturbed by the interment of the primary inhumations in burial Feature 61 or 216, or both, is uncertain. However, one possible scenario is that a partial cremation was interred after the interment of the primary inhumation in burial Feature 216 and then subsequently impacted by the inhumation of the primary inhumation in burial Feature 61. This is supported by the fact that bone associated with the primary inhumation in burial Feature 216 in contact with the burned remains was also burned. This pattern was not observed in burial Feature 61, indicating that the thermal event had already ceased by the time the primary inhumation in burial Feature 61 was interred.

The second additional individual, based on a vertebral neural arch and an ilium, was estimated to be a 3–5-year-old child of indeterminate sex. Age was based on the level of skeletal development.

The next additional individual, an infant of indeterminate sex and between 6 months and 1 year of age, was represented by an unsided ulna, left radius, two vertebral neural arches, and deciduous dentition. Age was estimated based on the level of skeletal development.

The fourth additional individual was 10–12 years old and of indeterminate sex and was identified by a right maxillary first permanent premolar that exhibited dental attrition and development consistent with an individual in this age range.

The final additional individual was a 30–32-week-old (in utero) fetus of indeterminate sex. This individual was identified by a right first rib that displayed a level of development consistent with someone in this age range.

Pathological conditions were also observed on other, unassociated human-skeletal elements recovered from the feature matrix. Osteophytic growth was observed on the vertebral centrum of an unassociated vertebra. The location was not specified. Remodeling was also observed on a rib tubercle, with fairly extensive lipping around the articular surface. Finally, osteophytic lipping was noted on the superior articular surface of the promontory of an unassociated sacrum. The degree of the lipping was not discussed.

Associated Features

The primary inhumation in burial Feature 216 was located 20 cm directly north of burial Feature 61. Also, the primary inhumation in burial Feature 216 was located approximately 10 cm above nonburial Feature 238 (Figure 57).

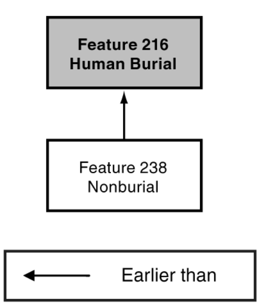

Figure 57. Chart showing the feature relationships associated with burial Feature 216 at LAN-62.

Associated Artifacts

No artifacts could be directly associated with any individual represented in this burial feature.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix. These included a worked-bone bead, a flake of lithic debitage, a Cottonwood Triangular projectile point, a ground stone disk bead, and nearly 30 shell beads. These beads consisted of six varieties: red-abalone-epidermis disk, olivella bushing, olivella cupped, olivella cylinder, olivella round thin lipped, and semiground olivella disk. Roughly half these beads were of the cupped variety, and the rest of the beads were relatively evenly divided among the other types. An olivella-shell cupped bead and a cylinder bead were also found.

The combined date range associated with these shell beads ranges from A.D. 1150 to 1816. The semiground-olivella-shell disk beads and olivella-shell round thin-lipped beads have narrower date ranges, albeit nonoverlapping. These date ranges are A.D. 1800–1816 and 1500–1600, respectively. However, because of their context, these dates provide little insight into the age of this interment.

Burial Feature 218

Feature Age: indeterminate
MNI: 3 (1 primary and 2 additional)
Primary Individual: possible female, 18–25 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: right side
Burial Orientation: south
Head Facing: east
Additional Individuals: (1) indeterminate sex, adult; (2) indeterminate sex, child
Burial Pit: single

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of faunal bone and several cultural materials. Isolated human remains associated with at least two additional individuals were also found in the feature matrix. Additionally, a fragment of an unsided scapula and two unidentified long-bone fragments that could not confidently be associated with any of the individuals represented in this burial feature were recovered, as were fragments of human bone that could not be identified to the element level.

Feature Disturbance

Interment of the primary inhumation associated with burial Feature 323 had intruded into the eastern portion of this burial feature, resulting in the displacement of several skeletal elements from their anatomical positions. Some skeletal elements exhibited holes, possibly from the use of the digging sticks. On the lateral aspect of the left humerus, 13 postmortem cut marks were observed in a region ranging from 63 to 125 mm from the proximal end, placing them over the point of attachment of the deltoid muscle. Though postmortem, these cut marks did not appear to have been made recently and were likely the result of human activity impacting this burial feature, possibly during some subsequent interment event. The longest of the cuts measured 21 mm and was approximately 0.4 mm wide. Several overlapping cut marks produced a damaged area 20 mm long and 3 mm wide. Twelve of the 13 cut marks shared the same orientation, between 120° and 130° from the vertical axis of the bone. One cut, however, was between 240° and 250° from the vertical axis and overlapped another cut at an angle of approximately 70°. This unique cut appeared to have been made after the other cut marks, because the path was uniform, and the lower cut mark was interrupted. The cut marks were also shallow and U-shaped in cross section.

Burial Pit

A single ovate, 90-by-53-by-16-cm burial pit was associated with the primary individual in this burial feature. The bottom of the burial pit was lined with a layer of white ash, and the plan-view shape is ovate.

Feature Interpretation

This burial feature was located near the center of the main burial concentration and consisted of a single primary inhumation and isolated human remains associated with at least two additional individuals (Figure 58). The primary individual was an 18–25-year-old possible female interred fully flexed on the right side, oriented to the south, with the head facing east. Stature could not be estimated.

The skeletal remains associated with the primary individual exhibited a modest degree of articulation but was poorly preserved. Several skeletal elements were missing postmortem, including elements of the extremities, most of the pelvis, the lumbar vertebrae, and the ends of several long bones. A line of red-ocher staining was observed along the left side of the cranium, extending from the region superior to the left orbit, continuing posteriorly and inferiorly to the left temporal, and ending in the region of the left mastoid process.

Isolated human remains associated with at least two additional individuals were recovered from the feature matrix. The first individual, an adult of indeterminate sex, was represented by a right lateral maxillary incisor. The second individual, a child of indeterminate sex, was defined by the presence of three deciduous teeth: a canine and two molars. No pathological conditions, morphological variants, or behavioral indicators were observed.

Associated Features

The primary inhumation in burial Feature 218 was located 10 cm below burial Feature 9. The nature of the relationship between these two burial features was unclear. Additionally, located immediately south of the cranium of the primary inhumation in burial Feature 218 was burial Feature 220. Burial Feature 220 appeared to actually border this burial feature, and it is possible that the cluster of remains associated with this burial feature was created during the interment of the primary inhumation in burial Feature 218. Because burial Feature 9 was a continuation of burial Feature 220, it is rational to infer that burial Feature 220 was created after the interment of burial Feature 218. The eastern border of burial Feature 218 was intruded upon by burial Feature 323. Additionally, burial Feature 218 was located approximately 40 cm above nonburial Feature 450. Finally, the cranium and upper thorax of the primary inhumation associated with burial Feature 218 was located approximately 7 cm beneath the western half of nonburial Feature 70 (Figure 59).

Associated Artifacts

No mortuary offerings were found in direct association with the primary inhumation.

Possibly Unassociated Artifacts

Many cultural materials were found in the feature matrix, including 3 small lumps of red ocher, a fire-affected-cobble fragment, nearly 70 historical-period glass beads, and approximately 75 shell beads. These shell beads consisted of olivella rough large lipped, semiground olivella disk, Pismo-clam tube, and Pismo-clam cylinder. The majority of these beads (approximately 70 in number) were of the semiground-olivella-disk variety. Although these glass and shell beads were recovered from the feature matrix, they still might provide some indirect chronometric data for this burial. The combined date range for the shell beads is A.D. 1150–1816, and most of the beads were manufactured between A.D. 1800 and 1816. The historical-period glass beads were manufactured between A.D. 1770 and 1825.

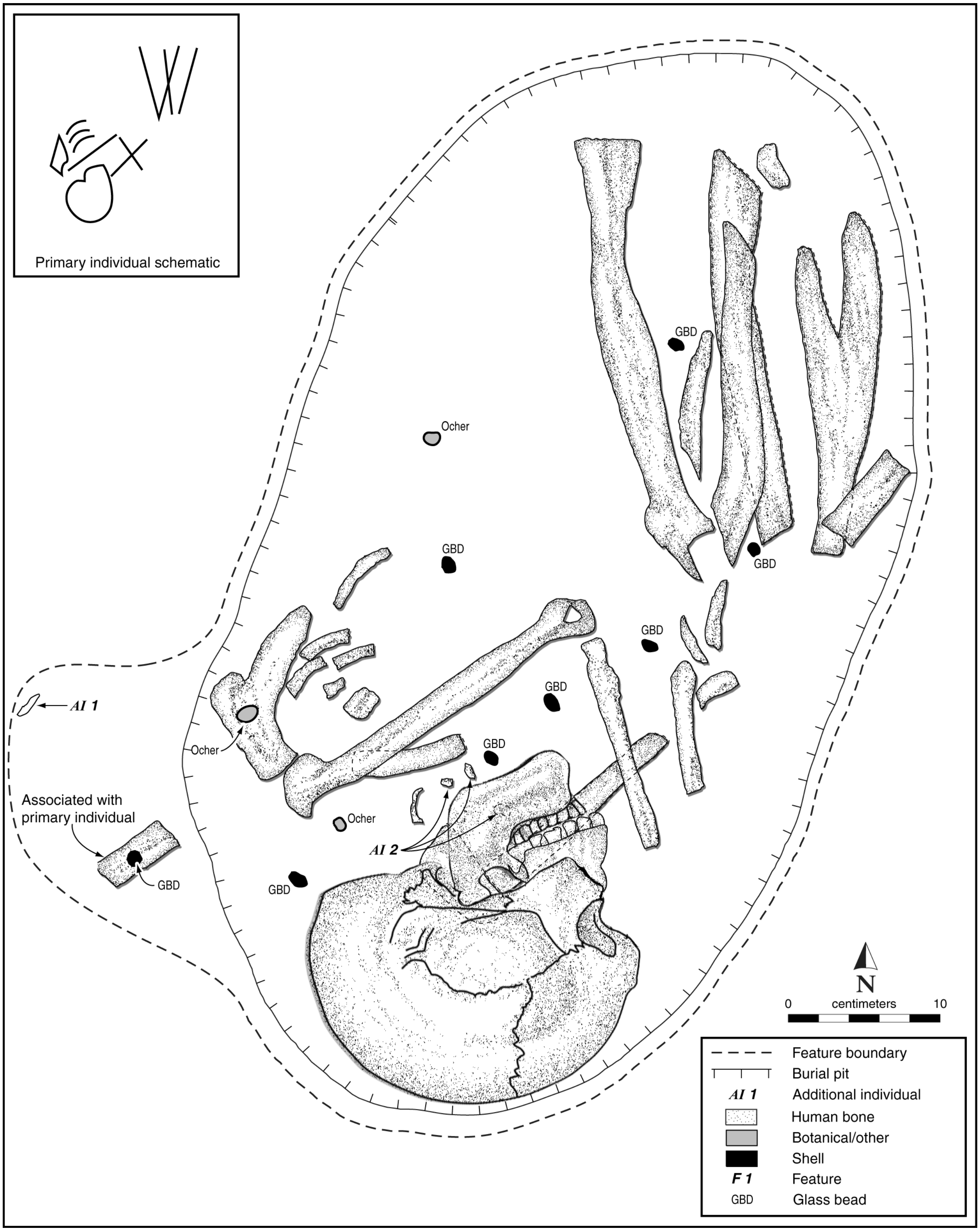

Figure 58. Illustration of burial Feature 218 at LAN-62.

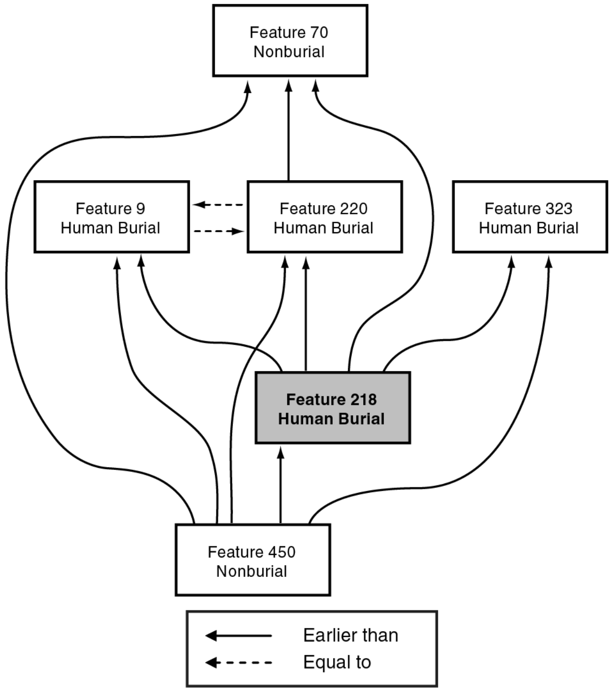

Figure 59. Chart showing the feature relationships associated with burial Feature 218 at LAN-62.

Burial Feature 250

Feature Age: indeterminate
MNI: 5 (1 primary and 4 additional)
Primary Individual: female, 25–35 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: left side
Burial Orientation: southeast
Head Facing: down
Additional Individuals: (1) possible male, 17–25 years; (2) possible female, 25–40 years; (3) possible female, 20–25 years; (4) indeterminate sex, 3–4 months in utero
Burial Pit: single

Feature Fill

The feature matrix was silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, faunal bone, charcoal, shell fragments, and numerous cultural materials. Disarticulated human remains associated with at least four additional individuals were also recovered. Furthermore, approximately 80 human-skeletal elements that could not be directly associated with any individual represented in this burial were found. Although all regions of the skeleton were represented, over half the remains were represented by remains from the appendicular and axial skeleton. Fragments of human bone that could not be identified to the element level were also recovered. Thick, black, claylike sediment was observed in the abdominal area of the primary individual. This substance might be associated with the decomposition of soft tissue.

Feature Disturbance

Roots, rodent gnaw marks, and burrows were all observed. The presence of three to four secondary deposits of human remains above and around the primary individual indicated that the additional human remains were subjected to redeposition after they had been disturbed, probably during the interment of the primary inhumation.

Burial Pit

A single, circular burial pit measuring approximately 80 by 80 cm was observed. The burial pit was identified by the discrete circular cluster of human remains located above and around the primary individual in this burial feature.

Feature Interpretation

This burial feature was located along the southern periphery of the main burial concentration and consisted of a single primary inhumation and disarticulated human remains from at least four additional individuals (Figures 60 and 61). The primary individual was a 25–35-year-old female interred fully flexed on the left side and oriented to the southeast, with the head facing down (see Figure 61). Stature could not be estimated for this individual. Osteoarthritis of the right proximal tibia articular surface and osteophytic lipping of the proximal fibular articular surface on the right tibia was observed. Furthermore, a squatting facet was noted on the same tibia. A medium-sized carious lesion was observed on the left first mandibular molar, and enamel hypoplastic defects were observed on the left and right maxillary central incisors and canines and maxillary right lateral incisor. Standard cranial epigenetic traits and cranial and postcranial osteometric measurements were also recorded. The left second metatarsal exhibited an os intermetatarseum, an accessory bone sometimes found fused to the first or second metatarsal.

Disarticulated human remains associated with at least four additional individuals were recovered from the feature matrix. The first additional individual, a 17–25-year-old possible male, was represented by a cranium and associated dentition. This individual exhibited minimum porotic hyperostosis on the right parietal near lambda. Several enamel hypoplastic defects were observed on the dentition associated with this individual. Standard epigenetic traits and craniometric measurements were recorded.

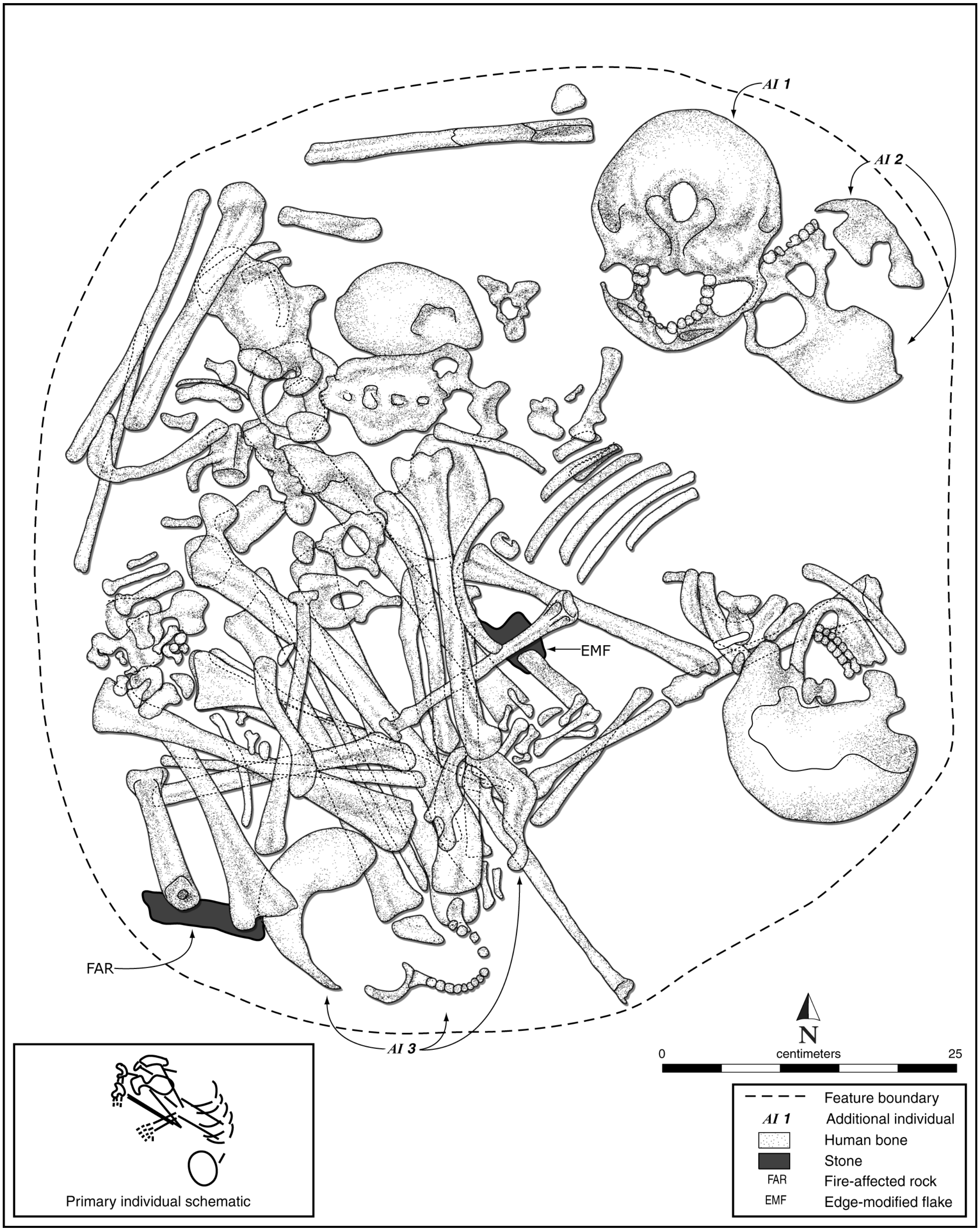

Figure 60. Illustration of burial Feature 250 at LAN-62.

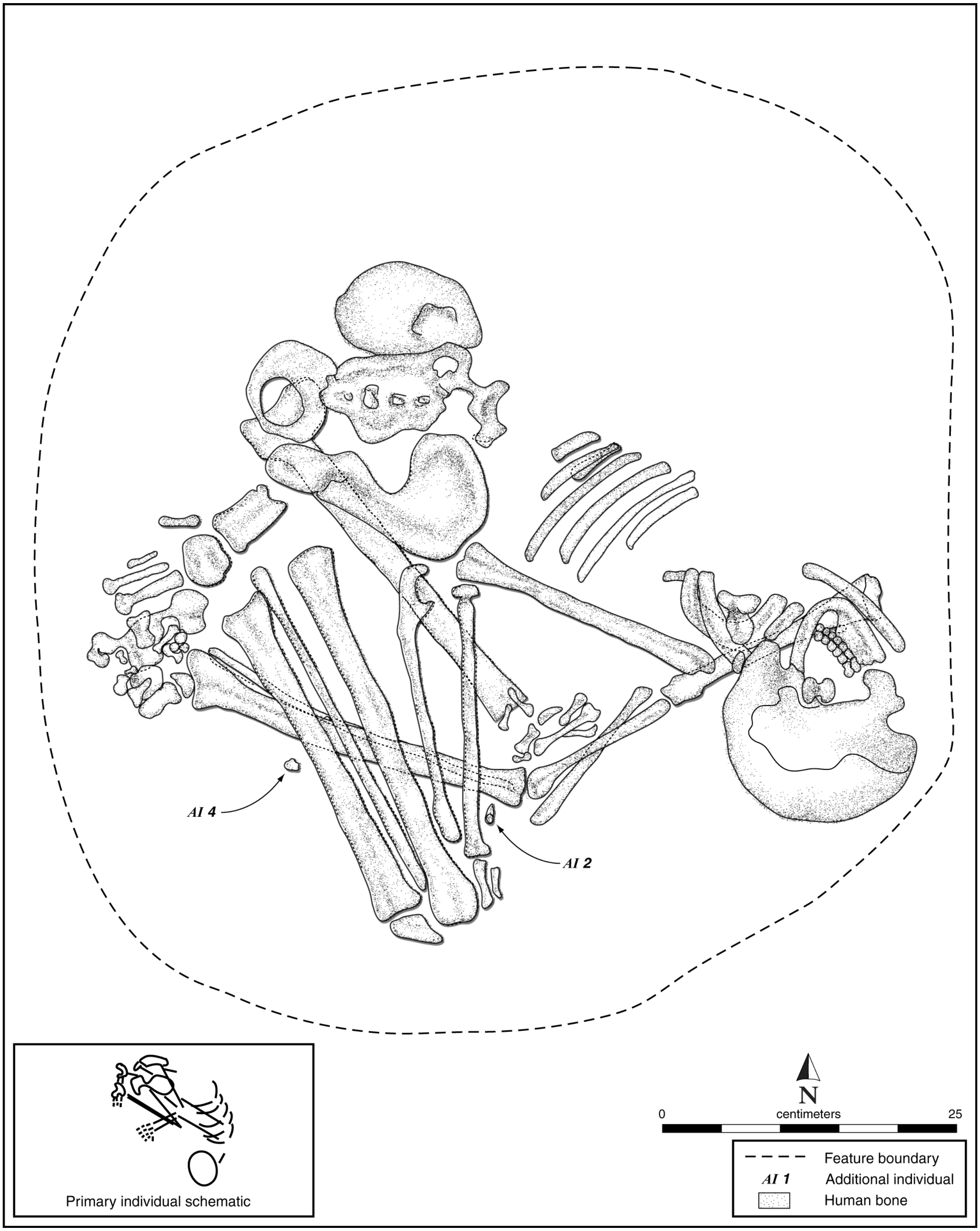

Figure 61. Illustration of the primary individual from burial Feature 250 at LAN-62.

The second additional individual, a 25–40-year-old possible female, was also represented by a cranium, associated dentition, and a right innominate. Additionally, the right pubis was incompletely fused. The right second maxillary premolar exhibited abnormal crown morphology, in that it appeared as if two peglike paramolar cusps were attached to a normal premolar crown. The smallest peg cusp was attached to the mesio-buccal side, with nearly a free apex. The larger cusp was attached to the mesial (toward the center) side of the root and is deflected mesially, apparently lying in the smooth-bordered, open space of the alveolar bone (open to accommodate the cusp) next to the distal side of the right first premolar.

Like the two above individuals, the third additional individual was represented by a cranium, associated dentition, and a mandible. This individual was a possible female aged between 20 and 25 years. A supernumerary tooth erupted directly right of the midline of the maxilla. The tooth itself was not recovered, but the crypt suggests this tooth was of pegged morphology. The right maxillary canine was heterotopic, or unerupted, and displaced within the bone. Standard craniometric measurements were recorded.

The final additional individual was aged 3–4 months in utero. Sex could not be estimated. This individual was represented by a left scapula, a right zygomatic, an unsided zygomatic, an unidentified vertebral centrum, and long-bone fragments, all of which exhibited levels of development consistent with an individual in this age range. Cranial and postcranial osteometric information was recorded for this individual.

Standard postcranial osteometric observations were recorded for several of the skeletal elements. Additionally, cut marks were observed on the medial aspect of the distal diaphysis of an isolated left tibia. These cut marks were identified as four defects running medio-laterally and anterio-posteriorly along the medial crest and ranging in size from 5 to 8 mm. The cut marks were noted within 44 mm from the distal one-third of the diaphysis. There was a regularity in the orientation of the defects, suggesting that they were introduced in a single event. The nature of the cut marks was consistent with—but not necessarily exclusive to—a defleshing process (i.e., several small, clustered cut marks with uniform orientation). The same tibia exhibited an anterior-medio bowing. The origin of the bowing is unknown. Also, a right rib displayed some osteophytic lipping at the tubercle and densification of the articular surface, suggesting that some osteoarthritic activity was present.

Associated Features

The southeastern quadrant of burial Feature 250, which included several isolated human-skeletal remains and the cranium and right forearm of the primary inhumation, was located approximately 30–35 cm beneath burial Feature 37. The northwestern quadrant of burial Feature 250 was located beneath the isolated human bone and artifacts on the eastern side of burial Feature 134 and the southeastern portion of the first primary inhumation associated with burial Feature 38. These burial features were located 20–25 cm and approximately 50 cm above burial Feature 250, respectively (Figure 62).

Associated Artifacts

No cultural materials could be directly associated with any individual represented in this burial feature.

Possibly Unassociated Artifacts

Numerous artifacts were recovered from the feature matrix. These included a worked-bone tube, 3 fire-affected-cobble fragments, 1 flake of debitage, a fire-affected-mano fragment, an edge-modified flake, a historical-period glass bead, and nearly 35 shell beads. The shell beads included olivella bushing, clam disk, olivella cupped, olivella cylinder, red-abalone-epidermis disk, giant rock scallop disk, olivella rough large lipped, olivella round thin lipped, semiground olivella disk, and olivella disk. Most of the beads were split between the olivella-bushing and semiground-olivella-disk types, which each represented approximately one-third of the total number of shell beads found in this burial feature. One of the olivella cupped beads had asphaltum staining on it. Although found in the feature matrix, the beads could provide indirect chronometric data for this burial feature. The combined date range associated with the shell beads is A.D. 1150–1816, and the semiground-olivella-shell disk beads were manufactured between A.D. 1800 and 1816. Interestingly, the olivella-round-thin-lipped variety has a corresponding date range of A.D. 1500–1600, which differs from the semiground-olivella-shell disk beads by 300–400 years, suggesting that this bead either had been curated or was intrusive to this burial feature. The historical-period glass bead was manufactured between A.D. 1770 and 1825.

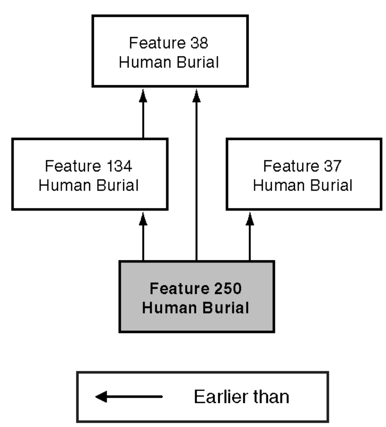

Figure 62. Chart showing the feature relationships associated with burial Feature 250 at LAN-62.

Burial Feature 267

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: female, 25–33 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: prone
Burial Orientation: northeast
Head Facing: down
Additional Individual: indeterminate sex and age
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, faunal bone, and a small amount of cultural materials. Isolated human remains associated with at least one additional individual were also recovered from the feature matrix. Additionally, a single unidentified vertebral fragment that could not be confidently associated with any of the individuals represented in this burial feature was recovered from the feature matrix.

Directly beneath and adhering to the bone was a more-ashy-colored matrix. Black, greasy, claylike sediment was recovered from beneath the lumbar vertebrae. This sediment might be the remnants of organics left after the decaying process.

Feature Disturbance

No rodent burrows were observed; however, the disturbed nature of the ribs and the presence of rodent bone suggested that this disturbance was related to rodent activity. Additionally, although the remains were exceptionally well preserved, the right lower leg, right forearm, and right foot and hand were missing postmortem. Proximity to the historical-period trench (nonburial Feature 16) suggested that either this burial feature was directly impacted by construction of the trench or these remains became dislodged as the sides of the trench eroded.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 72 cm; width, 56 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan-view shape is ovate.

Feature Interpretation

Burial Feature 267 was located in the northern portion of the burial area, within the concentration of diffusely scattered burials immediately adjacent to the historical-period trench (nonburial Feature 16), and consisted of a single primary inhumation and isolated human-skeletal remains associated with at least one additional individual (Figure 63). The primary inhumation was a 25–33-year-old female interred fully flexed in a prone position, oriented to the northeast, with the head facing down. The estimated living stature of this individual, based on the maximum length of the left femur, was 146.5–154.1 cm (57.7–60.7 inches). The skeletal remains associated with this individual were exceptionally well-preserved; only the right lower leg, right forearm, and right foot and hand were missing postmortem. The parietal/squamosal region of the left temporal exhibited some cortical exfoliation. Many of the long bones displayed longitudinal drying cracks, indicating past exposure of part of the burial.

Numerous pathological and traumatic conditions were observed for this individual. These conditions consisted of osteoarthritis of the temporomandibular joints, vertebral osteophytosis, osteophytic lipping on several rib tubercles, partial spondylolysis of the fourth lumbar vertebra, complete spondylolysis of the fifth lumbar vertebra, and enthesophytic growth in the retroauricular region of the right innominate.

Most notable for this individual were at least six separate, distinct, perimortem cut marks on the right tenth and eleventh ribs. On the inferior border of the right tenth rib, this individual displayed at least four cut marks, and a fifth cut mark was visible on the superior surface of the same rib (see Chapter 9). Additionally, a sixth cut mark was observed on the inferior margin of the right eleventh rib (see Chapter 9). Depending on the depth of the punctures, the indicated cuts might have resulted in damage to the liver and the surrounding structures. None of the cut marks exhibited any sign of healing, and the individual appeared to have died as a result of this trauma or complications from it. Conversely, because these cut marks were perimortem in nature and could have conceivably occurred at any point during the time between death and interment, ritualistic activity cannot be entirely ruled out.

The four cut marks on the inferior margin of the tenth rib represented four successive sharp-force traumas, probably through a sawing motion, that entered the body at approximately 90°. The individual was probably not moving, because the wounds were in a tight formation. The floors of the cut marks were smooth, and several displayed a thin, curling spall, indicating that an extremely sharp blade was used to cut through fresh bone. The cut mark observed on the superior margin of the tenth rib was small and was likely a nick from a blade as it passed through the intercostal space between the ninth and tenth ribs. Additionally, the inferior margin of the right eleventh rib, associated with the sixth cut mark, was pulled outward slightly, suggesting that the bone was dragged out as the blade was removed.

In addition to these pathological and traumatic conditions, standard epigenetic traits; cranial and postcranial osteometric data; several morphological variants, including articular-surface defects and unfused transverse processes associated with the lumbar vertebrae; and a suite of dental observations

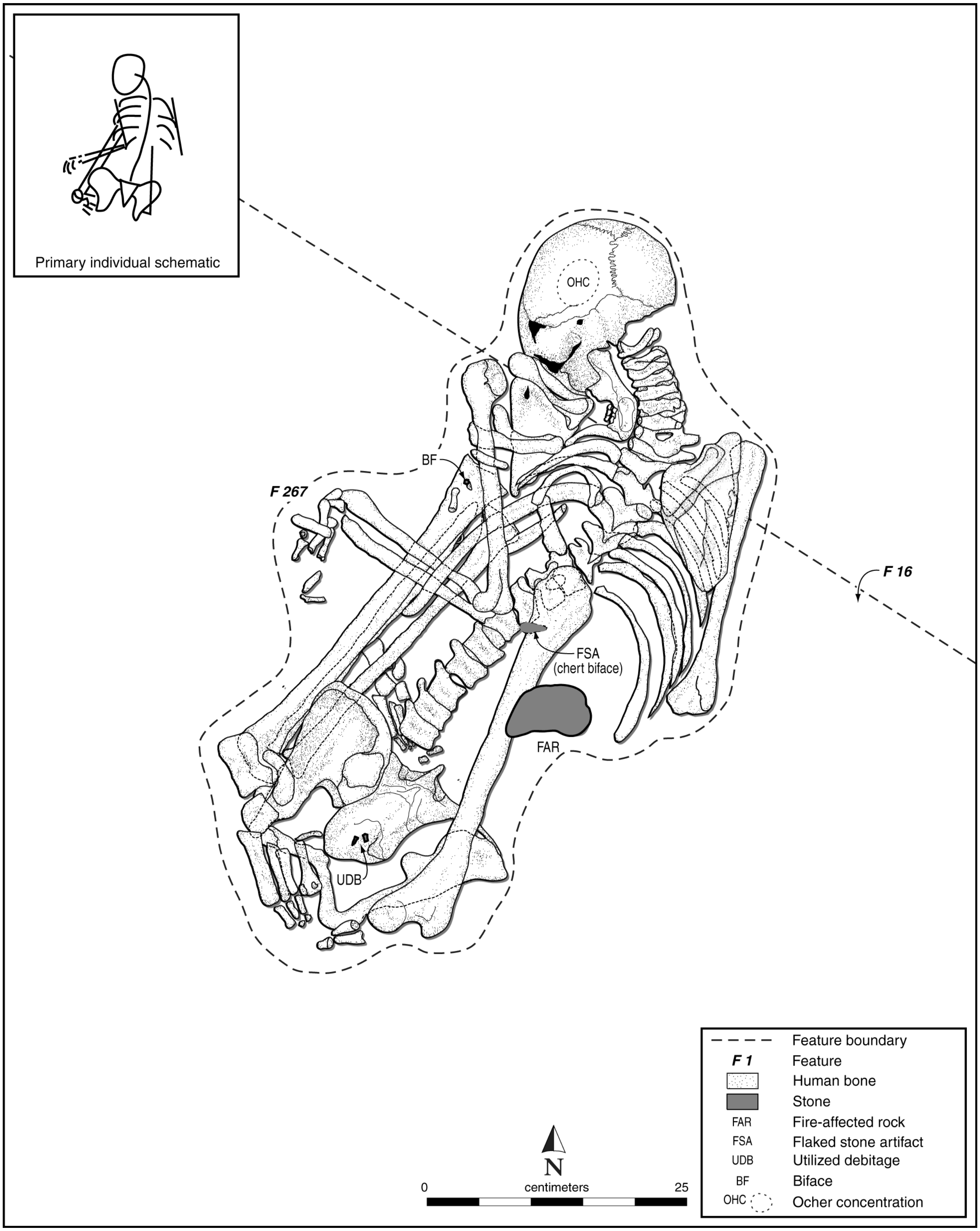

Figure 63. Illustration of burial Feature 267 at LAN-62.

concerning attrition, variation, and pathology were also recorded. Also, evidence of periodontal disease was observed on the maxilla. Furthermore, the occlusal surface of the left maxillary central incisor was worn at an angle from mesial (toward the midline of the mouth) to distal (away from the midline of the mouth), suggesting that the individual used their teeth in task-related activities, such as stripping plant matter for basket making.

Isolated human remains associated with at least one additional individual were recovered from the feature matrix. This individual was defined by the presence of burned human remains. The remains were completely blackened. Because of a lack of diagnostic traits, no demographic information could be recorded.

Associated Features

The southwestern portion of this burial feature was intruded upon by nonburial Feature 16, a historical-period trench.

Associated Artifacts

Beneath the right femur was a large, lanceolate, dark-gray-chert biface. The edge of the tool matched that of the sixth cut mark, and all the cut marks but one were consistent with the shape of a similar tool. Red ocher was recovered from beneath the cranium and above the left side of the pelvis. The fragments of ocher were 4 by 5 cm and 4 by 4 cm, respectively.

Possibly Unassociated Artifacts

Additionally, four flakes of debitage, a fire-affected-cobble fragment, and two olivella-shell round thin-lipped beads were recovered from the feature matrix. The beads have a corresponding date range of A.D. 1500–1600.

Burial Feature 268

Feature Age: Mission period (A.D. 1800–1816)
MNI: 3 (1 primary and 2 additional)
Primary Individual: possible female, 17–25 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: right side
Burial Orientation: south
Head Facing: east
Additional Individuals: (1) indeterminate sex, 1–4 years; (2) indeterminate sex, adult
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of 1–5-cm-diameter subangular clasts, faunal bone, shell fragments, and numerous cultural materials. Scattered human bones associated with at least two additional individuals were recovered from the feature matrix. Furthermore, fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

Extensive rodent disturbance was observed for this burial feature, and small roots were prevalent throughout the feature matrix. The skeletal elements associated with the primary inhumation appeared to have been slightly disturbed. The left innominate was out of articulation with the left femur by approximately 2–3 cm. The left leg bones were pushed very close to the body and were almost in line with the vertebral column. The origin of the disturbance is unknown, but rodent activity is suspected.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 90 cm; width, 80 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan-view shape is circular.

Feature Interpretation

This burial feature was located along the southeastern end of the main burial concentration and consisted of a single primary inhumation and scattered human bone associated with at least two additional individuals (Figure 64). The primary inhumation was a 17–25-year-old possible female interred fully flexed on her right side, oriented to the south, with the head facing east. The living stature of this individual, based on the approximate maximum length of the left femur, was between 139.26 and 146.89 cm (54.8–57.8 inches). Minimal dental attrition with very little loss of enamel was observed for this individual. A small carious lesion was noted on the left maxillary third molar. Standard postcranial osteometric observations were recorded for this individual. The skeletal remains associated with this individual were poorly preserved; much of the skeleton was missing postmortem, including most of the ribs, vertebrae, and bones of the extremities.

Isolated human bone associated with at least two additional individuals was recovered from the feature matrix. The first individual was a child of indeterminate sex between 1 and

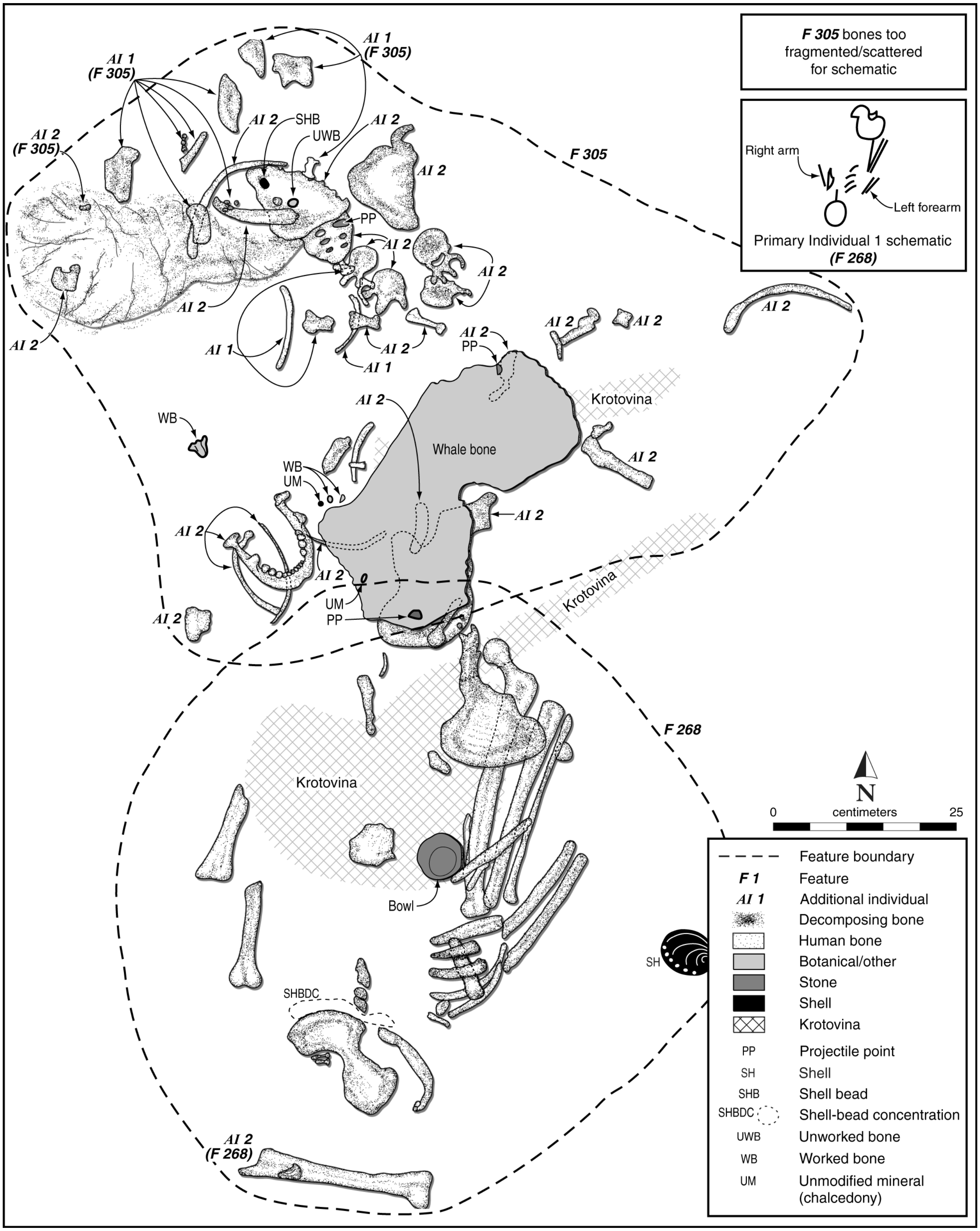

Figure 64. Illustration showing the relationship between burial Features 268 and 305 at LAN-62.

4 years of age. This individual was represented by a vertebral body, a deciduous maxillary molar, and cranial fragments. The second individual identified from the isolated bone was an indeterminate-sex adult represented by a single intact left tibia located approximately 5 cm south of the cranium for the primary individual. Standard postcranial osteometric observations were recorded for this individual.

Associated Features

The pelvis and legs of the primary inhumation in burial Feature 268 were 21–27 cm above the left innominate and leg of the primary inhumation from burial Feature 515. Also, the cranium associated with the primary inhumation from burial Feature 268 was located 56–57 cm above the left humerus and ribs of the primary inhumation associated with burial Feature 396.

The cranium associated with the primary inhumation in burial Feature 455 was located approximately 20 cm beneath the thorax of the primary inhumation in this burial feature. The whale bone, which was beneath part of the pelvis for this individual, was found immediately on the right innominate associated with the adult-male individual in burial Feature 305, located immediately north of burial Feature 268 (Figure 65).

Associated Artifacts

Several possible mortuary offerings were recovered from this burial feature. The first artifact was a small, incised, ocher-covered, steatite bowl with two perforations near the rim. This bowl was found immediately west of the middle thorax, near the distal end of the left femur. About 2.5 cm to the west of this steatite bowl was a large (5-by-5-cm) lump of red ocher.

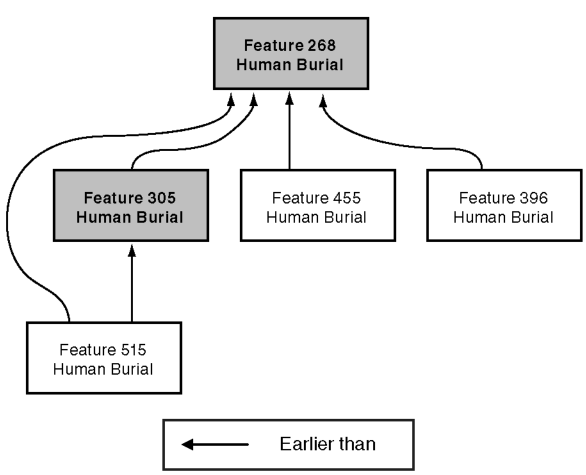

Figure 65. Chart showing the feature relationships associated with burial Feature 268 at LAN-62.

Directly over the neck region of the primary inhumation was a cluster of shell beads consisting of approximately 220 olivella semiground beads and nearly 10 red-abalone-epidermis disk beads. A large (43-by-23-cm) fragment of whale bone was located in the northern portion of this burial feature. The whale bone, which was lying flat, was partially covered by the pelvis of the primary inhumation for this burial feature.

The olivella semiground shell beads, with a corresponding date range of A.D. 1800–1816, and the red-abalone-epidermis disk beads, with a corresponding date range of A.D. 1150–1834, provided good chronometric data for this burial feature.

Possibly Unassociated Artifacts

Several artifacts that could not be confidently associated with any individual represented in this burial feature were found in the feature matrix, including 2 fire-affected-cobble fragments, a glass bead, a flake of lithic debitage, an abalone shell, and nearly 390 shell beads. The beads consisted of 11 different types, including red-abalone-epidermis disk, California-mussel cylinder, olivella bushing, olivella cupped, olivella rough large lipped, olivella round thin lipped, semiground olivella disk, semiground olivella lipped disk, olivella spire, Pismo-clam disk, and Pismo-clam cylinder. Nearly 360 of these beads were of the semiground-olivella-disk type.

The combined date range associated with the shell beads is A.D. 1150–1816, and most of the beads were manufactured between A.D. 1800 and 1816. A single round thin-lipped olivella-shell bead was associated with an A.D. 1500–1600 date range. This bead might have been intrusive to the burial feature or may represent a curated artifact. The glass bead was manufactured between A.D. 1770 and 1825, which is consistent with the general feature age.

Burial Feature 273

Feature Age: indeterminate
MNI: 1 (1 primary)
Primary Individual: indeterminate sex, adult
  Burial Type: cremation
  Burial Treatment: primary
  Burial Position: indeterminate
  Burial Orientation: indeterminate
  Head Facing: indeterminate
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, charcoal, ash, and faunal bone. Approximately 10 human-cranial and long-bone fragments that could not be confidently associated with any individual represented in this burial feature were recovered from the feature matrix. Additionally, several fragments of human bone that could not be identified to the element level were recovered.

Feature Disturbance

Minor amounts of rodent and plant disturbance were observed.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 56.25 cm; width, 51.25 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan view shows an irregular shape.

Feature Interpretation

This burial feature was located along the northwestern periphery of the main burial concentration and consisted of a single primary cremation of an adult of indeterminate sex (see Figure 27). No pathological conditions or morphological variants were observed. The skeletal remains associated with this individual were highly fragmented. Only cranial and unidentified long-bone fragments were recovered. The remains exhibited a range of burn patterns from unburned to completely calcined. Concentric rings of differential burn patterns were observed in the main concentration of bone in the eastern side of the burial feature. The center of the concentration was primarily partially calcined, with decreasingly less-advanced stages radiating outward. This undisturbed state indicated that the remains were most likely burned in place. Although other human-skeletal elements were recovered from the feature fill, they could not be confidently associated with the cremation identified in the burial feature.

Associated Features

The main concentration of burned bone associated with burial Feature 273 was located 10–15 cm above the eastern portion of burial Feature 271. The steatite olla associated with burial Feature 273 was found directly above the cranium from burial Feature 271. The fragment of steatite ground stone found in burial Feature 271 might be associated with this bowl. Furthermore, the fragments of burned bone associated with the fourth additional individual in burial Feature 271 were likely associated with the primary individual in burial Feature 273. An association was made between these two individuals.

The western side of burial Feature 598 was located within 30 cm beneath the eastern side of this burial feature. Most of the northern portion of burial Feature 69 completely overlapped burial Feature 273. Burial Feature 69 was located within 16 cm directly above this burial feature (Figure 66).

Associated Artifacts

One half of a steatite olla was recovered from the western side of the burial feature. This vessel was approximately 210 mm deep and had an approximately 270-mm-diameter orifice. Wall thickness varied, measuring 11.5 mm at the rim, 40 mm on the wall, and only 3.2 mm at the base. A dense soot layer extended two-thirds up the exterior wall from the base, and a 4-mm-thick layer of burned residue adhered to the interior base. This residue might have formed because of the very thin base of the vessel (i.e., too much heat transfer) or might represent an asphaltum "patch" or an attempt to thicken the base. The burned residue formed a 205-mm-diameter circle in the bottom of the vessel. A few small drops of asphaltum were observed on the interior lower wall, just above the charred residue. Additionally, fragments of burned basketry were recovered from the feature matrix but might have been originally associated with this cremation.

Burial Feature 274

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: female, 29–31 years
  Burial Type: inhumation
  Burial Treatment: semiflexed
  Burial Position: prone
  Burial Orientation: northeast
  Head Facing: down
Additional Individual: indeterminate sex, adult
Burial Pit: unobservable

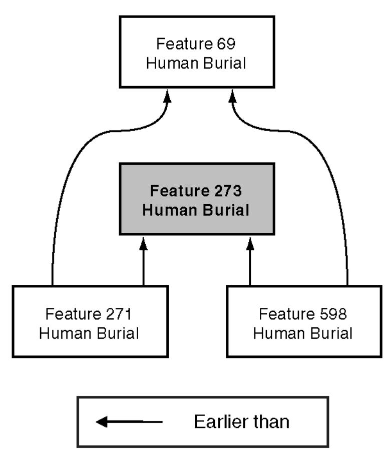

Figure 66. Chart showing the feature relationships associated with burial Feature 273 at LAN-62.

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of 5–25-cm-diameter subangular clasts, faunal bone, shell fragments, and several cultural materials. Isolated human-skeletal remains for at least one additional individual were recovered from the feature matrix. Additionally, a right twelfth rib and a proximal tarsal phalanx that could not be confidently associated with any individual represented in this burial feature, as well as a fragment of human bone that could not be identified to the element level, were recovered from the feature matrix.

Feature Disturbance

Although the remains of the primary inhumation were relatively undisturbed, several skeletal elements exhibited rodent gnaw marks. Furthermore, a root of substantial size grew through the distal end of the left femur, into the medullary cavity, and exited the femoral head into the acetabulum.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 65 cm; width, 92.5 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan view shows a rectangular or subrectangular shape.

Feature Interpretation

This burial feature was located along the eastern periphery of the burial area, among the scattered burials, and consisted of a single primary inhumation and isolated human-skeletal remains associated with at least one additional individual (Figure 67). The primary inhumation was a 29–31-year-old female interred semiflexed in a prone position, oriented to the northeast, with the head facing down. The living stature of this individual, based on the maximum length of the right femur, was between 145.73 and 153.36 cm (57.4–60.4 inches). The remains were well preserved and articulated, and few skeletal elements were missing postmortem. The insertion for the brachialis muscle on the right ulna was large relative to that of the left ulna. Standard cranial epigenetics and cranial and postcranial osteometrics were recorded. The overall dental attrition for this individual was moderate to severe; evidence of possible task wear was associated with the left anterior mandibular dentition. Furthermore, an abscess was associated with the right maxillary first molar. The right mandibular canine exhibited an enamel hypoplastic defect.

The placement of the primary individual in the grave pit was of special interest. The lower regions of the skeleton (legs, pelvis, and lower back) were semiflexed on the right side, directed east. The spine then twisted to the right and then turned to the left. The result was that the upper thorax and head were prone and directed north. The right arm was nearly extended on its right side. The left arm was semiflexed on its ventral side, with the elbow at a higher elevation than both the shoulder and the wrist. The overall position of the body in the grave was inconsistent with the more widely encountered fully flexed burials at the site, which were laid out on one side. In short, the position or orientation of the primary individual was suggestive of a hasty, unprepared burial—the body appeared to have been placed in a manner inconsistent with other, prepared burials.

In addition to the primary inhumation, isolated human remains associated with at least one additional individual were found in the feature matrix. This individual, an adult of indeterminate sex, was represented by a duplicate unsided temporal bone.

Associated Features

No features, burial or otherwise, were associated with this burial feature.

Associated Artifacts

An abalone shell was found, internal side up, approximately 15 cm west of the cranium of the primary inhumation. This appeared to be the only artifact associated with the burial that might have been a mortuary offering.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix: a Cottonwood Triangular projectile point, a ground stone disk bead, 4 fire-affected-cobble fragments, 1 biface, a fragment of pointed worked bone, and nearly 15 shell beads of four varieties: California-mussel cylinder, olivella round thin lipped, semiground olivella disk, and olivella bushing. Almost half the beads were of the California-mussel-cylinder variety, and the rest were divided among the other varieties.

The combined date range associated with the beads stretches from A.D. 1150 to 1816. Included with that date range are two very narrow date ranges associated with two types of beads. The first range, associated with the olivella-shell round thin-lipped bead, stretches from A.D. 1500 to 1600. The second range, associated with the semiground-olivella-shell disk beads, stretches from A.D. 1800 to 1816.

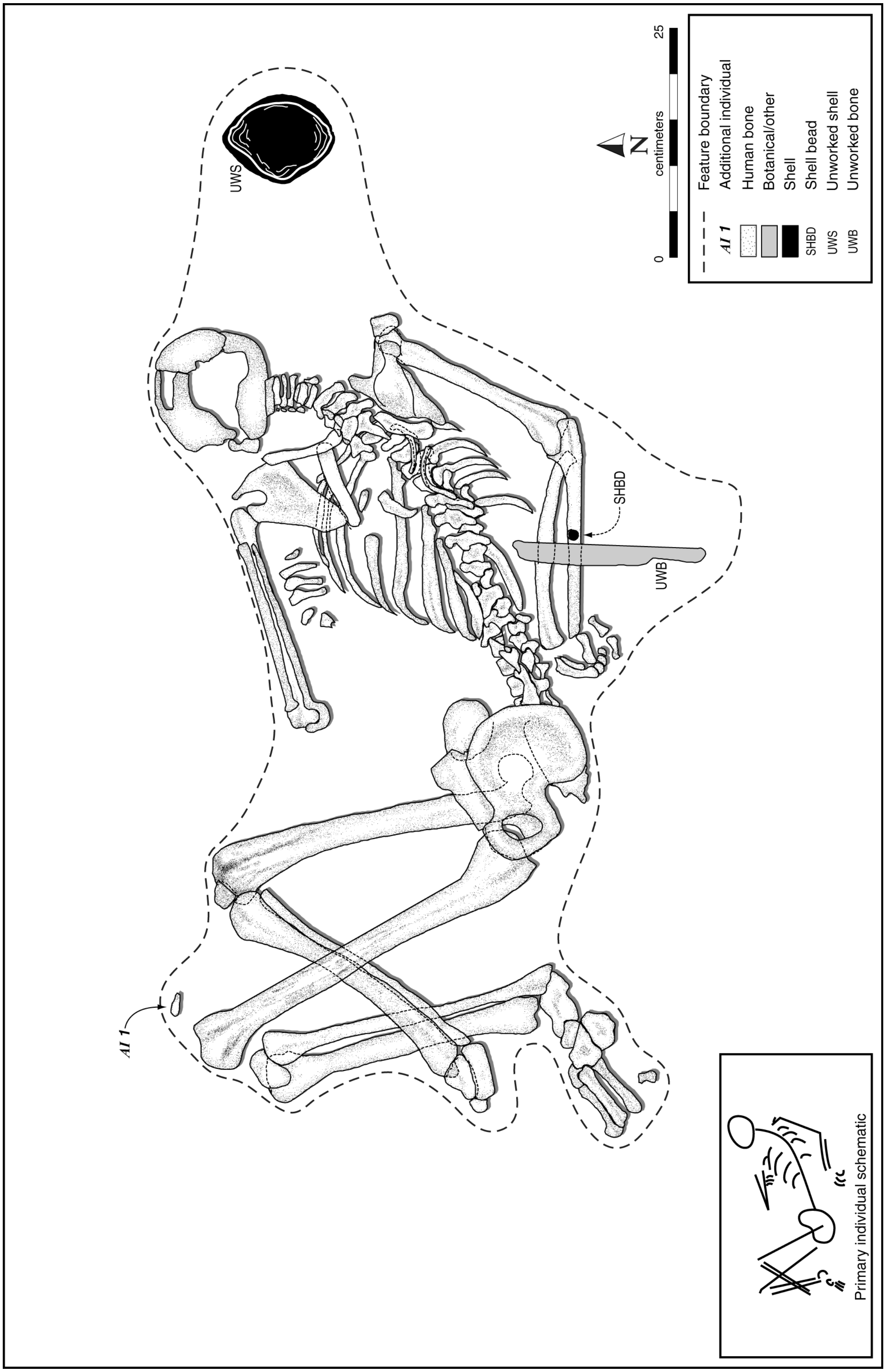

Figure 67. Illustration of burial Feature 274 at LAN-62.

Burial Feature 277

Feature Age: indeterminate
MNI: 1 (1 primary)
Primary Individual: male, 30–35 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: right side
Burial Orientation: east
Head Facing: north
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of 1–5-cm-diameter subangular clasts, faunal bone, shell fragments, and several cultural materials. Additionally, at least two human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were recovered from the feature matrix. These remains consisted of a fragment of a left femur and a fragment of an unidentified tarsal bone. Furthermore, fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

Some rodent burrows extended into burial Feature 277 from burial Feature 150, located approximately 20 cm directly above burial Feature 277. These burrows were directly over the arms and hands of the primary inhumation and likely resulted in the displacement of the right radius and hand. Because of the relationship among these two burial features and the rodent burrow, skeletal elements of the hands in the feature matrix of burial Feature 150 might belong to the primary inhumation in either burial Feature 150 or burial Feature 277. Because we could not determine with which burial these remains were associated, they were not attributed to either individual.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 57.5 cm; width, 112.5 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan view of the feature shows an ovate shape.

Feature Interpretation

This burial feature was located in the southeastern periphery of the burial area, in the scattered burial concentration, and consisted of a single primary inhumation, a 30–35-year-old male, interred fully flexed on his right side, oriented to the east, with his head facing north (Figure 68). The skeletal remains of this individual were well preserved and, with the exception of minor disturbance, well articulated. Stature could not be estimated for this individual. Standard cranial epigenetic traits and numerous cranial and postcranial osteometric measurements were recorded.

The most notable feature of this individual was the extensive proliferative bone growth throughout the skeleton and the ankylosis (fusion) of the entire vertebral column, pelvis, and several ribs, likely the result of some form of seronegative spondyloarthropathy. The term “seronegative” refers to the negative presence of the rheumatoid factor, an antibody that may bind to healthy tissue and result in damage. Skeletally, these conditions often exhibit ankylosis (fusion) of vertebral and sacroiliac joints, fusion of the ribs to the vertebrae, abnormal bone growth at points of ligamentous attachment, and, in some conditions, periostitis and erosion of extremity joints (Rogers and Waldron 1995:68, 77). Although the type of seronegative spondyloarthropathy is unknown, a condition similar to Reiter’s syndrome is suspected. An extensive and detailed description of the manifestation of this condition can be found in Chapter 9, this volume.

In addition to this condition, the midshaft of the right femur exhibited a well-healed fracture. The distal end of the femur was angled laterally from the vertical axis, possibly the result of misalignment during healing of the aforementioned fracture. On the left radius, a cloaca, a drainage canal for pus and other exudates formed during an infection, was observed on the anterior surface, 40 mm from the proximal end, near the radial tuberosity. The cloaca measured 6 mm proximo-distally and 3 mm medio-laterally. The margins of the cloaca appeared jagged and exhibited some remodeling, suggesting that the bone was reactive until the time of death (i.e., not in the process of healing). This cloaca was likely related to osteomyelitis. The distal and middle pedal phalanges on a right toe were fused to one another at the distal interphalangeal joint, a condition known as pedal symphalangism. Several abscesses were observed on the maxillae and mandible, and a medium-sized carious lesion was noted on the right maxillary first molar.

Associated Features

The arms and hands of the primary inhumation in burial Feature 277 were located approximately 20 cm directly beneath burial Feature 150. The lower legs and feet of the primary inhumation in burial Feature 277 were located within 1 cm directly beneath nonburial Feature 272, which might be the origin of the disturbances observed in that location (Figure 69).

Associated Artifacts

No artifacts were found in direct association with any individual represented in this burial feature.

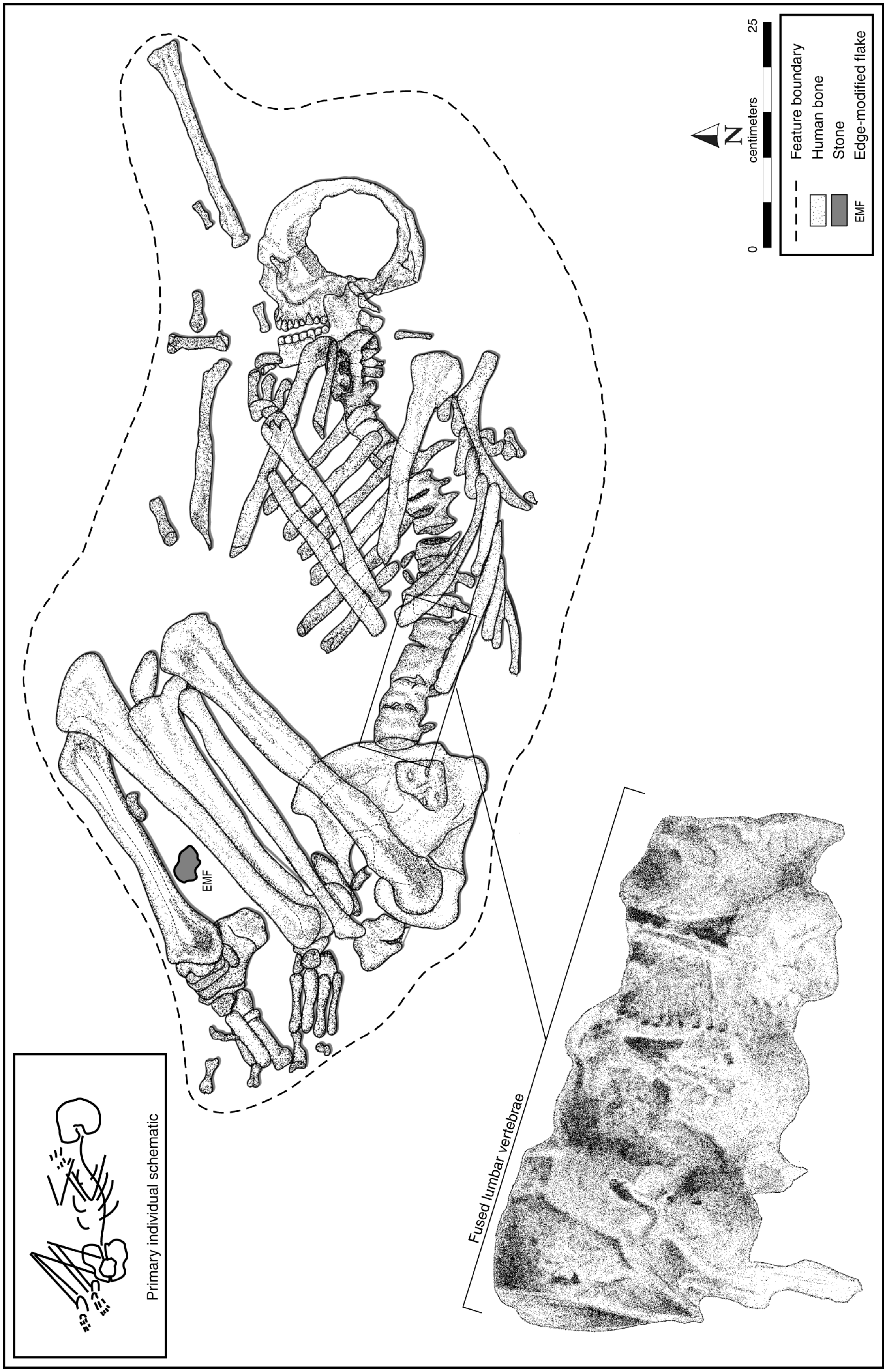

Figure 68. Illustration of burial Feature 277 at LAN-62.

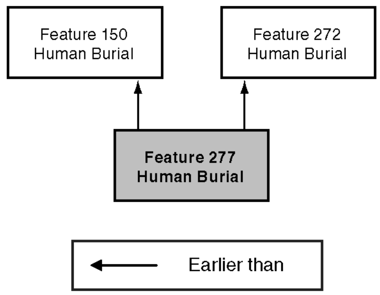

Figure 69. Chart showing the feature relationships associated with burial Feature 277 at LAN-62.

Possibly Unassociated Artifacts

Numerous cultural materials were found in the feature matrix. These included 3 fire-affected cobbles, 1 edge-modified flake, 1 ground stone disk bead, nearly 100 glass beads, and around 90 shell beads. The shell beads were of seven varieties: olivella cupped, red-abalone-epidermis disk, giant-rock-scallop disk, olivella oval thin lipped, olivella round thin lipped, olivella semiground disk, and Pismo-clam cylinder. By far the most numerous of the shell beads found in the feature matrix, numbering nearly 80, were the semiground-olivella-shell disk beads. One of the olivella-shell cupped beads had asphaltum on it. Although found in the feature matrix, the shell and glass beads associated with this burial feature might still provide some indirect chronometric data. The shell beads have a combined date range of A.D. 1500–1816, and the majority of the beads fall within the rather narrow range of A.D. 1800–1816. The glass beads were manufactured between A.D. 1770 and 1825. Although this suggests that this burial was interred during the Mission period, the lack of directly associated diagnostic artifacts precludes such an assessment.

Burial Feature 281/300

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: male, 30–40 years
  Burial Type: inhumation
  Burial Treatment: extended
  Burial Position: prone
  Burial Orientation: east
  Head Facing: north
Additional Individual: indeterminate sex, 2–12 years
Burial Pit: unobservable

Feature Fill

The feature matrix was very dark-brown sandy silt with shell and faunal-bone fragments, charcoal flecks, a moderate amount (5–25 percent) of rounded clasts 1–5 cm in diameter, and several cultural materials. Furthermore, two fragments of juvenile human bone associated with a second individual were found in the feature matrix. Fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

A large rodent burrow extended southeast–northwest through the midsection of the primary inhumation, resulting in the postmortem destruction of many of the thoracic vertebrae, the face, and most of the right humerus; the displacement of several ribs; and the removal or scattering of the hand bones. Furthermore, rodent gnaw marks were observed on the lateral border of the left scapula, on the linea aspera of the left femur, and along the margins of a postmortem hole in the occipital. Rodent activity was also likely responsible for the introduction of fragments of skeletal elements from a second individual. Root etching was noted along the shaft of the left femur. Finally, the entire right leg, the left lower leg, and both feet were missing postmortem.

Burial Feature 281 contained the lower left leg and some of the bones of the feet for this individual, displaced eastward during the construction of the modern trench (nonburial Feature 16), which cuts through the western portion (i.e., legs and feet) of this burial feature. The right leg was not recovered.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 96 cm; width, 102.5 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan view of the feature shows an irregular shape.

Feature Interpretation

This burial feature was located immediately north of the historical-period trench (nonburial Feature 16), in the northeastern portion of the locus, among scattered burials. It consisted of a single primary interment and two isolated skeletal elements representing a second individual (Figure 70). The primary inhumation was a 30–40-year-old male interred extended in a prone position, oriented to the east, facing north. Stature could not be estimated.

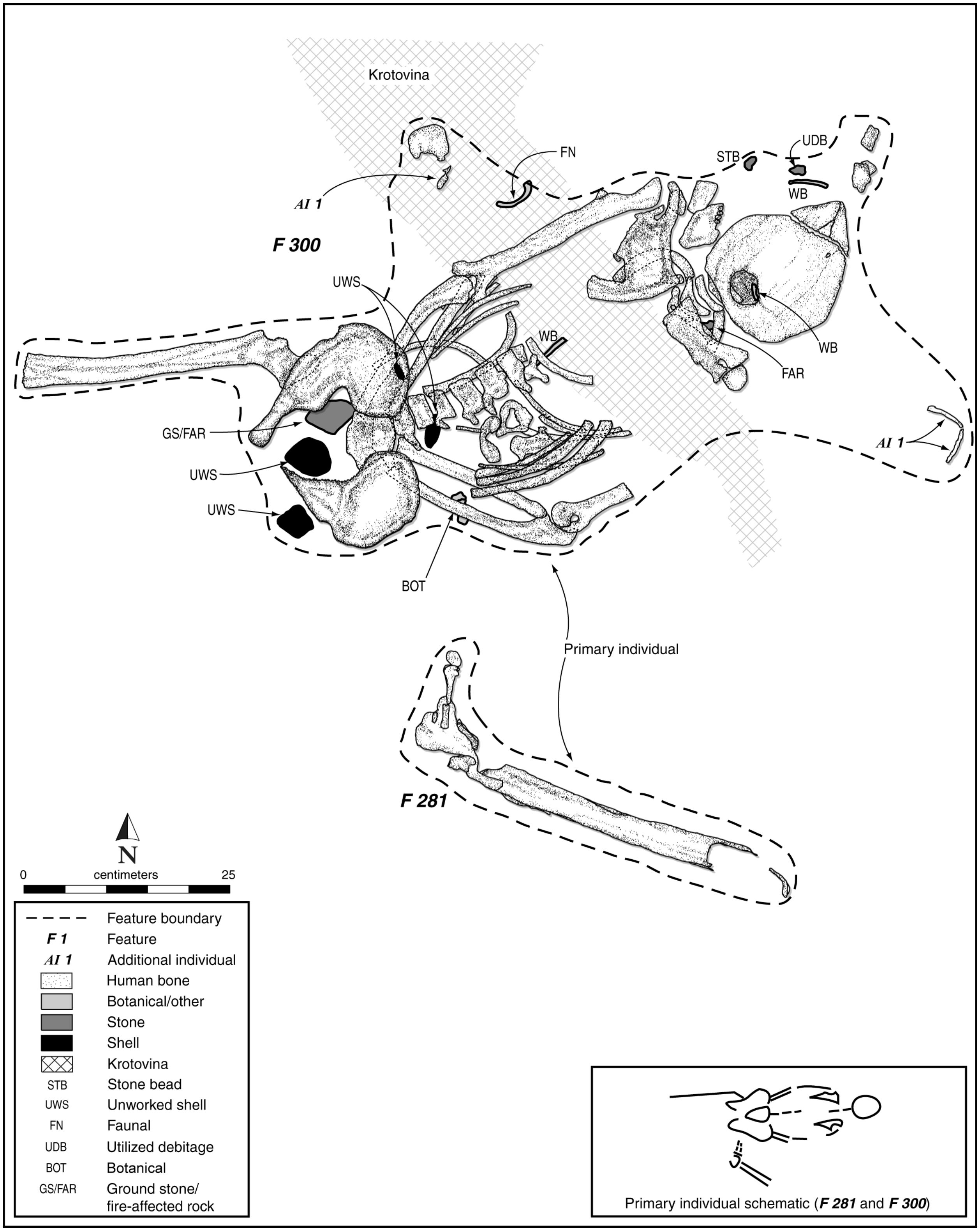

Figure 70. Illustration showing the relationship between burial Features 281 and 300 at LAN-62.

Vertebral osteophytosis was observed along the margins of the cervical, lower thoracic, and lumbar vertebrae. Minor osteophytosis was also observed along the margins of both glenoid fossae, the medial side of the proximal right ulna, and elements of the left hand. Some osteoarthritic activity was observed on the articular facets of the second and third cervical vertebrae. The second cervical vertebra exhibited the less-severe expression of the two vertebrae. The right inferior articular facet displayed moderate lipping and extension of the facet, as well as some eburnation (polishing resulting from bone-on-bone contact) and porosity. The inferior articular facet of the third cervical vertebra exhibited severe eburnation, erosion, and porosity with an increase in the facet size.

The anterior dentition exhibited severe, uneven attrition. Furthermore, a single abscess was observed on the mandible, at the left first molar. The abscess was associated with a very large carious lesion that had obliterated the crown of the left first mandibular molar. A second carious lesion was observed on an unidentified tooth.

A possible compression fracture was observed on the tenth thoracic vertebra, and possible periostitis was noted on the shaft of the left clavicle. Inactive porotic hyperostosis was observed on the occipital, the frontal, and both parietals. Furthermore, the cranium exhibited several depressions that might represent healed lytic lesions. Two were located on the right parietal. The first lesion on the parietal measured 10 by 6 mm, and the second lesion was smaller, measuring 5 by 2 mm. The two lesions were located 10 mm laterally from the sagittal suture and approximately 50 mm (for the first lesion) and 60 cm (for the second lesion) anteriorly from lambda. A third lesion, measuring 6 by 4 mm, was located approximately 30 mm laterally from bregma and 5 mm posterior from the coronal suture on the left parietal. Standard skeletal epigenetic traits were also recorded for this individual.

Because of the extensive rodent and mechanical disturbances, many of the skeletal elements for this individual were missing or scattered, including most of the right humerus, many of the thoracic vertebrae and ribs, and skeletal elements of the legs and extremities. Although disturbed, this burial still exhibited a high degree of articulation among the remaining elements. Initially, burial Feature 281 was believed to be a separate individual from the primary inhumation in burial Feature 300. Upon excavation, however, it was found that these remains are likely part of burial Feature 300. The close spatial relationship, lack of duplication between burial features, and associated historical-period disturbance all point toward this association.

The second individual recovered from this burial feature was identified by the presence of fragments of a thoracic vertebra and rib from a child (2–12 years in age) of indeterminate sex. These elements might have been introduced by the extensive rodent disturbance evident in the area.

Associated Features

Burial Feature 281 contained the lower left leg and some of the bones of the feet for the primary inhumation in burial Feature 300 that were displaced eastward during the construction of the historical-period trench (nonburial Feature 16), which cuts through the western portion (i.e., legs and feet) of this burial feature. The remains associated with burial Feature 281 were located approximately 60 cm beneath the scattered artifacts in the northwestern portion of nonburial Feature 322 (Figure 71).

Associated Artifacts

No artifacts were found in direct association with the primary inhumation from this burial feature.

Possibly Unassociated Artifacts

Several cultural materials were found in the feature matrix. These included two fire-affected cobbles, one fire-affected mano, three flakes of lithic debitage, one fire-affected fragment of indeterminate ground stone, one Cottonwood Triangular projectile point, and two olivella-shell beads. The beads consisted of two varieties: bushing and cupped. Both types correspond to a date range of A.D. 1150–1816 and so provided little information concerning the age of this burial.

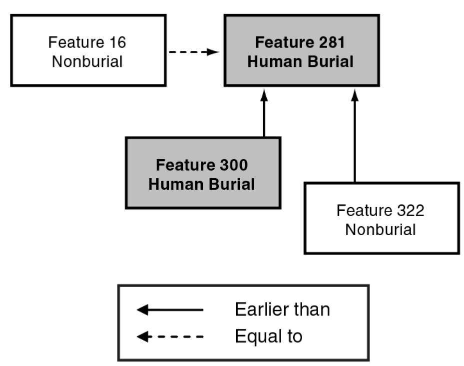

Figure 71. Chart showing the feature relationships associated with burial Features 281 and 300 at LAN-62.

Burial Feature 305

Feature Age: indeterminate
MNI: 2 (2 additional)
Additional Individuals: (1) indeterminate sex, 6–9 months; (2) male, 30–40 years
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of subangular clasts, charcoal flecks, faunal bone, and numerous cultural materials. Scattered human-skeletal remains associated with at least two individuals were also recovered from the feature matrix. Additionally, a patella that could not be confidently associated with any individual represented in this burial and fragments of human bone that could not be identified to the element level were recovered from the feature matrix.

Feature Disturbance

Minor rodent disturbance was observed.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 85 cm; width, 82.5 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The feature plan view shows a circular shape.

Feature Interpretation

This burial feature was centrally located in the main burial concentration and consisted primarily of a cluster of human bone associated with at least two individuals (see Figure 64). The first individual represented in this cluster was a 6–9-month-old infant of indeterminate sex. This individual was defined by the presence of numerous infant bones, including a partial femur, a right scapula, an unsided ilium, cranial fragments, seven deciduous mandibular teeth, five deciduous maxillary teeth, two right ribs, and vertebral centra.

The second individual identified in this burial feature was a 30–40-year-old adult male defined mostly by the presence of several elements from the axial skeleton (e.g., ribs, vertebrae, and pelvis), as well as a mandible and skeletal elements of the hands and feet. The skeletal elements associated with this individual were fairly well preserved though completely disarticulated. This individual exhibited three distinct, serious wounds to the body from light- to medium-gray-chert Cottonwood Triangular projectile points, which were still embedded in the bone at the time discovery. One projectile point was embedded in the anterior left side of the first sacral vertebra. The trajectory of the point indicated that the point went through the front of the abdomen at an upward angle. The second projectile point was embedded in the anterior aspect of the right innominate, near the auricular surface. The location of the point indicated that it also entered the front of the abdomen at a 45° angle. The final projectile point was lightly embedded in the left side on the inferior aspect of the body of a midthoracic vertebra. None of these wounds exhibited any evidence of healing, which indicated that this individual died from them or as a result of the infection, such as peritonitis, that likely resulted.

Associated Features

The southeastern corner of the whale bone associated with burial Feature 305 was located within 20 cm above the posterior aspect of the middle thorax of the primary inhumation in burial Feature 515. Also, the main cluster of bone from this burial feature was located directly above the burial pit associated with burial Feature 346. Burial Feature 268 was located immediately south of burial Feature 305. The whale bone, which was beneath part of the pelvis for the primary individual in burial Feature 268, was found immediately on the right innominate associated with the adult-male individual in burial Feature 305 (Figure 72).

Associated Artifacts

The only artifacts directly associated with any individual represented in this burial feature were the three Cottonwood Triangular projectile points embedded in the remains associated with the adult male.

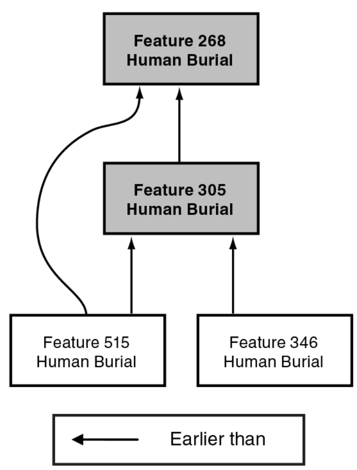

Figure 72. Chart showing the feature relationships associated with burial Feature 305 at LAN-62.

Possibly Unassociated Artifacts

Numerous cultural materials were recovered from the feature matrix. These included a large (42.5-by-22.5-cm) fragment of whale bone, a flake of debitage, 2 cobble manuports, and nearly 20 shell beads. The whale bone was lying flat at the time of discovery. The beads consisted of six varieties: olivella bushing, olivella cupped, olivella elongate pendant, olivella round thin lipped, semiground olivella disk, and Pismo-clam cylinder. Nearly half the beads were of the semiground-olivella-disk type. The combined date range associated with the beads is A.D. 1150–1816, and a narrower date range is associated with the semiground-olivella-shell disk beads: A.D. 1800–1816.

The two cobble manuports were small, waterworn, chalcedony pearls. Koerper (personal communication 2006) suggested that such small stones might have been used as elements inside rattles and that they were sometimes mined out of ant nests.

Burial Feature 308

Feature Age: indeterminate
MNI: 1 (1 primary)
Primary Individual: male, 35–45 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: right side
  Burial Orientation: northwest
  Head Facing: northwest
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, shell fragments, faunal bone, and several cultural materials. Additionally, several fragments of human bone that could not be identified to the element level were recovered from the feature matrix.

Feature Disturbance

Extensive postmortem damage to the midsection of the primary inhumation associated with this burial feature bisected the burial. Essentially, the upper thorax, cranium, and arms were separated from the pelvis and legs by approximately 13 cm. This large section of skeletal material was likely removed by extensive rodent activity. Similar damage was also noted at the inferior aspect of the pelvis and feet. The forearms and hands of the individual were missing postmortem because of intrusion during the interment of burial Feature 444, located approximately 6 cm to the west of burial Feature 308. Skeletal elements associated with the primary inhumation in burial Feature 308 were found in the matrix associated with burial Feature 444.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 72 cm; width, 70 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The feature plan view shows a circular shape.

Feature Interpretation

This burial feature was centrally located in the eastern portion of the burial area, within the concentration of burials along the historical-period trench (nonburial Feature 16). It consisted of a single primary inhumation, a 35–45-year-old male interred fully flexed on his right side, oriented to the northwest, with his head facing northwest (Figure 73). Using the approximate maximum length of the left femur, the living stature of this individual was estimated at between 161.0 and 167.9 cm (63.4–66.1 inches). The placement of this individual within the grave was very different from many of the other burials found at this site. The knees were fully flexed, but the femora were only semiflexed. This gave the appearance of someone kneeling. The left humerus was extended and semiflexed at the elbow. The right arm was too damaged for any commentary. The cranium was completely flexed, so that the occipital rested on the spinous processes of the lower cervical/upper thoracic vertebrae. Minor to moderate vertebral osteophytosis was observed along the margins of the lower lumbar and the first sacral bodies. Several abscesses (four active and one healed) were associated with the mandible. Cranial and postcranial osteometric information was also recorded.

Between rodent and past human activity, many of the skeletal elements associated with this individual, including most of the ribs, the thoracic vertebrae, the lumbar vertebrae, both hands and feet, and the left and right ulnae and radii, were missing postmortem, and those that remained only exhibited a fair to moderate degree of preservation. Fragments of the left ulna and radius for this individual were found in the sediment associated with burial Feature 444. These bone fragments were reassociated with the primary inhumation in burial Feature 308.

Associated Features

This burial feature was intruded upon during the interment of the primary inhumation associated with burial Feature 444. Additionally, the left forearm associated with the primary inhumation in burial Feature 308 was located within 30 cm directly beneath burial Feature 24. Though definitely occurring after the interment of burial Feature 308, the placement of burial Feature 24 did not appear to have disturbed this burial feature. Finally, the pelvis of the primary inhumation associated with burial Feature 308 was located approximately 10 cm above the northwestern portion of nonburial Feature 464 (Figure 74).

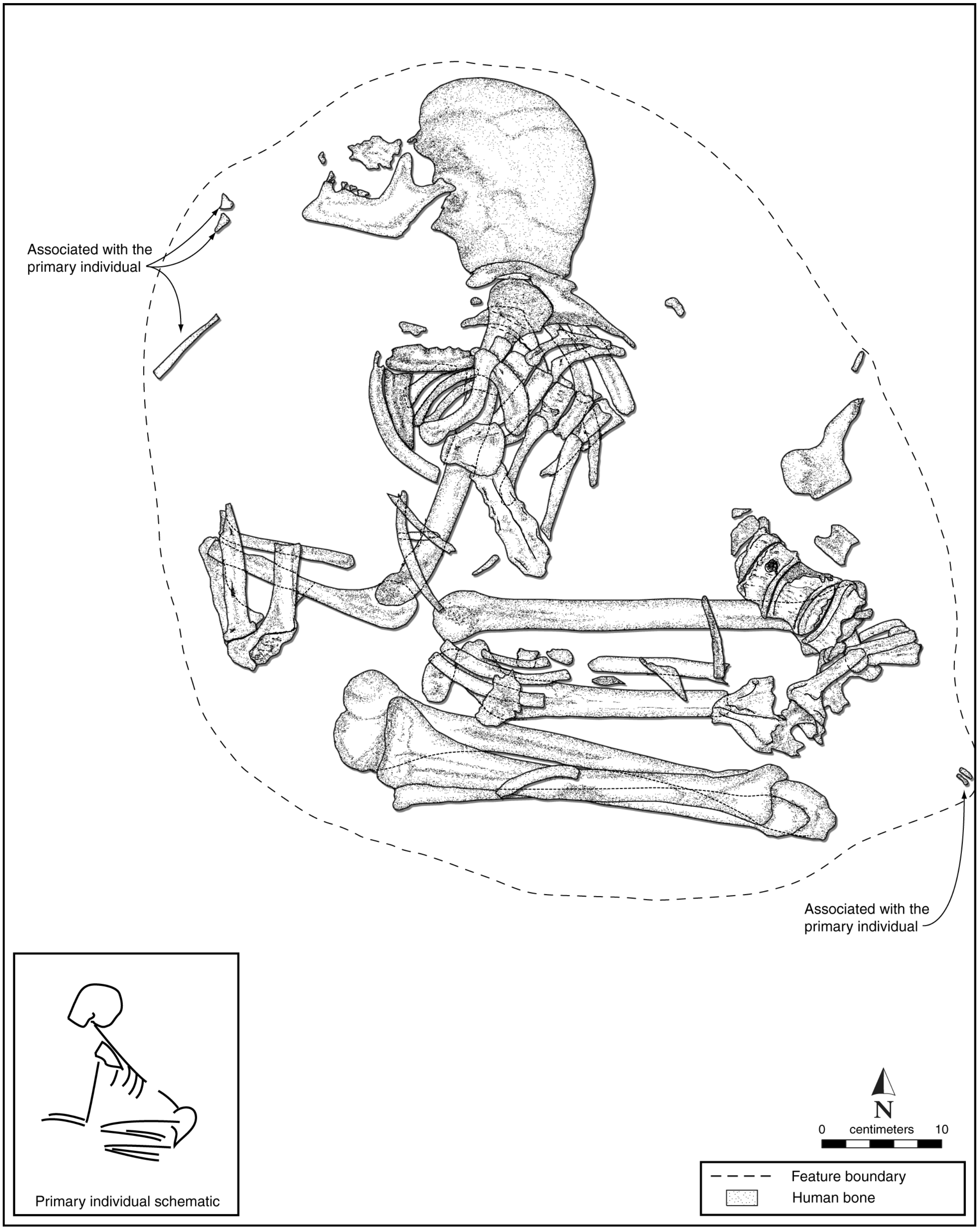

Figure 73. Illustration of burial Feature 308 at LAN-62.

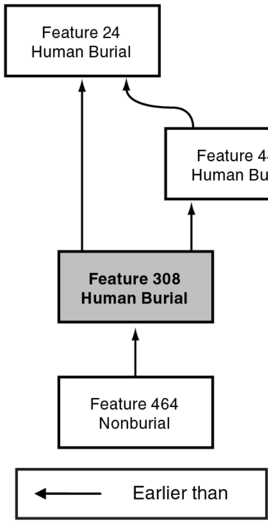

Figure 74. Chart showing the feature relationships associated with burial Feature 308 at LAN-62.

Associated Artifacts

No artifacts could be directly associated with the individual represented in this burial feature.

Possibly Unassociated Artifacts

Numerous cultural materials were found in the feature matrix. These consisted of five fire-affected-cobble fragments, a Cottonwood Triangular projectile point, an edge-modified flake, and six shell beads. The shell beads consisted of six varieties: olivella cupped, olivella cylinder, olivella full lipped, giant-rock-scallop disk, olivella rough large lipped, and semiground olivella disk. The combined date range associated with the beads is A.D. 1150–1816. The semiground-olivella-shell disk bead is associated with a very narrow date range of A.D. 1800–1816.

Burial Feature 313

Feature Age: Mission period (A.D. 1800–1816)
MNI: 3 (2 primary and 1 additional)
Primary Individual 1: indeterminate sex, 25–35 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: left side
  Burial Orientation: east
  Head Facing: west
Primary Individual 2: indeterminate sex, 5–7 months in utero
  Burial Type: indeterminate
  Burial Treatment: indeterminate
  Burial Position: indeterminate
  Burial Orientation: indeterminate
  Head Facing: indeterminate
Additional Individual: indeterminate sex, birth to 4 months
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of faunal bone and numerous cultural materials. Scattered human remains associated with at least one additional individual and fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

Nearly the entire right side of the primary inhumation was missing postmortem, likely from cultural disturbances, such as nearby mortuary activity.

Burial Pit

No burial-pit boundary was observed. The recorded dimensions (length, 80 cm; width, 86.5 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial feature. The plan view of the feature indicates an irregular shape.

Feature Interpretation

This burial feature was located near the southwestern periphery of the main burial concentration and consisted of two primary inhumations and isolated human bone associated with at least one additional individual (Figure 75). The first primary inhumation was a 25–35-year-old adult of indeterminate sex interred fully flexed on the left side, oriented to the east, with the head facing west. Stature could not be estimated for this individual. The skeletal remains associated with this individual exhibited exceedingly poor preservation. Most of the right side of this individual was missing postmortem. In addition to these elements, the left hand and foot were missing. No skeletal pathological conditions, morphological variants, or behavioral indicators were observed. No osteometric information could be recorded.

The second primary inhumation in this burial feature was a 5-to-7-month-old in utero fetus of indeterminate sex. Very little remained of this individual. Only fragments of the cranium, mandible, ribs, and vertebrae were recovered, none of which was articulated. No information on body position, orientation, head facing, or degree of flexure could be recorded.

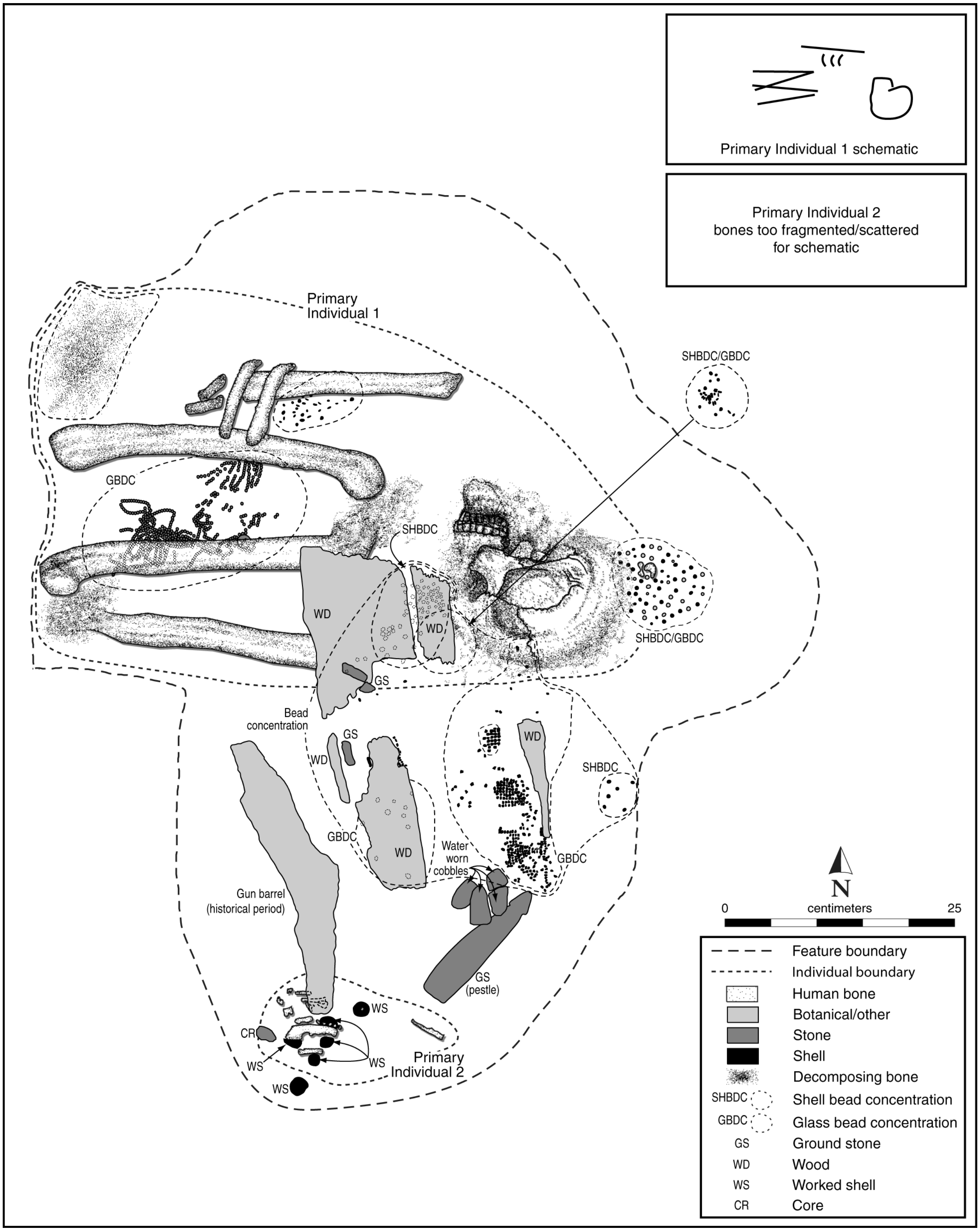

Figure 75. Illustration of burial Feature 313 at LAN-62.

These remains were located 30 cm south of the first primary inhumation in this burial feature. The basilar portion of the occipital for the fetus exhibited an increased amount of porosity, possibly associated with an inflammatory response.

Isolated human remains associated with at least one additional individual were recovered from the feature matrix. This individual, an infant aged between birth and 4 months, was defined by the presence of an unsided ischium and pubis. These remains were located in the bead cluster immediately east of the posterior side of the cranium of the adult individual.

Associated Features

The first primary inhumation was located within 10 cm directly beneath the main cluster of human remains and artifacts associated with burial Feature 255. Furthermore, the pelvic area associated with the first primary inhumation in this burial feature was intruded upon by the cranium associated with the primary inhumation in burial Feature 408. Although it was poorly preserved, the cranium from burial Feature 408 was clearly well within the space originally occupied by the pelvis of the adult in burial Feature 313. Finally, burial Feature 313 was located approximately 25 cm above nonburial Feature 450 (Figure 76).

Associated Artifacts

A large suite of artifacts were recovered with the first primary inhumation, including a decomposed reed bundle, three large (one is 15 by 7 cm, and two are 10 by 5 cm) fragments of wooden planks, a corroded metal tube, a ground stone pestle, a concentration of fibrous botanical material, a metal button, seven fragments of manuport cobbles, and several large clusters of shell and glass beads. The seven manuport-cobble fragments refit into two waterworn, prolate pebbles that were covered with ocher. Vegetal matter was embedded in one of the fragments. The ground stone pestle was a finely shaped phallic pestle with abundant and large (approximately 6-mm-diameter) asphaltum drops over the entire surface, except for the proximal end. The asphaltum splatter was much less common on one-quarter of the tool, perhaps because that side was facing down when it was splattered or because asphaltum was washed away after deposition on that face. A very small (approximately 5 mm in length) chip off the proximal end was observed. It might have been postdepositional damage, but similar damage was observed on pipes in this burial collection.

The clusters of 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 remains. The southern concentration was the largest cluster, measuring 30 cm in diameter. All told, these clusters of beads yielded nearly 2,500 glass beads and over 900 shell beads. The majority of the shell beads were semiground-olivella-shell disk beads (A.D. 1800–1816). Five shell beads of this type were covered in red ocher. In addition, there was 1 red-abalone-epidermis disk bead (A.D. 1150–1834) and 1 semiground-olivella-shell shelved bead (A.D. 1800 to post–Mission period). It is more than likely that the shell and glass beads found in the feature matrix originated from these clusters of beads. The glass beads were manufactured between A.D. 1770 and 1825.

The skeletal remains associated with the second primary individual were associated with five glass beads and seven perforated shell disks. The glass beads were manufactured between A.D. 1770 and 1825.

Possibly Unassociated Artifacts

Although so many artifacts were recovered with the two primary inhumations in this burial feature, many additional artifacts were found in the feature matrix and could not be directly associated with any individual represented in this burial feature. These consisted of a fire-affected-cobble fragment, 2 flakes of debitage, 1 edge-modified flake, a multidirectional core, 2 fragments of indeterminate metal, a biface, approximately 440 glass beads, and approximately 475 shell beads. These shell beads were of five varieties: olivella bushing, California-mussel cylinder, semiground olivella disk, semiground olivella shelved, and olivella tiny saucer. One of the semiground-olivella-shell disk beads exhibited red-ocher staining. Approximately three-quarters of the beads were of the olivella-tiny-saucer variant, and an additional one-third represented the semiground-olivella-disk type. Though found in the feature matrix, the shell and glass beads associated with this burial feature might still provide some additional, circumstantial chronometric data. The combined date range associated with the shell beads is 600 B.C.–A.D. 1816, and many of the shell beads were manufactured between A.D. 1800 and 1816. The glass beads found in the matrix, like those associated with the two primary inhumations, were manufactured between A.D. 1770 and 1825.

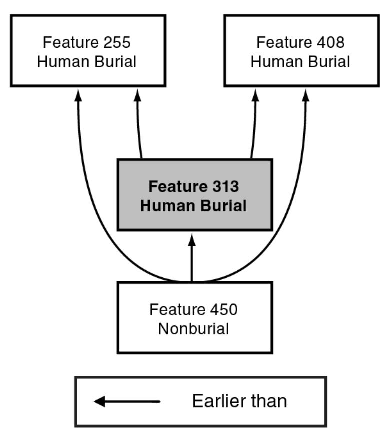

Figure 76. Chart showing the feature relationships associated with burial Feature 313 at LAN-62.

Burial Feature 336

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: male, 25–35 years
Burial Type: inhumation
Burial Treatment: indeterminate flexed
Burial Position: prone
Burial Orientation: northeast
Head Facing: down
Additional Individual: indeterminate sex, subadult to young adult
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter round clasts, shell fragments, faunal bone, and several cultural materials. Isolated human remains associated with an additional individual were also found in the feature matrix. Furthermore, nearly 10 scattered human-skeletal elements that could not be confidently associated with any individual represented in this burial feature were also recovered from the feature matrix. Although all of the regions of the skeleton were represented, most of the skeletal remains were from the appendicular and axial skeletons. Fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

This burial feature was directly impacted by adjacent burial Features 444 (to the south) and 459 (to the north-northwest), resulting in the fragmentation or complete loss of numerous skeletal components. Rodent activity further acted to disperse the skeletal remains of the primary individual.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 70 cm; width, 76 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan view of the feature indicates an ovate shape.

Feature Interpretation

This burial feature was located immediately south of the historical-period trench (Feature 16), along the northeastern periphery of the burial area, among the scattered burials. It consisted of a single primary individual and isolated human bone associated with at least one additional individual (Figure 77). The primary individual is a 25–35-year-old male interred flexed in a prone position, oriented to the northeast, with his head facing down. Stature could not be estimated for this individual. The proximal ends of the femora did still appear to be in situ, and their angulation indicated that some flexure was present. The degree of flexure, however, is unknown because of extensive postmortem damage to the legs. Minor vertebral osteophytosis was observed along the margins of the body of the fourth and fifth lumbar vertebrae. Also, a large pit was observed on the inferior surface of the sternal end of the right clavicle. This pit is not pathological in nature and was likely associated with costoclavicular syndesmosis, a condition resulting from "generalized stress of the pectoral girdle . . . particularly when the shoulders are bent forward while bending and moving heavy loads" (Capasso et al. 1998:52). Furthermore, the sacrum exhibited clefting of the sacral neural arch, resulting in the nonfusion of the first sacral element. The sacral hiatus was also observed extending from the fifth sacral element to the midpoint of the fourth sacral element. The left fifth distal and middle tarsal phalanges were congenitally fused, a condition known as pedal symphalangism.

This burial feature was extensively impacted by the interment of burial Features 444 and 459, resulting in complete loss of or heavy damage to most of the skeleton. By and large, the only skeletal elements that remained in place were the cranium, the proximal ends of the left and right femora, the right scapula, the sacrum, the fourth and fifth lumbar vertebrae, both pubic bones, the left hip joint, the right foot, the sternum, and four mid-thoracic vertebrae and their accompanying ribs. Fragments of the left and right ulnae and radii were also present but were located out of anatomical position, near the pelvis. Scattered remains found in other burial features were reassociated with the primary individual.

Isolated human remains associated with at least one additional individual were also recovered from the feature matrix. This additional individual, a subadult or young adult of indeterminate sex, was represented by a right maxillary central incisor.

Associated Features

This burial feature was directly impacted by adjacent burial Features 444 (to the south) and 459 (to the north-northwest), resulting in the fragmentation or complete loss of numerous skeletal components (see Figure 77). Additionally, the pelvis of the primary inhumation associated with burial Feature 336 was located approximately 40 cm above nonburial Feature 541. Finally, the left shoulder of burial Feature 336 was located approximately 40 cm above nonburial Feature 542 (Figure 78).

Associated Artifacts

No artifacts were found in direct association with the primary inhumation.

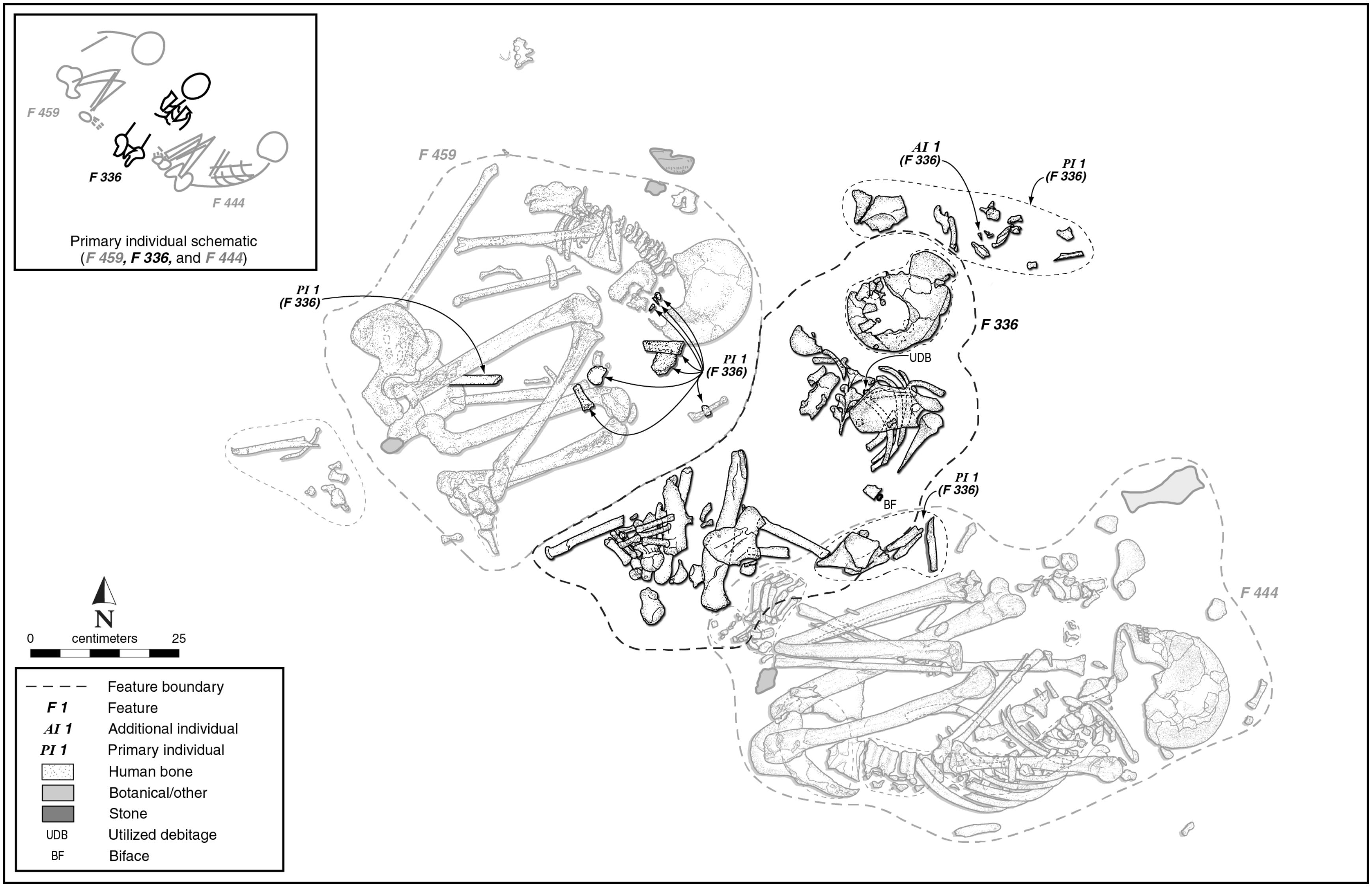

Figure 77. Illustration showing the relationship between burial Features 336, 444, and 459 at LAN-62.

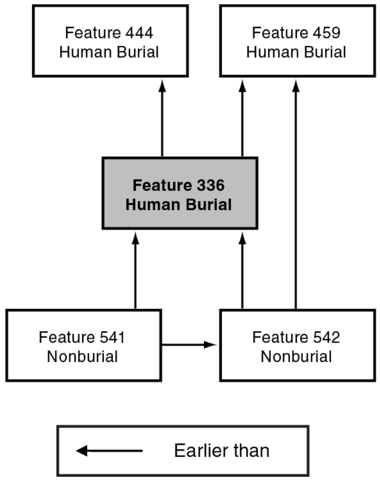

Figure 78. Chart showing the feature relationships associated with burial Feature 336 at LAN-62.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix: two ground stone disk beads, three fire-affected-cobble fragments, an edge-modified flake, a flake of lithic debitage, a biface, and four olivella-shell beads. Each of the beads was of a different type: bushing, cupped, full lipped, and tiny saucer. The olivella-shell bushing bead exhibited evidence of having been burned.

Though found in the feature matrix, the shell beads associated with this burial feature might provide some circumstantial chronometric data. The combined date range associated with the beads is 600 B.C.–A.D. 1816, and a much narrower date range is associated with the full-lipped variant: A.D. 1650–1816.

A ground stone effigy was located at the northwestern edge of the ARB-30 surrounding the primary inhumation within burial Feature 336 and approximately 2 cm north of the cranium for the primary inhumation in burial Feature 459. Although this artifact was probably more spatially related to the primary inhumation in burial Feature 459, the extreme amount of disturbance to burial Feature 336 makes many associations among artifacts and primary inhumations in burial Features 336, 444, and 459 tenuous, at best.

Burial Feature 370

Feature Age: indeterminate
MNI: 7 (3 primary and 4 additional)
Primary Individual 1: male, 25–35 years
  Burial Type: inhumation
  Burial Treatment: semiflexed
  Burial Position: right side
  Burial Orientation: southeast
  Head Facing: north
Primary Individual 2: possible male, 20–35 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: left side
  Burial Orientation: northeast
  Head Facing: southwest
Primary Individual 3: indeterminate sex, 4–5 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: indeterminate
  Burial Orientation: southeast
  Head Facing: indeterminate
Additional Individuals: (1) indeterminate sex, adult; (2) indeterminate sex and age; (3) indeterminate sex, 2–4 years; (4) indeterminate sex, 4–11 years
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of faunal bone, charcoal, and numerous cultural materials. Scattered human remains associated with at least four additional individuals were also recovered. Furthermore, at least six human-skeletal elements that could not be confidently associated with any individual represented in this burial were recovered from the matrix. These remains were representative of the appendicular skeleton, as well as the extremities and dentition. Fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

Rodent disturbance was observed in relation to the third primary inhumation. Furthermore, a root extended through the thorax of the third primary inhumation. Interestingly, although the primary inhumations were found in direct contact with one another, that spatial relationship did not incur any additional postmortem damage, suggesting that the three primary inhumations were interred around the same time.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 150 cm; width, 120 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan view of the feature indicates an irregular shape.

Feature Interpretation

This burial was located near the center of the main burial concentration and consisted of three primary inhumations and scattered human remains associated with at least four additional individuals (Figure 79). The first primary inhumation was a 25–35-year-old male interred semiflexed on the right side, oriented to the southeast, with the head facing north. Stature could not be estimated for this individual. The skeletal remains associated with this individual were poorly preserved. Although most of the remains of this individual were present, they were all highly friable and fragmented. Even so, some additional observations of porotic hyperostosis on both parietals and the occipital could be recorded. A small, carious lesion was noted on the right mandibular third molar, and a possible enamel hypoplastic defect was observed on the right maxillary canine.

The second primary inhumation was a 20–35-year-old possible male interred fully flexed on the left side, oriented to the northeast, with the head facing southwest. This individual was located immediately north of the first primary inhumation. As with the first primary inhumation, the skeletal remains associated with this individual were poorly preserved and highly friable. Less of this individual, however, was present at the time of recovery. Although the cranium, limbs, and extremities (to some degree) were present, much of the thorax and pelvis was missing postmortem. Stature could not be estimated for this individual. Additionally, this individual exhibited a mild case of porotic hyperostosis localized at the intersection between the frontal and parietals. A small carious lesion was observed on the right maxillary third molar, and two hypoplastic defects were noted on the left maxillary canine.

The cranium of the second primary inhumation was located immediately above the feet and lower legs of the first primary inhumation. These inhumations clearly represented either a single event or two events that were separated by a narrow window of time, because some tissue was still present that prevented the legs and feet of the first primary inhumation from becoming disturbed by the second primary inhumation.

The third primary inhumation was a 4–5-year-old child of indeterminate sex interred with the body oriented to the southeast. The remains were exceedingly poorly preserved—only the skull and parts of the thorax were present at the time of recovery—and they might have been more heavily impacted by rodent activity than the other individuals represented in this burial feature. This individual was located immediately north of the second primary inhumation. Because much of the thorax and pelvis of the second individual were missing postmortem, a theory that the third primary inhumation might have been intrusive was vetted, but the exceptionally poor preservation of the remains in the region where the second and third inhumations met prevented any accurate assessment.

Scattered human remains associated with at least four additional individuals were also recovered from the feature matrix. As with the primary inhumations, these remains were very poorly preserved. They likely represent the remnants of burials that were either disturbed by the interment of these three primary inhumations or isolated remains that were transported to this burial through turbative events.

The first additional individual, an adult of indeterminate sex, was represented by an unsided femur. This element was found near several other poorly preserved adult remains, but a lack of preservation and diagnostic traits prevented any association with these elements.

The second additional individual was represented by burned cranial and long-bone fragments. Because of a lack of diagnostic traits, no demographic information could be recorded.

The third additional individual, a 2–4-year-old child, was represented by a burned left deciduous mandibular second molar and an unsided femoral fragment. These remains were recovered from inside the olla associated with the first primary inhumation.

The final additional individual, a 4–11-year-old child of indeterminate sex, was represented by a left maxilla, a deciduous maxillary tooth, and two permanent maxillary teeth.

Associated Features

Burial Feature 370 shared a unique relationship with numerous burials in the vicinity. The first and second primary inhumations in burial Feature 370 were located approximately 10 cm above nearly the entirety of burial Feature 613. Additionally, the knees of the first primary inhumation and a large steatite bowl in the eastern portion of burial Feature 370 were located immediately above the scattered human remains and artifacts in the western portion of burial Feature 597. The remains of the first and second primary inhumations in burial Feature 370 were also approximately 20 cm beneath nearly the entirety of the primary inhumation in burial Feature 253. The second primary inhumation in burial Feature 370 was located approximately 12 cm above burial Feature 615. The lower portion of the second primary inhumation in burial Feature 370 and the entirety of the third primary inhumation in burial Feature 370, on the other hand, were located approximately 20 cm above the south and southeastern portions of the cluster of human remains associated with burial Feature 610. Additionally, the pelvis and upper thorax of the second primary inhumation in burial Feature 370 were located approximately 20 cm beneath the southern portion of the primary inhumation in burial Feature 206, which consisted of the cranium, forearm, and knees. The third primary inhumation in burial Feature 370 was also located approximately 20 cm beneath the legs of the primary inhumation in burial Feature 206. The upper thorax of the second primary inhumation in burial Feature 370 and the cranium of the third primary inhumation in burial Feature 370 were also located approximately 5 cm above the western half of burial Feature 556. The posterior upper thorax of the second primary inhumation in burial Feature 370 was located approximately 20 cm beneath the pelvis of the primary inhumation in burial Feature 149. Finally, the third primary

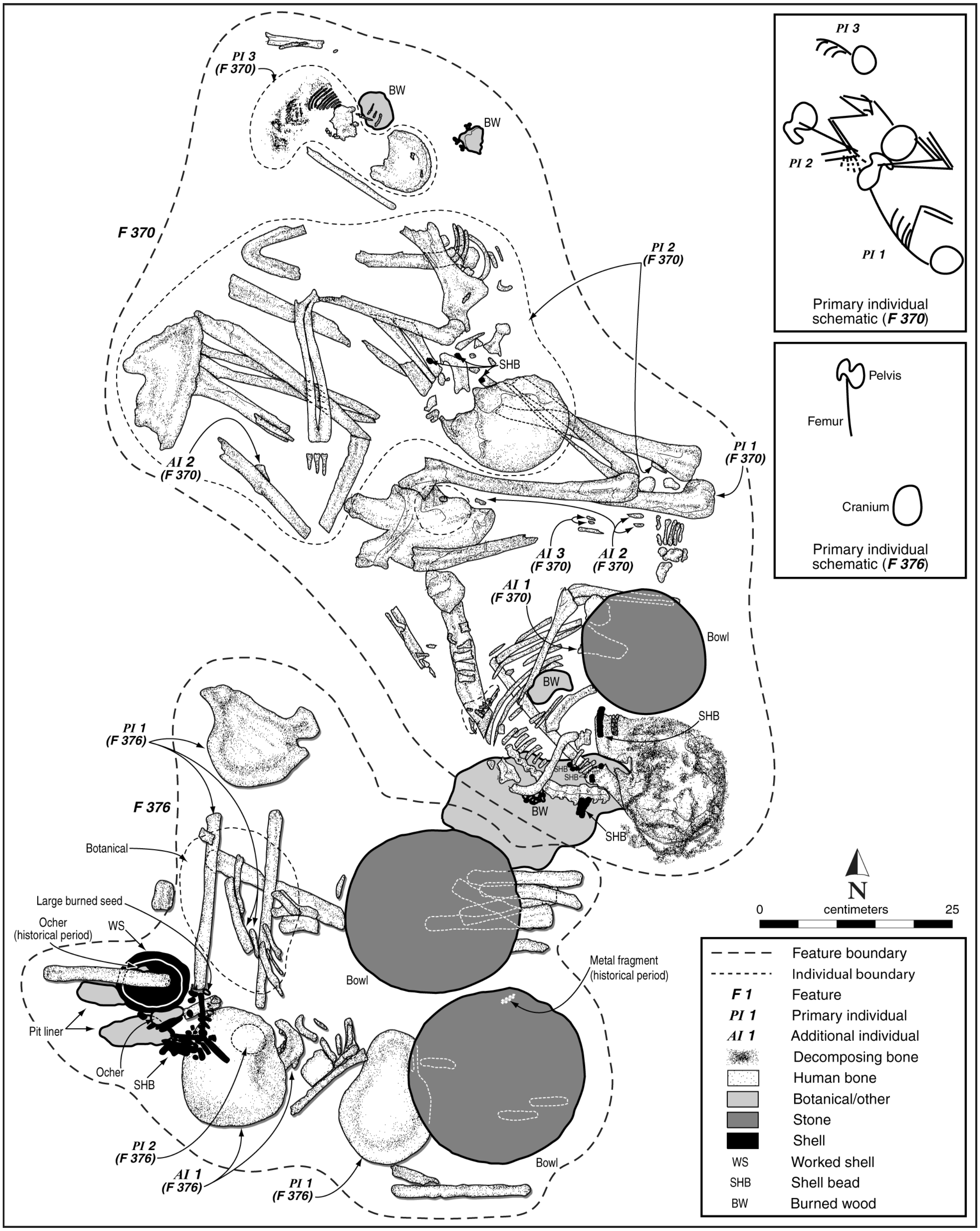

Figure 79. Illustration showing the relationship between burial Features 370 and 376 at LAN-62.

inhumation in burial Feature 370 was located approximately 20 cm beneath the scattered human remains in the western portion of burial Feature 149 (Figure 80).

Several burials, however, shared a more ambiguous relationship with burial Feature 370. This feature was located immediately north of the scattered remains and artifacts found in the northern portion of burial Feature 376 (see Figure 79). Although the nature of this spatial relationship was not clear, both burial Features 370 and 376 featured large, intact ground stone bowls. In addition, burial Feature 370 was located immediately north of and at the same elevation as the scattered remains and artifacts in the northern portion of burial Feature 257. Any temporal relationships that these burials might share were unclear. Also, burial Feature 370, specifically the first primary inhumation, was located immediately west of but approximately 5 cm lower in elevation than the primary inhumation in burial Feature 332. The relationship between these burial features, however, was unclear. Finally, the southern portion of burial Feature 370 abutted burial Feature 403, which might have been intruded upon during the interment of the primary inhumations in burial Feature 370. These features were separated by a distinct line of charcoal. The relationship between these two burials, however, was unclear.

Associated Artifacts

Several artifacts were directly associated with the primary inhumations found in burial Feature 370. Associated with the first primary inhumation were approximately 40 Pismo-clam cylinder beads and a large steatite olla. The Pismo-clam beads were located in at least one strand around the neck. They have a corresponding date range of A.D. 1150–1816. The steatite olla was found immediately east of the first primary inhumation, along the anterior portion of the body. This vessel was found base up and nearly flush with the cranium. The left arm of the first primary inhumation was wrapped around the olla, as though the individual were cradling it. The olla was 145 cm deep, and the top of the rim was tilted inward slightly. The exterior surface was uniformly finished and had dense, parallel, oblique striations from manufacture. Two areas on the exterior were slightly flattened and likely represented the original cobble surfaces. The diameter of the opening was approximately 10.5 cm, and asphaltum (or other black residue) had been sprayed over approximately half the interior, just above the base, to a point halfway up the wall. Some of the droplets were within 2 cm of the rim. The spray was found in droplets up to 0.4 cm in diameter. The distribution of the spray might indicate that the vessel

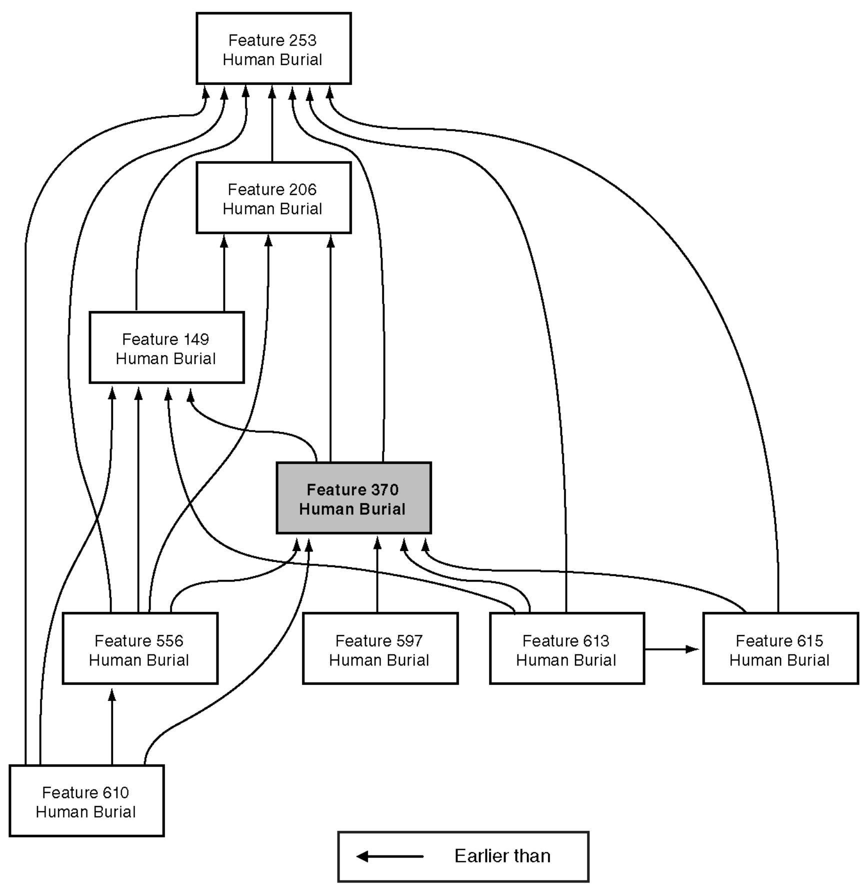

Figure 80. Chart showing the feature relationships associated with burial Feature 370 at LAN-62.

was slightly tipped to one side when the spray was applied. A significant amount of soot was observed on the exterior wall, from the base to slightly more than halfway up, but the base itself was mostly soot free.

Associated with the second primary inhumation was at least one strand of nearly 20 Pismo-clam cylinder beads, located around the neck. Like the other set of beads, which were associated with the first primary inhumation, these beads have a corresponding date range of A.D. 1150–1816.

Possibly Unassociated Artifacts

Numerous artifacts that could not be directly associated with any individual represented in this burial were found in the feature matrix: approximately five Pismo-clam beads, a single glass bead, two fire-affected-cobble fragments, an edge-modified flake, a leaf-shaped Cottonwood projectile point, a Cottonwood Triangular projectile point, and a ground stone disk bead. At least one of the Pismo-clam cylinder beads exhibited some asphaltum adhering to the surface. It is likely that the shell beads were originally from the strands associated with the first and second primary inhumations and had probably been disturbed through bioturbation. They have the same corresponding date ranges as those attributed to the directly associated shell beads. The glass bead, though found in the feature matrix, may still provide some indirect chronometric data for this burial. It was manufactured between A.D. 1770 and 1825.

Burial Feature 376

Feature Age: indeterminate
MNI: 3 (2 primary and 1 additional)
Primary Individual 1: indeterminate sex, 17–25 years
 Burial Type: inhumation
 Burial Treatment: fully flexed
 Burial Position: prone
 Burial Orientation: south
 Head Facing: down
Primary Individual 2: indeterminate sex, 9 months–1 year
 Burial Type: inhumation
 Burial Treatment: indeterminate
 Burial Position: indeterminate
 Burial Orientation: indeterminate
 Head Facing: indeterminate
Additional Individual: possible male, 25–35 years
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of faunal bone, charcoal, burned seeds, and several cultural materials. Scattered human remains associated with at least one additional individual were also recovered. Furthermore, nearly 40 human-skeletal remains that could not be confidently associated with any individual represented in this burial were recovered from the feature matrix. These remains consisted primarily of bone from the appendicular and axial skeletons. A small percentage of these remains were from the cranial skeleton. Fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

Rootlets were present in the feature matrix. The deposition of large human-skeletal elements with the primary individuals, who were disturbed, as well, points to cultural activity, such as the interment of other burials in the vicinity, as a major source of disturbance for this burial.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 93 cm; width, 93 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan-view shape of the feature is irregular.

Large concentrations of a white, fibrous botanical material similar to seed chaff were recovered from beneath the remains of the primary inhumation. The largest concentration measured 26 by 19 cm and was located beneath the thorax of the first primary inhumation. Two additional concentrations were located immediately west of the facial region of the adult cranium. Both of these concentrations were approximately the same dimensions, at 8–10 cm in length and 4–5 cm in width. This botanical material was observed in other burials, where it acted as a pit liner. The deteriorated nature of the material, however, prevented an assessment of the full dimensions of the burial pit.

Feature Interpretation

This burial was located near the center of the main burial concentration and consisted of two primary inhumations and scattered human remains associated with at least one additional individual (see Figure 79). The first primary inhumation was a 17–25-year-old adult of indeterminate sex interred fully flexed in the prone position, oriented to the south, with the head facing down. Stature could not be estimated for this individual. The skeletal remains associated with this individual were poorly preserved and highly disturbed. Only the skull, several teeth, left innominate, right femur, and two fibulae were recovered.

The second primary inhumation was a 9-month-old to 1-year-old infant of indeterminate sex. This individual was even more poorly preserved and was represented by few skeletal elements. These remains consisted of two deciduous maxillary teeth, an unidentified tooth, a sternebra (one of the many bones that fuse to become the sternum), and a fragment of an unidentified long bone. These remains were located immediately beneath the face and upper thorax associated with the first primary inhumation. Because these remains were bounded underneath by the first primary inhumation and a layer of white, botanical material, the same found beneath the thorax of the first primary inhumation, it would be reasonable to hypothesize that these individuals were interred together.

Scattered human remains associated with at least one additional individual were recovered from the feature matrix. This individual, a 25–35-year-old possible male, was represented by a cranium, a mandible, seven permanent mandibular teeth, and four permanent maxillary teeth. Observations on dental attrition were recorded.

A stack of better-preserved long bones was recovered from beneath the vesicular-basalt bowl and covered with a layer of asphaltum. It was unclear whether these remains represented a separate individual, however.

Associated Features

Burial Feature 376 shared a unique spatial relationship with numerous other burials in the vicinity. The scattered human remains and artifacts in the western portion of burial Feature 376 were located 5 cm beneath the posterior thorax of the primary inhumation in burial Feature 601. Furthermore, the pelvis associated with the adult in burial Feature 376 was located approximately 45 cm beneath the posterior upper thorax of the primary inhumation in burial Feature 253. A steatite bowl and several scattered human-skeletal elements associated with burial Feature 376 were located approximately 30 cm beneath the cranium and upper thorax of the primary inhumation in burial Feature 332. Additionally, the southern portion of burial Feature 376, which included scattered human remains, cultural materials, and the cranium of the adult burial, was located between 30 and 35 cm beneath the northern portion of burial Feature 236. The artifacts, specifically the large stone bowls, and the scattered human remains in the eastern portion of burial Feature 376 were located within 5 cm beneath the scattered human-skeletal remains and artifacts in the northern portion of burial Feature 257 (Figure 81). Finally, the scattered remains and artifacts found in the northern portion of burial Feature 376 were located immediately south of burial Feature 370. Although the nature of this spatial relationship was not clear, both burial Features 370 and 376 featured large, intact ground stone bowls.

Associated Artifacts

Numerous artifacts were recovered with this burial. Only a few of them could be directly associated with either of the primary inhumations, which might have been interred simultaneously.

A large cluster of shell beads was recovered from beneath the face and upper thorax region of the adult inhumation. Commingled with these beads were the remains of the infant. Because of the shared spatial relationship, it was difficult to place the beads with either individual. However, there was precedence in the burial area for scattered infant remains to be clearly associated with clusters of loose shell and glass beads. Within this cluster of shell beads were approximately 620 shell beads, consisting of at least four varieties: olivella bushing, Pismo-clam cylinder, Pismo-clam tube, and non-olivella columella. One of the olivella-shell bushing beads was stained from red ocher, likely from the red ocher associated with the black-abalone-shell receptacle found beneath this concentration (see below). These shell beads have a combined date range of A.D. 1150–1816, and a small constituent of non-olivella-columella beads are associated with a post–A.D. 1782 date, a period of intensification in the production of that bead variety.

Directly to the west of the cluster of remains associated with the second primary inhumation was an upturned black-abalone shell that acted as a receptacle for containing a concentration of red ocher. Immediately south of the abalone shell was a 6-by-2-cm lump of red ocher that possibly fell from the abalone shell when the burial was disturbed. The abalone shell rested upon two concentrations of a white, fibrous botanical material that possibly represented the deteriorated remnants of a grave liner, an article of clothing, or a mortuary offering. Both of these concentrations were approximately the same dimensions: 8–10 cm in length and 4–5 cm in width. A third, larger concentration of the botanical material, measuring 26 by 19 cm, was located beneath the thorax of the first primary inhumation.

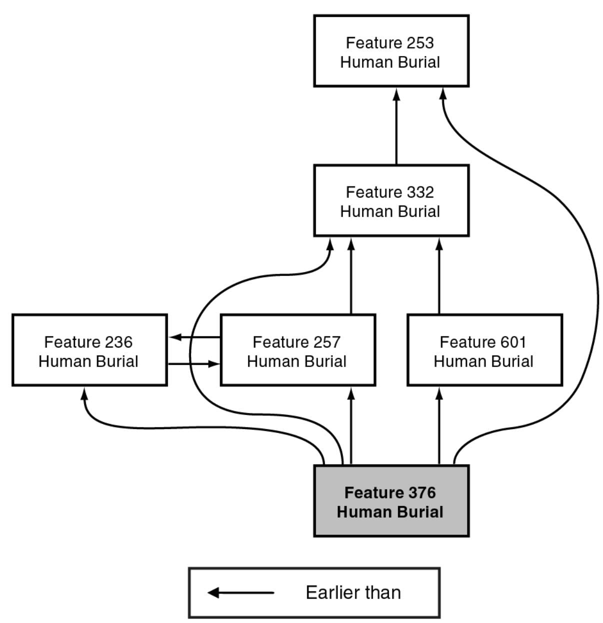

Figure 81. Chart showing the feature relationships associated with burial Feature 376 at LAN-62.

Possibly Unassociated Artifacts

Several other cultural materials were recovered from the feature matrix that could not be directly associated with either primary inhumation: 5 glass beads, nearly 50 shell beads, a fire-affected-cobble fragment, a ground stone disk bead, a fragment of corroded metal, a large steatite olla, a layer of asphaltum (possibly an asphaltum-covered basket), and a large ground stone bowl. Both the olla and the bowl were found base side up. The shell beads consisted of at least two varieties: olivella bushing and Pismo-clam cylinder. Five of the olivella bushing beads were burned.

The olla was made from a light-colored (tan) steatite. It was 155 mm deep, had a 112-mm-diameter mouth, and was slightly tilted on a flattened base that still retained a portion of the original cobble surface. Thick soot covered approximately two-thirds of the exterior wall from the base. The exterior surface of the base was fire blackened but exhibited a small amount of soot. There was a much-dispersed asphaltum spray on approximately half the interior portion of the base, to halfway up the wall. The spray was also located on the up-facing side of the tilted vessel. One 3.4-mm drop was observed on the exterior near the rim, on the opposite side (and might have been deposited as part of the same spray), and there were small (less-than-2-mm) green stains on the interior of the vessel base and partway up most of the sides. Faint red stains were on the mid-interior wall, likely ocher. Three of the Pismo-clam cylinder beads found in the feature matrix were found in this olla. Asphaltum adhered to those beads.

The ground stone bowl was made from vesicular basalt. The mouth of the bowl was 230 mm in diameter. It was an open vessel measuring 113 mm deep. A 100-by-90-mm area of ocher staining was observed on the exterior; it extended from the edge of the base to two-thirds up the wall and might have been applied in a curvilinear pattern. The rim and immediately adjacent areas were smoother than the rest of vessel. The exterior surface of the base was slightly squared off. Within this bowl, seven asphaltum-covered Pismo-clam cylinder beads were found.

Although found in the feature matrix, the shell and glass beads might provide some indirect chronometric data for this burial. The shell beads have a combined date range of A.D. 1150–1816, and the glass beads were manufactured between A.D. 1770 and 1825.

A cluster of long bone recovered from beneath the vesicular-basalt bowl was covered in a layer of asphaltum. The asphaltum had linear impressions that were perpendicular to the axes of the bones and might have been left by basketry.

Burial Feature 406

Feature Age: indeterminate
MNI: 1 (1 primary)
Primary Individual: possible female, 30–65 years
Burial Type: partial cremation
Burial Treatment: indeterminate
Burial Position: indeterminate
Burial Orientation: indeterminate
Head Facing: indeterminate
Burial Pit: unobservable

Feature Fill

The feature matrix consisted of dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, charcoal, faunal bone, shell fragments, and several cultural materials. Several scattered human-skeletal elements that could not be confidently associated with the primary inhumation were recovered from the feature matrix. Although all regions of the human skeleton were represented by these scattered remains, most were bone from the extremities or appendicular skeleton. Furthermore, fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

Rodent and plant activity were observed in this burial feature.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 92.5-cm; width, 60-cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan view of the feature indicates an ovate shape.

Feature Interpretation

This burial feature consisted of a single partial cremation of a 30–65-year-old possible female (see Figure 16). Stature could not be estimated. Information regarding position, orientation, and degree of flexure could not be recorded, because of the amount of disturbance associated with this type of burial feature. Although the cranium was facing southwest, the significance of the placement is unknown. It is equally unknown whether attempts to cremate these remains were done in place or the remains were collected and redeposited at this location. Both femora exhibited postmortem transverse fractures at midshaft. The direction of the force likely came from the dorsal side of the femur. The ventral surface of the break had a beveled appearance. Moderate osteophytic lipping was observed along the margins of the vertebral body of an indeterminate-order thoracic vertebra.

The skeletal elements associated with this burial feature consisted primarily of two articulated segments: (1) left and right innominates, sacrum, left and right proximal femora, and first through fifth lumbar vertebrae and (2) a cranium with articulated mandible and first through third cervical vertebrae. The pelvic segment was unburned, but a fragment of the acetabulum found in the feature matrix exhibited complete blackening along the superior margin, on the internal surface. The cranium was missing much of the vault and left side. Although most of the cranium was unburned, the edges of the broken vault (particularly on the occipital in the nuchal region), anterior maxilla, and right mastoid process were partially blackened. The remainder of the skeleton was represented to some degree, albeit incompletely and in small fragments. Few other fragments of human remains associated with the primary individual exhibited any evidence of burning. Those that do display burn patterns range from partially blackened to completely calcined. The skeletal remains associated with the partial cremation appeared to have been burned while covered with flesh, as evidenced by the presence of large, articulated segments.

Associated Features

A small cluster of tarsal bones associated with this burial feature were located within approximately 16 cm directly above the inferior pelvis of the primary individual in burial Feature 287. Also, the southeastern portion of burial Feature 406 was located approximately 40 cm above the northwestern portion of nonburial Feature 419 (Figure 82). Finally, southeast of burial Feature 406 was nonburial Feature 272. Both features were at the same elevation, were spatially close (within approximately 30 cm), and represented thermal events. It was unclear how these two features related to one another, although it was clear that neither was a continuation of the other.

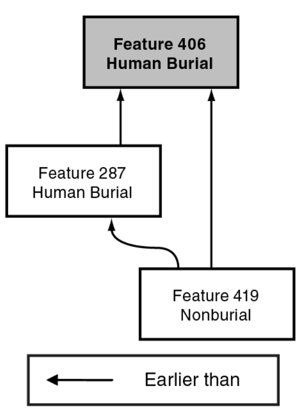

Figure 82. Chart showing the feature relationships associated with burial Feature 406 at LAN-62.

Associated Artifacts

No artifacts were found in direct association with the primary burial in this burial feature. However, the primarily disarticulated and scattered nature of these skeletal remains did not readily lend itself to such definitive observations.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix. These included nine fire-affected-cobble fragments, a cobble (most likely a manuport), two ground stone disk beads, and eight shell beads. These shell beads consisted of eight varieties, including olivella bushing, olivella cupped, olivella cylinder, olivella rough large lipped, olivella round thin lipped, semiground olivella disk, semiground olivella lipped disk, and giant rock scallop disk. Each of these beads was relatively evenly represented. A semiground-olivella-shell disk bead exhibited some ocher staining.

Shell beads found in the feature matrix have a combined date range of A.D. 1150–1816. Two of the beads, the olivella round thin-lipped bead and the semiground-olivella-shell disk bead, were associated with nonoverlapping date ranges. They were manufactured between A.D. 1500 and 1600 and A.D. 1800 and 1816, respectively, indicating that either they were curated by the indigenous populations or one or more of them were intrusive. Given the small number of beads found in the feature matrix, it is likely that they were intrusive.

Burial Feature 426

Feature Age: indeterminate
MNI: 1 (1 primary)
Primary Individual: indeterminate sex, 18–34 years
Burial Type: partial cremation
Burial Treatment: primary
Burial Position: indeterminate
Burial Orientation: indeterminate
Head Facing: indeterminate
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of numerous charcoal fragments, faunal bone, and numerous cultural materials. Two fragments of isolated human bone (a metatarsal fragment and an unsided cuboid) were also recovered. Although these skeletal elements were not represented by the primary individual, their differential preservation cast some doubt on that association, especially because this burial feature was located near numerous other burial features. These elements were not associated with the primary individual or any other individual. Several fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

The skeletal remains were in very poor condition, as a result of rodent and plant activity. Cultural activity was also suspected, because of the dispersal of several large, articulated skeletal elements.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 82.5 cm; width, 75 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan view of the feature indicates a square or nearly square shape.

Feature Interpretation

This burial feature was located along the northwestern periphery of the main burial concentration and consisted of a single primary partial cremation of an 18–34-year-old adult of indeterminate sex (see Figure 23). Stature could not be estimated. The skeletal remains associated with this individual were highly disturbed. The upper third of the cranium had been truncated. This portion of the cranium was deposited approximately 12 cm northwest, ectocranial side down. The sacrum and part of the left innominate were found around the upper chest and lower neck. The mandible was displaced, and approximately two-thirds of the bone was missing. The right femur, which was articulated with the right innominate, was truncated approximately one-third inferior to the proximal head. The left distal humerus and proximal ulna appeared to be in anatomical position. No information on degree of flexure, head facing, orientation, or position could be recorded, because of the disturbance. No bones of the extremities, tibiae, or fibulae were recovered.

The right femur exhibited evidence of a postmortem fracture at the point where the femur was truncated. The broken end was beveled approximately three-fourths around the end, and the final fourth exhibited a breakaway spur. The bone was likely fractured while still relatively green.

This individual exhibited a range of burning, from unburned to completely calcined. The inconsistent pattern of burning was due to differential fuel load, possibly from an insufficient supply of fuel. Several large pieces of wood had been placed on top (west) of and around (to the north and south of) the remains after the disturbance had taken place, as supported by the presence of burned wood above the truncated cranium. This appeared to indicate that the remains were burned in place. Numerous fragments of knotted cordage, possibly from netting, were found through the burial feature. Many of the large pieces of burned wood resembled planks. Burned basket fragments were found on the torso, east of the torso, and south of the torso. Associated with the burned baskets were dense root concentrations. A substantial amount of "cremation slag" adhering to the skeletal remains and cordage indicated that the temperatures within the grave did get high enough for long enough to cause the fusion of the silica in the sediment. Because the remains were not completely incinerated, however, that temperature was not maintained.

Associated Features

Burial Feature 426 was located directly beneath burial Feature 103. These two burial features were separated by approximately 70 cm. The thorax of the primary inhumation and an isolated cranium in burial Feature 278 were located within 7 cm above the southwestern concentration of charcoal and cordage in burial Feature 426. The southeastern concentration of burned wood and cordage in burial Feature 426 was also located within 5 cm beneath a cluster of isolated bone and artifacts in the northern portion of burial Feature 358. The northwestern corner of burial Feature 69 and the northeastern corner of burial Feature 128 were both located within 50 cm over the southeastern corner of burial Feature 426. The main concentration of human remains associated with the partial cremation in burial Feature 312 was located approximately 10 cm directly above the northern half of burial Feature 426 (Figure 83). The western half of burial Feature 426 overlapped the legs and right foot of the primary inhumation in burial Feature 312. These features were vertically separated by approximately 6 cm. Because burial Feature 312 contained the remains of a partial cremation, the individual represented by the burned cranial fragments might be associated with burial Feature 426.

Associated Artifacts

No artifacts could be directly associated with the primary inhumation associated with this burial feature.

Possibly Unassociated Artifacts

Numerous cultural materials were recovered from the feature matrix. These included 2 bifaces, 3 Cottonwood Triangular projectile points, 4 flakes of debitage, a bipolar core, a microblade core, a fragment of a shaped pestle, a pebble manuport, a large (15-by-17.5-cm) fragment of asphaltum, and approximately 10 olivella-shell cupped beads. The beads have an associated date range of A.D. 1150–1816.

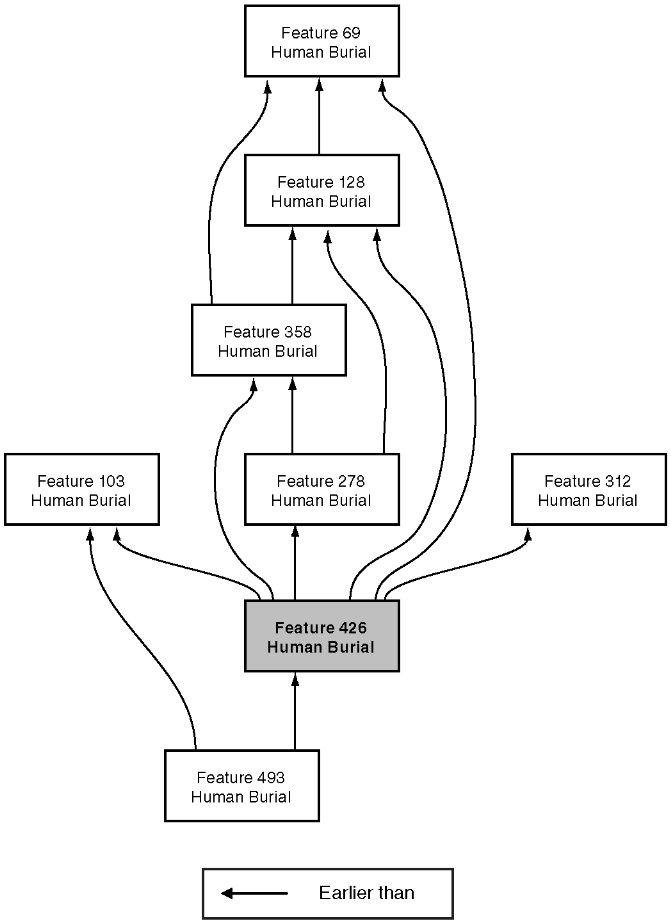

Figure 83. Chart showing the feature relationships associated with burial Feature 426 at LAN-62.

Burial Feature 444

Feature Age: indeterminate
MNI: 3 (1 primary and 2 additional)
Primary Individual: possible female, 25–35 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: right side
Burial Orientation: east
Head Facing: north
Additional Individuals: (1) indeterminate sex and age; (2) indeterminate sex, 12–17 years
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of charcoal, shell fragments, faunal bone, and several cultural materials. Isolated human bone associated with at least two additional individuals was also found in the feature matrix. In addition, nearly 30 fragments of human bone that could not be confidently associated with any individual represented in this burial feature were recovered. Although all regions of the human skeleton were represented by the remains, nearly two-thirds of the scattered human bone was associated with the extremities and axial skeleton. Finally, fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

Although many skeletal elements, such as those associated with the hands, were missing postmortem, the likely cause of the loss is unknown.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 64 cm; width, 94 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan view of the feature indicates an ovate shape.

Feature Interpretation

This burial feature was located immediately south of the historical-period trench (nonburial Feature 16), along the northeastern periphery of the burial area, among the scattered burials, and consisted of a primary inhumation and isolated fragments of human bone associated with at least two additional individuals (see Figure 77). The primary inhumation was a possible female between 25 and 35 years of age interred fully flexed on the right side and oriented to the east, with the head facing north. Some standard cranial epigenetic traits were recorded. Furthermore, the left fifth distal and middle tarsal phalanges exhibited pedal symphalangism. Standard cranial and postcranial osteometric observations were recorded. The frontal parietals also displayed some porotic hyperostosis.

The skeletal remains associated with the primary inhumation, though relatively complete, exhibited only a fair degree of preservation; several elements existed only in a fragmented state. Furthermore, most of the skeletal elements associated with the hands were missing postmortem. Although preservation was poor, the skeletal elements that were present were well articulated, with the exception of three cervical vertebrae, which were disarticulated but were in the general vicinity of the vertebral column.

Isolated human remains associated with at least two additional individuals were recovered from the feature matrix. The first additional individual was represented by a thermally altered fragment of a thoracic vertebra located immediately south of the occipital of the primary individual. Age and sex could not be estimated. The bone exhibited areas of complete blackening and partial calcination.

A petrous portion (the portion of the temporal bone that houses the bones of the inner ear) for the second additional individual represented in this burial feature, a 12–17-year-old individual of indeterminate sex, was also recovered from the burial matrix.

Associated Features

Although burial Feature 347 was located within 2 cm southwest of the posterior-inferior pelvis of the primary inhumation in burial Feature 444 and nearly at the same elevation, no damage or disturbance appeared to have resulted from the interment of either individual. Fragments of the left ulna and radius for the primary inhumation in burial Feature 308 were found in the sediment associated with burial Feature 444, suggesting that burial Feature 444 was intrusive to burial Feature 308.

Several fragments of human bone located along the northern aspect of the burial feature, including fragments of a right humerus, right clavicle, ilium, and radius, likely belonged to the primary individual in burial Feature 336 (see Figure 77). Interment of the primary inhumation in burial Feature 444 appeared to have directly impacted the right side of the primary inhumation in burial Feature 336. These skeletal elements were associated with the primary inhumation in burial Feature 336.

Burial Feature 24 was located within 30 cm directly above the primary inhumation in burial Feature 444 and covered almost the entirety of this burial feature. Although definitely occurring after the interment of this burial, placement of burial Feature 24 did not appear to have disturbed it. However, human bone, as represented by a thoracic vertebra, and possibly a burned olivella-shell cupped bead, both associated with the first additional individual in burial Feature 444, appeared to have migrated upward and into the sediment associated with burial Feature 24. Because at least two individuals in burial Feature 24 exhibited some degree of burning, this skeletal element cannot be associated with any degree of confidence to any individual in burial Feature 24 (Figure 84).

Associated Artifacts

No artifacts could be associated with any individual represented in this burial feature.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix. These included two fire-affected-cobble fragments, a pointed fragment of worked bone, a fragment of ground stone of indeterminate type, and approximately five shell beads. These beads consisted of four types: giant rock scallop disk, olivella cupped, olivella full lipped, and olivella bushing. One of the olivella-shell cupped beads was burned. The combined date range associated with these beads is A.D. 1150 to post–Mission period, and a narrower date is range associated with the olivella-shell full-lipped bead: A.D. 1650 to post–Mission period. Unfortunately, because these beads lack a discrete association with an individual in this burial feature, any temporal information they might provide is tenuous.

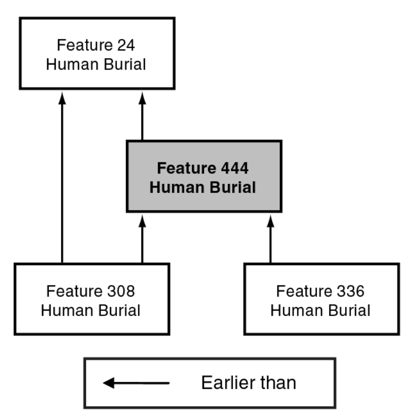

Figure 84. Chart showing the feature relationships associated with burial Feature 444 at LAN-62.

Burial Feature 459

Feature Age: indeterminate
MNI: 2 (1 primary and 1 additional)
Primary Individual: female, 30–40 years
Burial Type: inhumation
Burial Treatment: fully flexed
Burial Position: left side
Burial Orientation: northeast
Head Facing: southwest
Additional Individual: male, 25–35 years
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown to black silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter rounded clasts, charcoal flecks, shell fragments, faunal bone, and numerous cultural materials. Isolated human bone associated with an additional individual was also recovered from the feature matrix. Furthermore, nearly 10 fragments of human bone that could not be confidently associated with any individual represented in this burial feature were recovered. All but one of these skeletal elements were associated with the bones of the extremities. The exception was an isolated thoracic vertebra. Finally, numerous fragments of human bone that could not be identified to the element level were also recovered from the feature matrix.

Feature Disturbance

Much of the axial skeleton was missing postmortem, and the right fibula was located approximately 28 cm northwest of the right leg. Rodent activity is the suspected origin of this disturbance.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 70 cm; width, 74 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan view of the features indicates a circular shape.

Feature Interpretation

This burial feature was located immediately south of the historical-period trench (nonburial Feature 16), along the northeastern periphery of the burial area, among the scattered burials, and consisted of a single primary inhumation and isolated human remains associated with an additional individual (see Figure 77). The primary inhumation was a 30–40-year-old female interred fully flexed on her left side, oriented to the northeast, with her head facing southwest. The living stature of this individual, based on the approximate maximum length of the right femur, was between 147.54 and 155.18 cm (58.1–61.1 inches). This individual exhibited differential degrees of attrition; the right side of the oral cavity displayed more-extreme wear than the left. Hypercementosis was evident on the right maxillary first molar. The third lumbar and promontory of the sacrum displayed some minor osteophytic lipping along the margins of the vertebral bodies.

The skeletal remains associated with the primary individual were poorly preserved; most of the elements associated with the axial skeleton and hands, as well as the left radius and right ulna, were missing postmortem. Furthermore, rodent activity had relocated several elements, including an intact right fibula, throughout the burial feature.

Skeletal remains associated with the primary inhumation in burial Feature 336 were also recovered from the feature matrix and represented the second individual discovered in burial Feature 459.

Associated Features

Interment of the primary inhumation in this burial feature resulted in the disturbance of at least two nearby graves: burial Features 336 (see Figure 77) and 522. The left side of the primary inhumation in burial Feature 336, located south-southeast of, and heavily damaged by the interment of, the primary inhumation in burial Feature 459, resulting in the fragmentation and scattering of the bones of the cranium, left arm and thorax, both legs, and pelvis. These remains consisted of fragments of the left femur, left ulna, unsided scapula, unsided tibia, left second cuneiform, left patella, right mandibular second molar, maxillary right canine, and maxillary right first premolar and were associated with the primary inhumation in burial Feature 336.

Burial Feature 522, located immediately beneath burial Feature 459, was the second burial feature impacted by the interment of the primary inhumation in burial Feature 459. The cranium associated with the primary individual in burial Feature 522 was cut through during the interment of the primary inhumation associated with burial Feature 459. As damaging as that act was, however, no cranial fragments associated with burial Feature 522 were recovered from the matrix associated with burial Feature 459.

Additionally, the cranium of the primary inhumation associated with burial Feature 459 was located approximately 45 cm above nonburial Feature 542. Finally, the chin and knees of the primary inhumation associated with burial Feature 459 was located nearly 55 cm above nonburial Feature 563 (Figure 85).

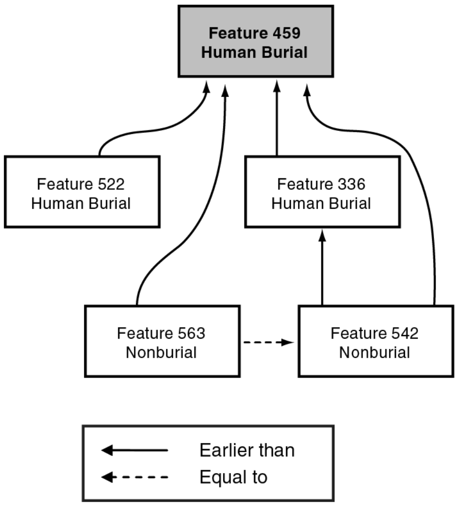

Figure 85. Chart showing the feature relationships associated with burial Feature 459 at LAN-62.

Associated Artifacts

No artifacts were distinctly associated with the primary inhumation in this burial feature.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix. These included a ground stone disk bead, 2 fire-affected-cobble fragments, a Cottonwood Triangular projectile point, a flake of lithic debitage, and approximately 10 shell beads. These beads consisted of eight different varieties: Pismo-clam cylinder, Pismo-clam disk, olivella bushing, olivella cupped, olivella round thin lipped, olivella cylinder, olivella full lipped, and olivella rough large lipped. The combined date range associated with these beads is A.D. 1150–1816, and the olivella rough large-lipped bead is associated with a much narrower date range of A.D. 1500–1600.

Burial Feature 505

Feature Age: indeterminate
MNI: 3 (1 primary and 2 additional)
Primary Individual: female, 25–35 years
Burial Type: inhumation
Burial Treatment: semiflexed
Burial Position: supine
Burial Orientation: southeast
Head Facing: southwest
Additional Individuals: (1) indeterminate sex, 1.5–3 years; (2) indeterminate sex, birth to 1 year
Burial Pit: unobservable

Feature Fill

The feature matrix was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, charcoal, shell fragments, faunal bone, and several cultural materials. Isolated fragments of human bone from at least two additional individuals were also recovered from the feature matrix. Additionally, approximately 15 fragments of human bone that could not be confidently associated with any individual represented in this burial feature were recovered. Although all regions of the skeleton were represented by these skeletal elements, two-thirds of these isolates were associated with the extremities. Several fragments of human bone that could not be identified to the element level were also recovered.

Feature Disturbance

The ribs, pelvis, right humerus, and left parietal appeared to have been impacted when the grave for burial Feature 188 was dug (Figure 86). Possible gouge marks (where flat, even pieces of bone approximately 1–2 mm thick were missing postmortem) were on the left innominate, approximately 5 cm distal of the sacroiliac joint superior to the auricular surface. The left and right ribs had been broken symmetrically along the sagittal plane, close to the sternal ends. A possible cut mark was observed on the medial surface of the distal end of the right humerus, indicating that the motion that damaged the ribs might have scraped the humerus. Of the ulnae and radii, only the proximal third of the left ulna and radius were articulated. Fragments of the left and right radii and ulnae, along with elements of the hands, were located near the knees of the primary individual. A 10-mm postmortem perforation observed on the left parietal might have been caused by a digging stick. Equally plausible is the possibility that the perforation on the left parietal was the result of insect burrowing.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 92 cm; width, 84 cm; depth, unknown) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan view of the feature indicates an ovate shape.

Feature Interpretation

This burial feature was located in the eastern portion of the burial area, among the scattered burials, and consisted of a single primary inhumation and scattered human bone associated with at least two additional individuals (see Figure 86). The primary inhumation was a 25–35-year-old female interred semiflexed in a supine position, oriented to the

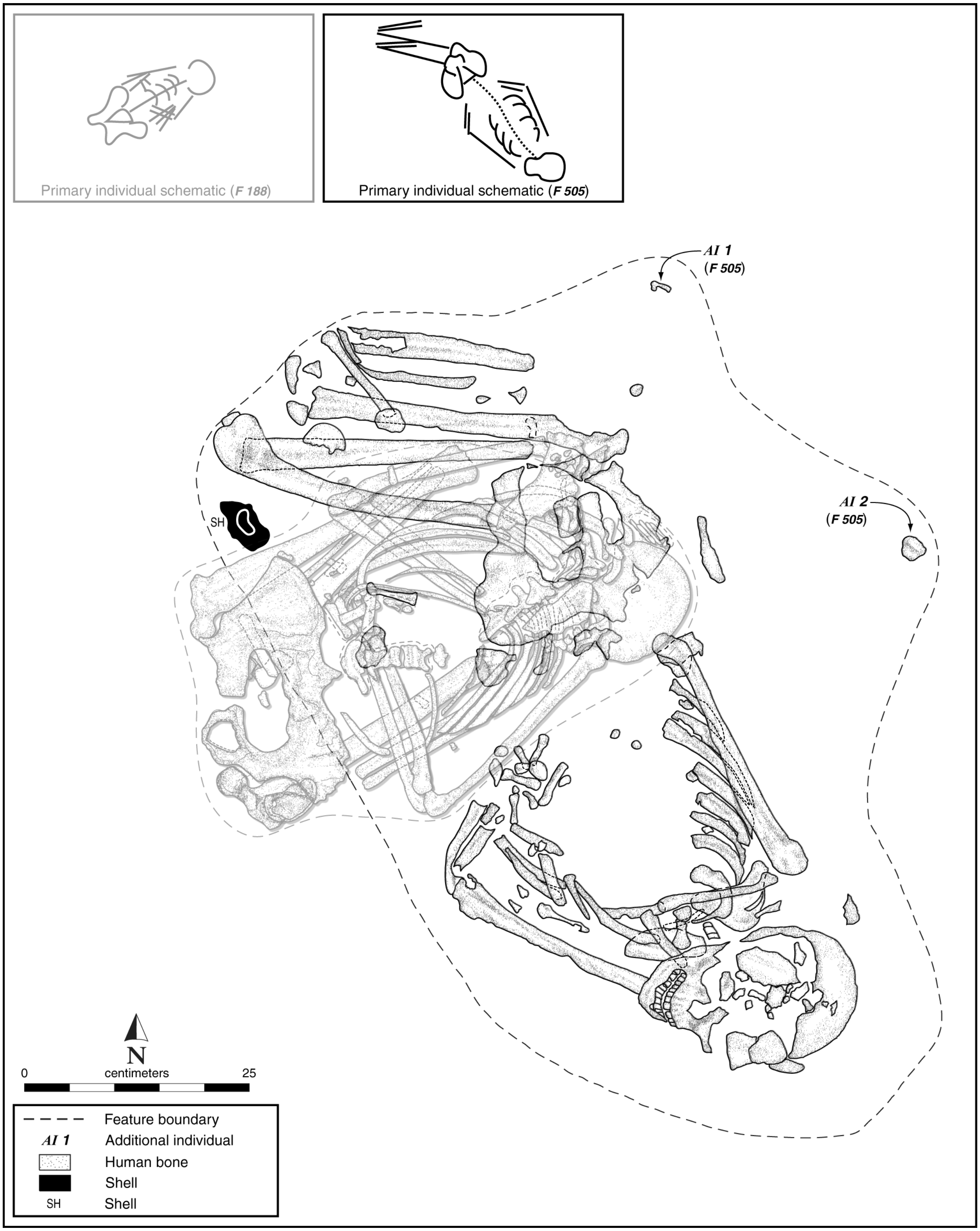

Figure 86. Illustration of burial Feature 505 at LAN-62.

southeast, with the head facing southwest. The living stature of this individual, based on the approximate maximum length of the left femur, was between 144.44 and 152.07 cm (56.9–59.9 inches). Although the primary individual was heavily impacted by the interment of the primary individual from burial Feature 188, the skeletal remains exhibited a fair to moderate level of preservation.

Several fragments of isolated human remains were found in the feature matrix. These fragments were associated with at least two additional individuals. The first individual, a 1.5–3-year-old child of indeterminate sex, was identified by an undeveloped neural arch of an indeterminate vertebral type. The second individual, an infant of indeterminate sex aged between birth and 1 year, was defined by the presence of undeveloped cranial fragments.

Associated Features

The primary inhumation in this burial feature was directly impacted by the primary inhumation in burial Feature 188. The primary inhumation in burial Feature 188 was perpendicular to the primary inhumation in burial Feature 505, and the upper thorax and cranium of the primary inhumation in burial Feature 188 were located within the abdomen/pelvis of the primary inhumation in burial Feature 505. Additionally, the lower thorax and abdomen of the primary inhumation in burial Feature 505 were located approximately 20 cm above nonburial Feature 571 (see Figure 54).

Associated Artifacts

A large fragment of ocher, approximately 4 by 4 cm, was recovered immediately southwest of the right ilium. It was the only recovered artifact that might be considered a mortuary offering.

Possibly Unassociated Artifacts

Several cultural materials were recovered from the feature matrix: five fire-affected cobbles; one flake of lithic debitage; one edge-modified flake; one Cottonwood Triangular projectile point; a chopper; a core hammerstone; one fire-affected stone of indeterminate type; two Gifford-type, worked, Venus-clamshell ornaments; fragments of a worked, Wavy-turban shell; and nine olivella-shell beads. The beads were of five varieties: bushing, cupped, rough disk, round thin lipped, and rough large lipped. Three of the shell beads were of the bushing type, and another three were the cupped variety. The rest of the beads were divided among the rough-disk, round-thin-lipped, and rough-large-lipped types. The beads have a combined date range of A.D. 1150 to post–Mission period; a single rough disk bead is associated with an A.D. 1816–1834 date range, and a single round thin-lipped bead is associated with an A.D. 1500–1600 date range.

Burial Feature 558

Feature Age: indeterminate
MNI: 7 (1 primary and 6 additional)
Primary Individual: indeterminate sex, 7–10 years
Burial Type: inhumation
Burial Treatment: extended
Burial Position: prone
Burial Orientation: southeast
Head Facing: north
Additional Individuals: (1) indeterminate sex, 9 months to 2 years; (2) indeterminate sex, 12–17 years; (3) indeterminate sex, 20–35 years; (4) indeterminate sex, 18–34 years; (5) indeterminate sex, 4–5 years; (6) indeterminate sex and age
Burial Pit: unobservable

Feature Fill

The feature was dark-brown silty sand with inclusions of a small amount (less than 5 percent) of 1–5-cm-diameter rounded clasts, faunal bone, shell fragments, charcoal flecks, and several cultural materials. Scattered human remains associated with at least six additional individuals were also recovered from the feature matrix. In addition, nearly 45 fragments of human bone that could not be confidently associated with any individual in this burial were found in the feature matrix. Although these remains consisted largely of complete bones associated with the extremities, numerous fragments of elements from other regions of the skeleton were also recovered. Finally, fragments of human bone that could not be identified to the element level were found in the feature matrix.

Feature Disturbance

Rodent burrows extended north–south through the eastern section of the burial.

Burial Pit

No burial-pit boundary was observed. Burial dimensions (length, 110 cm; width, 96 cm; depth, unknown) were defined by the maximum extent of the concentration of human remains and artifacts associated with the burial. The plan view of the feature shows an irregular shape.

Feature Interpretation

This burial was located in the northeastern portion of the main burial concentration and consisted of a single primary inhumation and scattered human remains associated with at least six additional individuals (Figure 87).

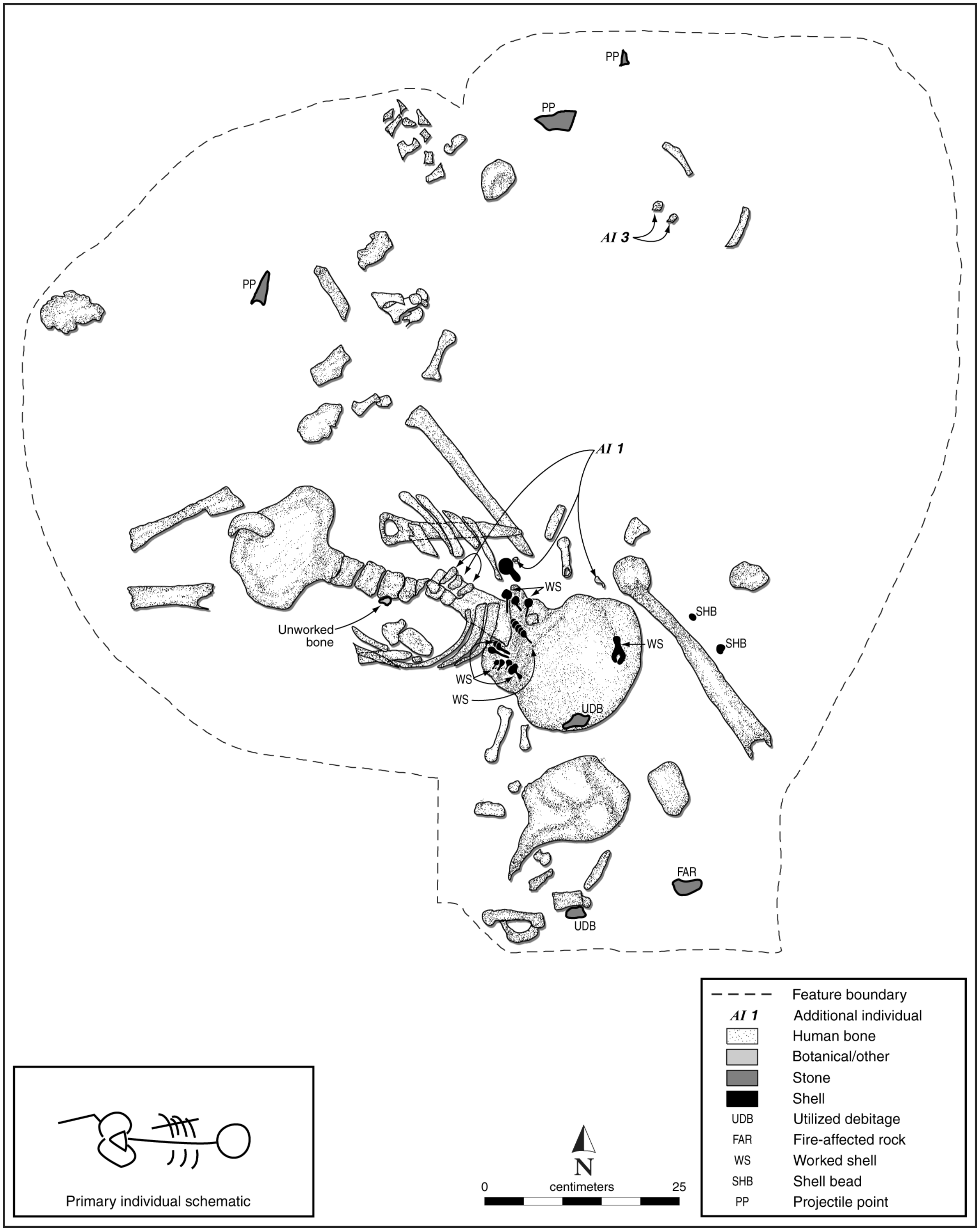

Figure 87. Illustration of burial Feature 558 at LAN-62.

The primary inhumation was a 7–10-year-old child of indeterminate sex interred extended in a prone position, oriented to the southeast, with the head facing north. Stature could not be estimated. Although the skeletal remains associated with this individual exhibited a moderate degree of preservation, several larger elements were missing postmortem. These included the left and right tibiae, right fibula, left and right forearms, much of the cranium, the sacrum, and several elements associated with the extremities. Extreme dental attrition was observed on the deciduous molars. No pathological conditions or behavioral indicators were observed.

Isolated human remains associated with at least six additional individuals were recovered from the feature matrix. The first individual was a 9-month- to 2-year-old infant of indeterminate sex. This individual was represented by a middle carpal phalanx, a left deciduous mandibular canine, a right mandibular first molar, an unsided humerus fragment, an unsided ischium fragment, and an unsided calcaneus.

The second individual, 12–17 years old and of indeterminate sex, was represented by a maxilla with several articulated teeth.

The third individual, 20–35 years old and of indeterminate sex, was defined by the presence of several teeth.

The fourth individual, 18–34 years old and of indeterminate sex, was represented by a right maxillary lateral incisor that exhibited a much greater degree of wear than those associated with the third additional individual.

The fifth individual, a 4–5-year-old child of indeterminate sex, was associated with a single left maxillary first molar.

The final individual was represented by several fragments of human bone that exhibited a burn pattern ranging from completely blackened to completely calcined. No demographic information could be estimated for this individual. Several unassociated vertebral body fragments exhibited osteophytosis.

Associated Features

The eastern portion of burial Feature 558, an area associated with several isolated human bones and artifacts, was immediately beneath the western portion of burial Feature 547, which was associated with the distal end of the lower legs of the primary inhumation in that burial feature and several isolated remains. Additionally, in the eastern and southern portions of burial Feature 558 were what appeared to be continuations of the isolated bone in burial Feature 559. The primary inhumation associated with burial Feature 558 was located approximately 10 cm beneath the primary inhumation associated with burial Feature 187.

The primary inhumation associated with burial Feature 558 was located 5 cm north of and at the same elevation as the primary inhumation associated with burial Feature 554. Although the primary inhumation in burial Feature 554 was missing a cranium, it was unclear whether the primary inhumation in burial Feature 558 had been the event responsible for this loss. The western portion of the primary inhumation associated with burial Feature 558 appeared to have been intruded upon by the primary inhumation in burial Feature 447.

The right femur associated with the primary inhumation in burial Feature 558 was located within 2 cm of the cranium associated with the primary inhumation in burial Feature 593. Although it appeared that burial Feature 593 was intrusive into burial Feature 558, the reverse might actually have occurred. The right femur from burial Feature 558 appeared to have been angled away from the cranium in burial Feature 593, as though during the original burial-pit excavation, when the excavator came across the remains of the primary inhumation in burial Feature 593, the leg had been adjusted instead of the cranium's being removed. The cranium associated with the primary inhumation in burial Feature 558 was located approximately 70 cm above the southern portion of nonburial Feature 655 (Figure 88).

Associated Artifacts

The primary inhumation associated with this burial feature had a series of approximately 15 abalone-shell pendants around the neck region. They were shaped like rings, and a single bar extended from each ring. A single small perforation was present on each bar, and it is likely that these pendants were strung together in a single strand. The pendants could not be dated.

Possibly Unassociated Artifacts

Several artifacts that could not be associated with any individual represented in this burial were also found in the feature matrix: 3 flakes of debitage; a ground stone disk bead; 2 Cottonwood Triangular projectile points; 2 fire-affected-cobble

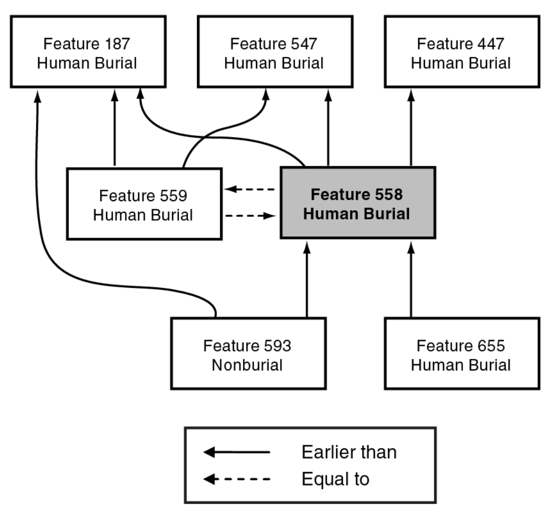

Figure 88. Chart showing the feature relationships associated with burial Feature 558 at LAN-62.

fragments; approximately 10 olivella-shell beads of variants that included bushing, cupped, large lipped, rough thin lipped, tiny saucer, and end-ground disk; a red-abalone-epidermis disk bead; and a giant-rock-scallop disk bead. The beads have a combined date range of 600 B.C.–A.D. 1816, and several types are associated with the A.D. 1150–1816 date range.

Burial Feature 562

Feature Age: indeterminate
MNI: 1 (1 primary)
Primary Individual: male, 30–45 years
  Burial Type: inhumation
  Burial Treatment: fully flexed
  Burial Position: left side
  Burial Orientation: east
  Head Facing: southwest
Burial Pit: single

Feature Fill

The feature matrix was dark-brown to black silty sand with inclusions of a small amount (less than 5 percent) of less-than-1-cm-diameter subangular clasts, charcoal, shell fragments, faunal bone, and numerous cultural materials. Several fragments of human bone that could not be identified to the element level, and thus could not be confidently associated with any individual represented in the burial, were also recovered from the feature matrix.

Feature Disturbance

The internal surface of the left parietal of the primary inhumation exhibited rodent gnawing. A small amount of root disturbance was observed throughout the burial pit.

Burial Pit

A single ovate burial pit was associated with this primary inhumation. It measured 100 by 82 by 31.5 cm and was not lined. Definition of the burial pit was based on changes in sediment color. The plan view of the feature shows an ovate shape.

Feature Interpretation

This burial feature was located on the northern periphery of the main burial concentration, approximately 1.5 m southwest of the historical-period trench (nonburial Feature 16). It consisted of a single primary inhumation (Figure 89) of a 30–45-year-old male interred fully flexed on the left side, oriented to the east, with the head facing southwest. The living stature of this individual, based on the approximate maximum length of the left femur, was between 152.67 and 159.50 cm (60.1–62.8 inches). The upper portion of the individual was placed in such a fashion that the arms and neck were tightly flexed, the right forearm was clutched close to the thorax, and the facial region was tucked under the right shoulder. The left forearm, however, was only semiflexed. Furthermore, the right forearm was positioned almost perpendicular to the ground surface, and the right hand appeared flexed, as though grasping an object. The placement of a hafted biface nearby suggested that the individual might have held a spear, knife, or other hafted, composite tool.

Except for the vertebral column, the skeletal remains associated with this individual were relatively well preserved, and few skeletal elements were missing or damaged postmortem. Periostitis was observed on the proximal shaft, neck, and head of the left radius. This condition was marked by porous, reactive bone on the neck and head; remodeling of the lateral aspect of the articular circumference where it meets the ulna; and thickening of the radial neck. A small lesion was also present on the superior radial tuberosity. Observations on vertebral osteophytosis of the lower lumbar, osteophytic growth associated with the right clavicular-joint margins, possible osteoarthritis of the proximal left tibia, and posterior sacralization of the fifth lumbar were also recorded. Porotic hyperostosis was observed on the left and right parietals as well as on the frontal, near the coronal suture. A carious lesion was observed on the occlusal surface of the right mandibular second molar. Additionally, abscesses were observed on the right and left sides of the maxilla at the first molars, and hypoplastic pits sparsely covered the right and left mandibular canines.

Associated Features

The pelvis associated with the primary inhumation in burial Feature 562 was located approximately 45 cm beneath the primary inhumation associated with burial Feature 386. Additionally, the legs and thorax of the primary inhumation in burial Feature 562 were located approximately 60 cm beneath the human remains in the western portion of burial Feature 148, and the pelvis of the primary inhumation in burial Feature 562 was located approximately 20 cm beneath the superior portion of the cranium of the primary inhumation in burial Feature 428. The legs associated with the primary inhumation in burial Feature 562 were also located approximately 40 cm beneath the remains associated with the primary inhumation in burial Feature 473 and approximately 30–40 cm beneath the scattered human remains in the northwestern portion of burial Feature 567. The thorax of the primary inhumation in burial Feature 562 was located approximately 30–40 cm beneath the pelvis of the primary inhumation in burial Feature 371. Finally, the legs of the primary inhumation in burial Feature 562 were located within 26 cm directly beneath the upper thorax and right arm/shoulder of the primary inhumation in burial Feature 600 (Figure 90).

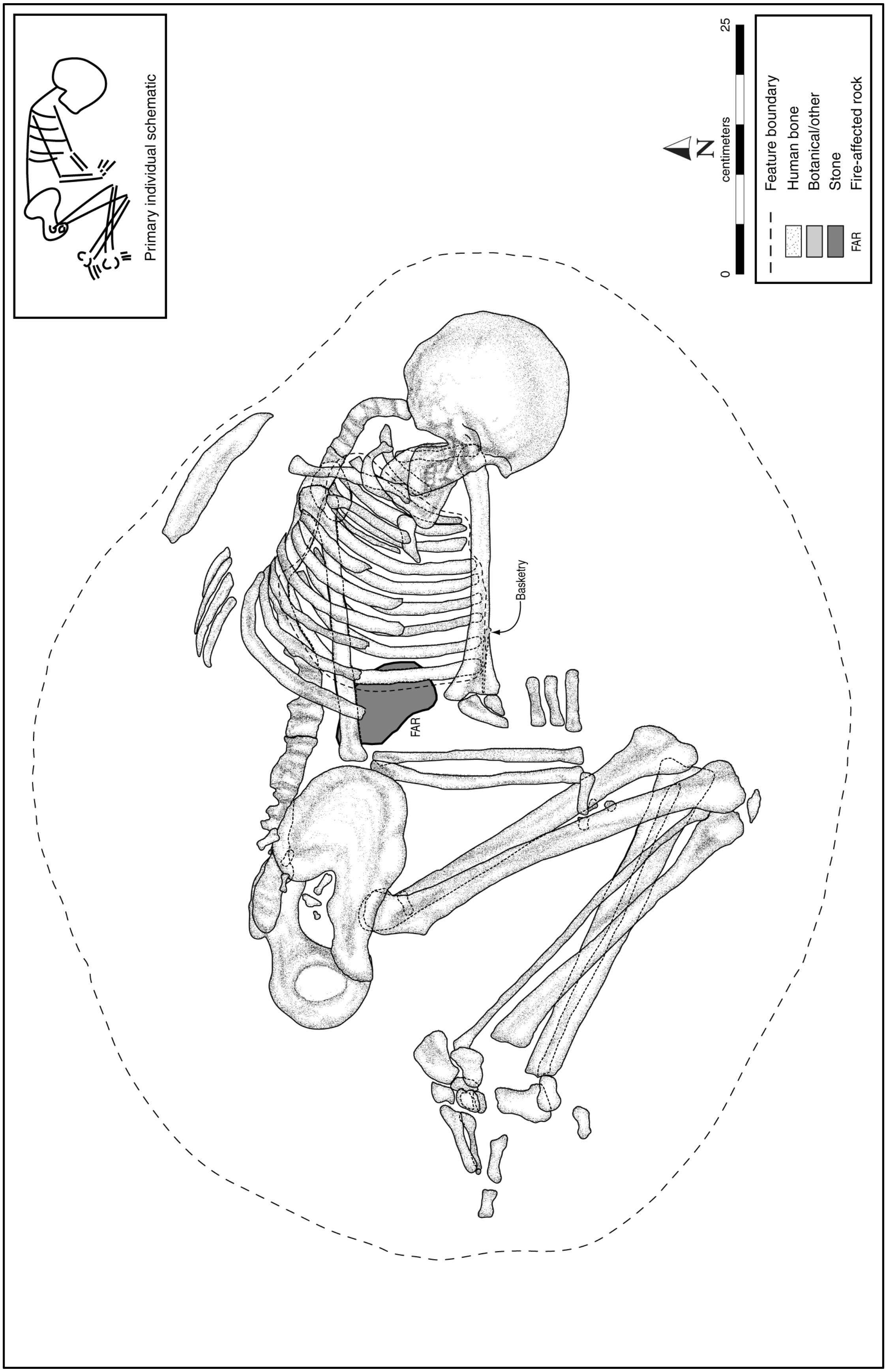

Figure 89. Illustration of burial Feature 562 at LAN-62.

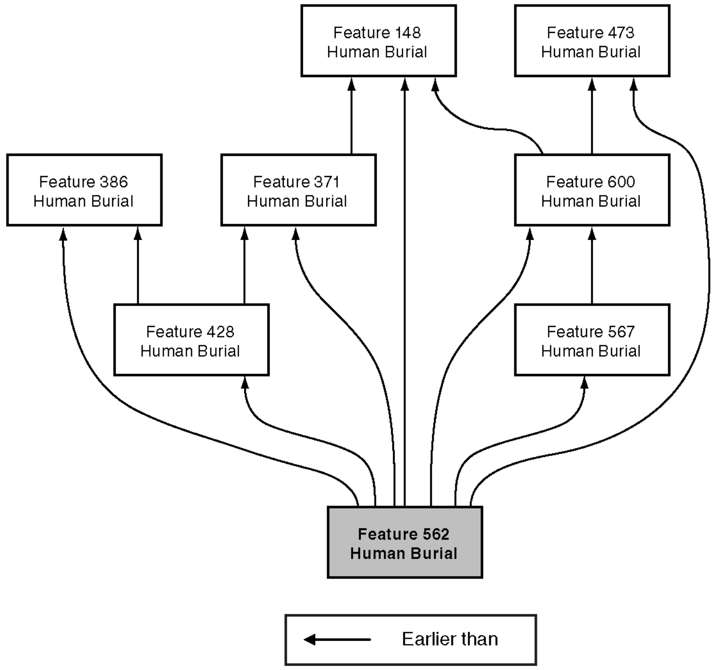

Figure 90. Chart showing the feature relationships associated with burial Feature 562 at LAN-62.

Associated Artifacts

A large, foliate biface with remnants of hafting (i.e., asphaltum with wood impressions) on both sides of the proximal end was associated with the primary inhumation. It was positioned with its distal end pointing west, toward the right radius and ulna and parallel to the body. The right hand was flexed and might have been holding something at one point, perhaps the shaft associated with the biface. Red ocher stained the sediment around the biface.

Possibly Unassociated Artifacts

Several artifacts that could not be directly associated with the primary inhumation were recovered from the feature matrix. These included a rounded tarring pebble, a flake of debitage, a cobble manuport with asphaltum drops, an edge-modified flake, two fire-affected-cobble fragments, and two olivella-shell beads. The beads were of two variants: round thin lipped and thick lipped. Though found in the feature matrix, they might provide some indirect chronometric data. Unfortunately, however, their corresponding date ranges do not overlap, indicating that one or both beads might have been intrusive. Their date ranges are A.D. 1500–1600 and 1650–1816, respectively.

Burial of Note from LAN-54

Although three burials were recovered from LAN-54, only one will be discussed in detail: burial Feature 6. The other two, burial Features 3 and 11, are presented in Appendix M, this volume.

Burial Feature 6

Feature Age: Intermediate period
MNI: 2 (2 primary)
Primary Individual 1: female, 40–44 years
  Burial Type: inhumation
  Burial Treatment: semiflexed
  Burial Position: supine
  Burial Orientation: southwest
  Head Facing: south
Primary Individual 2: female, 25–39 years
  Burial Type: inhumation
  Burial Treatment: semiflexed
  Burial Position: prone
  Burial Orientation: west
  Head Facing: south
Burial Pit: unobservable

Feature Fill

The feature matrix was compacted gray silty sand with inclusions of shell and some cultural materials. The lower levels of the burial were associated with a slight increase in small gravel inclusions.

Feature Disturbance

Some minor plant activity was observed. Furthermore, the first primary inhumation was discovered during mechanical stripping, which resulted in some postmortem excavation damage to the cranium and thorax. Most of the legs of both individuals appeared to have been removed during the excavation of Trench 8. Furthermore, although the first primary inhumation was located immediately above the remains of the second primary inhumation, which would indicate a later deposition of the first primary inhumation, the second primary inhumation did not appear to have been impacted by that event, which suggested that these individuals were interred at the same time or that only a short interval of time passed between interment events.

Burial Pit

No burial-pit boundary was observed. The dimensions of the burial (length, 86 cm; width, 85 cm; depth, 72 cm) were the maximum dimensions of the concentration of artifacts and human remains associated with the burial. The plan view of the feature indicates an ovate shape.

Feature Interpretation

This burial was located in the northeastern portion of LAN-54 and consisted of two primary inhumations (see Figures 28 and 29). The first primary inhumation was of a 40–44-year-old female interred in a supine position, oriented to the southwest, with the head facing south. Stature could not be estimated. The skeletal remains associated with this individual were moderately preserved. The legs, and consequently the feet, inferior to the proximal one-third of the femora were missing postmortem, and the cranium was fragmented. Many of the bones of the hands were also missing postmortem. The angle of the remnants of the legs suggested that this individual was interred in a semiflexed position. The arms, on the other hand, were fully flexed, with the hands brought up to the shoulders, as if in a pugilistic position. The head had settled to the right. This individual was located immediately above the remains of the second primary inhumation. No skeletal pathological conditions, morphological variants, or behavioral indicators were observed.

The second primary inhumation was a 25–39-year-old female interred semiflexed in a prone position, oriented to the west, with the head facing south. Stature could not be estimated. The right arm and knee of this individual were semiflexed and were located immediately beneath the first primary inhumation. The left hand, which was curled as though clasping something, was located immediately next to the right humerus, indicating that the left arm had crossed the anterior thorax. The cranium had settled to the right side, and the chin was located over the right shoulder. This burial exhibited a level of preservation similar to that of the first primary inhumation. Most of the thorax, pelvis, and legs were missing postmortem. Bilateral septal apertures, a morphological variation that sometimes presents as a large foramen on the distal end of the humerus, were observed on the humeri.

Associated Features

No feature, burial or otherwise, was directly associated with this burial feature.

Associated Artifacts

No artifacts could be directly associated with either individual represented in this burial feature.

Possibly Unassociated Artifacts

Four flakes of debitage and an intact abalone shell were recovered from the feature matrix. The abalone shell was located interior side up, approximately 50 cm southwest of the first primary inhumation.

Summary

On the whole, burial features for the non–Mission period burial population at LAN-62 consisted of fully flexed primary inhumations with uncommon or rare representations of partial or complete cremations. The Mission period population followed a similar pattern, albeit with no partial cremations. Burials for the non–Mission period population were, by and large, oriented to the southeast and east, and burials for the Mission period population were oriented southeast and south. Furthermore, the non–Mission period burials generally faced down or north, whereas Mission period burials generally faced west, and northwest and down were also common. Most of the burials for both groups were interred on their left sides.

Though small in number, several burial features were identified as partial or complete cremations. Eighteen partial cremations were recovered from LAN-62. They consisted of partially disarticulated and jumbled concentrations of minimally burned human-skeletal remains. Additionally, for several partial cremations, evidence of burning was located on the superficial skeletal landmarks, suggesting that at least some tissue was present on the remains and shielded the deeper portions of the skeleton from contact with the heat source. Furthermore, the majority of the partial cremations consisted of a pelvis with the proximal one-third to one-half of one or both femora still articulated. Half the primary partial cremations with associated femora exhibited early postmortem transverse or spiral fractures of the femoral shafts. Many times, a cranium (represented in various levels of completeness) and other articulated segments were also recovered. Although these segments usually consisted of vertebral elements, other segments, such as a hand or an articulated tibia and fibula, were also recovered. Very little remained of the thorax, limbs, and extremities of these individuals beyond a few scattered fragments. This burial type was relatively evenly distributed among both male (n = 5) and female (n = 4) adults. Subadults were also represented, albeit to a lesser extent. Individuals younger than 12 years (i.e., fetuses, infants, and children) did not appear to have been treated in this fashion. With the exception of 4 partial cremations, all were found in a band extending northwest–southeast along the northeastern border of the burial area, immediately south of and roughly parallel to the historical-period trench, nonburial Feature 16.

Only eight cremations were found at LAN-62. Roughly 2 percent of the scattered human bone was burned, suggesting that more cremations were likely deposited in the burial area, but subsequent inhumations had disturbed them. The cremations were evenly split between juveniles and adults within the non–Mission period burial population, but the sex of only one adult, a female, could be estimated. Very little demographic information was available for the Mission period cremations. The cremations associated with LAN-62 were located in three clusters scattered throughout the burial area. The first concentration consisted of two cremations located in the north-central portion of the main burial concentration, immediately south of the historical-period trench, nonburial Feature 16. The second concentration consisted of three cremations located in the western portion of the main burial concentration. The two Mission period cremations were associated with this concentration. The final concentration was the most diffusely scattered of the three concentrations and consisted of three cremations located in the eastern portion of the burial area, all juveniles (two infants and one subadult). The locations of all the cremation concentrations generally overlapped with the locations of the partial cremations.

Both partial and complete cremations appeared to have been burned in a low-oxygen environment wherein temperatures did not usually exceed 800°C, although the presence of vitrified sand and organic materials suggested that some cremations reached temperatures of least 900°C. One possible reason for that disparity and also for the differences in degrees of cremation (complete vs. partial) is that there were differences in the amounts and types of fuel available for use at the times of the cremation events. Represented in these thermally affected burial features was wood of willow, bigcone Douglas-fir, sagebrush, and California sycamore. The split dependency on lowland and highland species is indicative of several possible behavioral patterns. Perhaps it suggests that a seasonal use of resources or overuse of local resources required the population to travel farther afield to gather the necessary provisions. Equally as plausible is opportunism, wherein local wood was supplemented with wood that the Spanish found less desirable (e.g., branches) and with scavenged, unmilled building supplies.

Furthermore, preservation may have also played a role in degree of cremation. The large segments of bone, likely with adherent tissue, observed in the partial cremations might have limited the effectiveness of the cremation events. Disarticulated and fragmented bone would have been more affected by a thermal event, because of a decrease in the number of shielded locations, such as joint surfaces. Similarly, the basic demographic profile of the individual would have played a major role in the effectiveness of a cremation event. Funeral pyres are exceedingly harsh environments, and the small bones of an infant would not usually survive.

Finally, mortuary observations at the other sites excavated during the PVAHP were very different. First of all, although some burned bone was found in the sediments of these sites, all of the burial features were inhumations. Unlike at LAN-62, there was a slight preference for semiflexed over fully flexed inhumations. Furthermore, there was a relatively even distribution of burials oriented generally northeast, northwest, or southwest. Whereas interment on the left side was the most common type of burial position observed at LAN-62, at the other PVAHP sites, individuals were rarely interred on the left side, and there was a greater presence of supine interments. Finally, burials tended to face south.

The mortuary environments observed at the various sites excavated during the PVAHP were very different and had complex, subtle nuances. It is through the analysis of those nuances that bioarchaeologists are afforded glimpses into these past cultures. In many instances, this was the only information available; however, through careful and intelligent analysis of these data, researchers can begin to piece together cultural aspects that have been lost.

Preservation and Population

Patrick B. Stanton and Joseph T. Hefner

Introduction

This chapter details the taphonomic processes affecting the preservation of the human remains recovered from LAN-62, LAN-211, LAN-2768, LAN-193, and LAN-54 during the PVAHP, as well as the paleodemography of these five sites. Because taphonomy can directly affect the estimate of the number of individuals at a given site, site-specific MNI and MLNI are also discussed. The first half of this chapter defines taphonomy and briefly details the various types of taphonomic processes affecting skeletal material. Although the taphonomic processes affecting each site will be presented, most of the discussion will focus on the processes affecting the human remains at LAN-62. The second half of this chapter discusses the methods used to estimate the number of individuals from each site in the project area. At LAN-62, SRI has estimated 349–377 individuals as the most likely range, with less than 20 individuals recovered from the remaining sites. The final section defines paleodemography and details the paleodemographic profile of the five PVAHP sites. Additionally, this section discusses general impressions regarding the demographic profile of Native Californian populations in this region of California during the Mission period, based on data recovered from baptismal and death records recorded by clergy associated with the local missions. Throughout the chapter, emphasis is placed on the complexity of the burial area at LAN-62, which required a more detailed analysis than the other sites.

Taphonomy

The evidence of postdepositional forces that affected the human remains at Playa Vista has provided a wealth of information regarding the formation of the burial area at LAN-62, which was extremely complex and experienced a diverse, and sometimes subtle, suite of processes that resulted in varying degrees of bone preservation.

Differential preservation was clearly observed at LAN-62, where approximately 310 intact burials were recovered, commingled with several-thousand isolated and partially articulated human remains. The LAN-62 burials were concentrated in a roughly 28-by-14-m area; the bulk of the burials were located within an approximately 19-by-11-m area in the southwestern portion of the burial area. The burial area was over 1 m in depth. Most of the burials were intrusive to other burials or had been impacted by other burials and nonburial features. Isolated remains consisted primarily of small, intact skeletal elements, such as teeth, infant remains, and bones of the extremities, as well as fragments of larger skeletal elements. However, numerous sets of scattered human remains associated with portions of the skeleton with tough, fibrous, soft-tissue attachments, such as segments of the vertebral column, extremities, and parts of the pelvis, were often found in articulated segments. Furthermore, skeletal remains, both isolated and associated with intact burials, exhibited levels of preservation ranging from excellent to exceptionally poor. Often, remains adjacent to one another, or even within the same skeleton, for that matter, displayed widely varying levels of preservation. As noted by Henderson (1987:43), preservation of human remains is dependent upon the interaction of many variables at different levels, and only through an in-depth understanding of those variables might researchers gain insight into how human remains in burial contexts are affected by such a complex and dynamic ecosystem.

Intrinsic Forces of Preservation

The intrinsic forces that affect the preservation of human bone, according to Henderson (1987:44), are those processes that "stem from the nature of bone itself and the complexity of the skeletal structure" and include composition, shape, size, density, and the age and sex of the individual. Furthermore, intrinsic traits act to undermine the structural integrity of the bone and to facilitate destruction from extrinsic forces by amplifying their effectiveness.

As strong as bone may seem, the organic and inorganic composition of bone readily lends itself to complete destruction. During the decay process, protein-mineral bonds are weakened via transformation of the organic components of the bone into amino acids, reorganization of the inorganic crystalline structure, and infiltration and absorption of ions from the surrounding matrix (Henderson 1987:44; Turner-Walker and Parry 1995:190). This initial stage opens the door for other processes, both intrinsic and extrinsic, by increasing susceptibility to these forces and promoting effective dissolution of the remains. During this process, shifts in the level of groundwater and soil types appear to have profound effects (Gordon and Buikstra 1981; Ortner et al. 1972:518–519; Turner-Walker and Parry 1995:190). Furthermore, Collins et al. (1995:178, 180–182) have demonstrated that half of the collagen is lost very rapidly days after deposition, although subsequent collagen loss is slowed very greatly, and such factors as temperature, water availability, collagen type (mineralized vs. unmineralized), soil pH, microbial ecology, and time add burial-specific variation to the equation.

Bone geometry can also have a profound effect on preservation by increasing the susceptibility of certain bones to different outside forces (Henderson 1987:44–45). For instance, the cranium, which is globular and hollow, and the pelvis, which is irregular and intricate, can be damaged significantly from the forces of compression and warpage.

The size of the skeletal element also plays a role in preservation. Not only are smaller remains more vulnerable to destruction than larger bones, they are also more affected by recovery efforts and disturbance (Henderson 1987:45). Depending on the level of effort and the procedures used (e.g., screen size and hand-excavation vs. mechanical stripping), the numbers of smaller elements, such as phalanges and teeth, that are recovered can be extremely variable. Zooarchaeological studies conducted by Gordon (1993) and Shaffer (1992) have shown that the size of the mesh used in screening can bias samples toward larger species and ultimately affect behavioral interpretations. Although these studies were conducted under the auspices of zooarchaeological research, the conclusions of the authors serve as cautionary tales for all aspects of archaeological research. In addition to size, bone density is an important factor, because there is a greater likelihood of recovery of elements that are composed of thick, durable cortical bone, such as the petrous portion of the temporal bones, than of thinner, less-dense bones, such as ribs or vertebrae (Henderson 1987:44–45).

Inextricably linked to the size and density of bone are, of course, the age and sex of the individual. Obviously, because of their small size, many juvenile bones can be missed, even with the most diligent of recovery protocols. The fragile nature of newly formed bone lends itself readily to disintegration, especially if soil pH is less than optimal (Gordon and Buikstra 1981:589). Osteopenic conditions, such as senile osteoporosis, hinder paleodemographic analysis by decreasing bone density. This ultimately affects the level of preservation of remains associated with older individuals. Such pathological conditions hinder paleodemographic analysis. Because of higher trabecular, or spongy, bone content, pelvic bones are highly susceptible to fragmentation associated with a loss of bone density. This, in turn, results in less-accurate age- and sex-estimation criteria for older individuals, especially for older women, because of the high prevalence of senile osteoporosis from postmenopausal hormone shifts (Ortner 2003:411; Walker et al. 1988:187).

Extrinsic Forces of Preservation

Extrinsic forces that affect bone preservation fall into three categories: environment of the site, which includes the amounts of water and oxygen, temperature, and soil type; the nature of the local flora and fauna; and human activities (Henderson 1987:45).

Water, in the form of humidity, drainage, or precipitation, leaches minerals from the remains and is the most important force of decay (Henderson 1987:46). Water acts as a means to transport ions, which are absorbed by the remains and further act to disintegrate the bone. Fluctuations in water levels and cycles of wet and dry seasons also destroy bone by creating deep cracks in the sediment during times of drought or by eroding the ground surface during the rainy seasons and exposing remains to the damaging effects of sunlight or scavengers. The level of moisture in the soil can influence the types of plants that will grow in the area. Lack of moisture aids in the preservation of some soft tissues, in conjunction with soil pH and oxygen levels.

Temperature and oxygen mostly affect the preservation of soft-tissue elements. Lower temperatures and a lack of oxygen will slow putrefaction by inhibiting aerobic bacteria from functioning effectively or causing cessation of their activities (Henderson 1987:47–48). Although primarily affecting soft tissue, these factors can also have some bearing on the survival of osseous materials. Temperature, for instance, can limit the activity cycles of scavengers and burrowing animals in northern climes to certain times of the year. Additionally, Ortner et al. (1972) have demonstrated a link between temperature and protein decay in bone.

Soil composition is easily identified as a major factor in the preservation of human remains (Gordon and Buikstra 1981). The pH, porosity, and composition of the soil can all act to accelerate or impair decomposition. For instance, porosity affects oxygen levels in the soil. In regard to pH, bone preservation tends to be best in neutral or slightly alkaline soils, where the dissolution of the inorganic matrix of the bone by acids in the soil is reduced (Henderson 1987:46). By contrast, salts precipitating from highly alkaline soils can form crystals that will flake and splinter bone (Behrensmeyer 1978:154). Additionally, the sheer mass of the overlying sediment works against preservation by destroying or warping buried remains.

Postdepositional animal and plant activity influences bone preservation. Burrowing animals and scavengers directly impact bones through minor disturbance, complete translocation of small skeletal elements, or destruction, through either ingestion or burrowing. Invertebrate activity can also impact bone preservation. The decay process will attract a host of insects at all stages. The burrowing activity of some carnivorous snails and beetles can impact remains up to 2 m below the surface and damage the bone, often mimicking pathological conditions (Henderson 1987:49; Smith 1908).

Human remains deposited in areas of abundant flora might also be directly impacted by root growth. Roots can be exceedingly strong, and damage occurs when a root forces its way into a bone, especially through tiny cracks. The result is extreme fragmentation as the root grows and levers the bone apart. Furthermore, plant roots exude a variety of compounds, such as acids, that can score the surfaces of bones (Behrensmeyer 1978:154; Henderson 1987:48; Smith 1976).

Human activity plays a major role in the preservation of skeletal remains. Culture dictates the postmortem fate of the remains of a deceased member of a society. Huntington and Metcalf (1979), as cited by Henderson (1987:49–50), put it succinctly:

> Corpses are burned or buried, with or without animal or human sacrifice; they are preserved by smoking, embalming, or pickling; they are eaten—raw, cooked or rotten; they are ritually exposed as carrion or simply abandoned; or they are dismembered and treated in a variety of ways.

In other words, humans play a major role in how the remains of their dead are treated and deposited, a decision that ultimately affects the types of forces interacting with the body. The burials recovered during the PVAHP were largely interred in a primary context; a smaller component represented cremations, and each type of burial recovered demonstrated different responses to taphonomic processes. The impact of human activity, however, did not stop once the remains had been interred. At LAN-62, in particular, human activity was a major mechanism of burial disturbance. Earlier inhumations and cremations were impacted, and subsequently scattered, by later mortuary events, as well as modern and Historical period mechanical activity, especially the excavation of a Historical period erosion-control ditch (nonburial Feature 16) through the burial area. Discussion of the postmortem fate of human remains discovered during the PVAHP can also be found in Chapters 4 and 9, this volume.

Level of Preservation at LAN-62

Burial Integrity

The level of preservation at LAN-62 varied greatly and ranged from exceptional to extremely poor, the level at which the integrity of the bone could not be maintained after recovery. To assess the overall preservation of burials at LAN-62, the integrity of each burial was tabulated by age category (Figure 91). Because age is a major factor in burial integrity and preservation, individuals with a burial integrity of indeterminate or without an estimated age range could not be included in this analysis. The total number of individuals estimated in the field and during laboratory analysis (n = 949) was narrowed down using these parameters, and a site-wide burial population of 286 individuals with high, medium, low, or no burial integrity was defined for LAN-62.

Figure 91 shows some interesting trends regarding site preservation at LAN-62. Levels of burial integrity were relatively evenly represented by the fetal and senescent burials. Overall, infant burials exhibited the worst preservation, with roughly 80 percent of the burial features displaying low to no burial integrity. That is not surprising, considering that infant remains are very delicate, and their small size makes

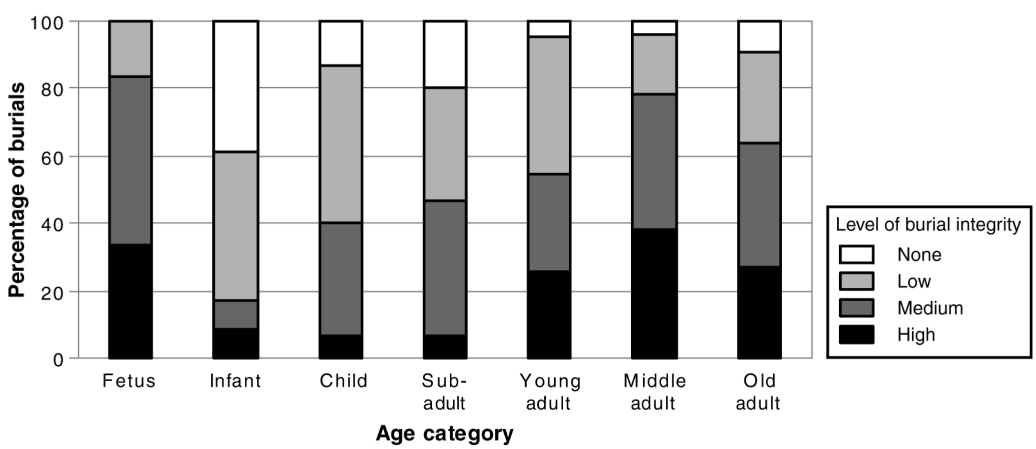

Figure 91. Graph of levels of burial integrity by age category at LAN-62 for all time periods.

them more susceptible to postdepositional transport through the soil by turbative agents than the larger bones of skeletally more-mature individuals. Oddly enough, fetal remains, which would have been heavily impacted by postdepositional forces, exhibited a fairly high degree of burial integrity. Preservation for children and subadults was nearly identical. Most of the burial features in these two groups exhibited medium to low levels of burial integrity. That increase in burial preservation was likely related to changes in the robustness and size of the bone associated with individuals in those age categories.

The skeletal remains of the young-adult individuals at the site appeared to have poorer preservation than the remains of the middle-aged adults. The rather ubiquitous nature of the young-adult burials might account for the diminished preservation. At LAN-62, nearly one-half of the burials were young adults—nearly twice as many as middle-aged-adult burials and almost 10 times the number of juvenile and senescent burials. Such a large number of young-adult burials in comparison to other age categories increased the probability that any one individual would be impacted by taphonomic processes, a likelihood that probably increased throughout the use of the burial area, because continuous use of the area placed earlier burials in greater jeopardy of disturbance by subsequent interments.

The much smaller population of juvenile and senescent individuals than of young and middle-aged adults, as noted above, was likely related to the fragility and subsequent fragmentation of those burials. Burials of many of the younger individuals might have been impacted considerably by taphonomic processes, resulting in their being scattered over a wide area. Such remains would have been recovered as isolated human bone during the excavation of test pits or other burial features and, as a consequence, not included in this particular analysis. Furthermore, poorer preservation of older individuals, because of osteopenic conditions, would have hindered accurate age estimation (see Chapter 9, this volume), and many of them would have been placed with the indeterminate adults, a population that was not included in this analysis of preservation.

Articulatory Integrity

The level of articulation of an individual (articulatory integrity) was compared to the burial integrity of the individual in order to explore the relationship between the two traits (Table 21). Although individuals with an indeterminate assignment in either the articulatory- or burial-integrity category were excluded from this analysis, the sample was not organized by age category like the burial-integrity analysis, and individuals without age estimations were included, which resulted in a slightly larger sample size of 313 individuals. Only individuals with both articulatory and burial integrity were selected.

As expected, when the level of burial integrity decreased, the level of articulation for that individual dropped, as well. The small number of individuals that exhibited a high level of burial integrity but an exceedingly low or nonexistent level of articulation can best be explained by burial type. Cremations and partial cremations are composed of a variety of articulated and disarticulated human bone. When these burial types are found intact, most of the skeletal elements are disarticulated and fragmentary. Instances of articulation are usually reserved for elements associated with dense areas of connective tissue. Isolated human remains that could be identified as belonging to an individual not otherwise represented in a burial (i.e., not one of the burial individuals), as well as heavily disturbed burials, were identified as semiarticulated.

The Spearman ranked correlation coefficient was used to test for agreement, or a relationship, between burial and articulatory integrity. This test was significant (r = .642; χ^2 = 165.776; df = 1; p = .001) and suggested a positive relationship (i.e., as burial integrity increases, so too does articulatory integrity). These results support the statement that burial and articulatory integrity are inextricably related, and one appears to be a function of the other. To test this relationship more fully, a correspondence analysis was performed. The correspondence map highlights the relationship of burial integrity to articulatory integrity. The first two dimensions, or axes, explain over 93 percent of the variation. The correspondence map (Figure 92) demonstrates that the first axis separates burials with low or no burial or articulatory integrity from those with medium to high integrity. Each of the four types of burial and articulatory integrity (high, medium, low, and none) exhibited discrete and relatively close pairings, suggesting that for a particular burial, the articulation of the individual will present a similar degree of integrity. The obvious advantage of a correspondence analysis is that

Table 21. Numbers and Distribution of Burials at LAN-62 Exhibiting Both Articulatory and Burial Integrity

Articulatory Integrity	Burial Integrity				Total
	High	Medium	Low	None	
High	55	40	12	—	107
Medium	15	45	28	1	89
Low	3	10	53	7	73
None	5	2	14	23	44
Total	78	97	107	31	313

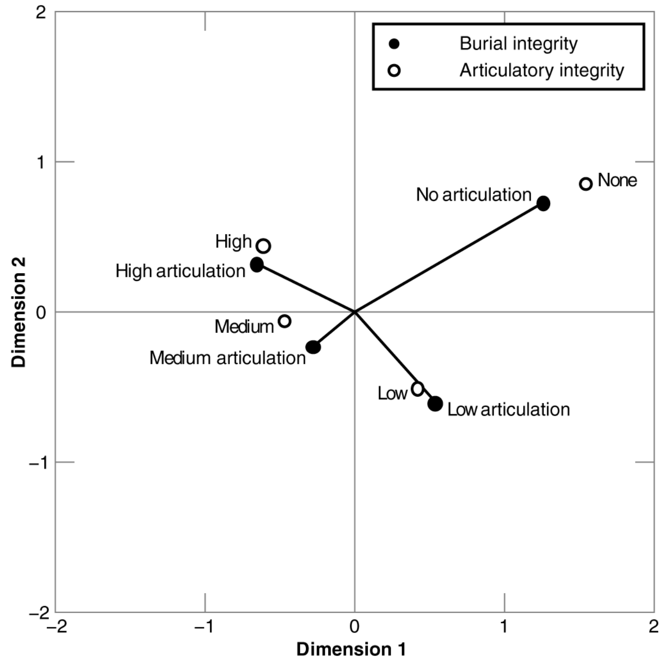

Figure 92. Correspondence map showing articulatory integrity vs. burial integrity at LAN-62.

theoretical interpretations can be supported, both visually and empirically, through interpretation of the correspondence of one variable to another.

Adipocere

Twenty-one burial features in the main burial concentration at LAN-62 had a waxy, greasy, black substance associated with them (Figure 93). That substance was associated with crania and long bones but more commonly was found in the pelvic region. For burial Feature 273, however, the substance was found in association with a steatite olla and might represent the remains of a food offering. Although positive identification of the substance proved to be problematic, the direct association with human remains, the ecology of the site, and the texture of the substance suggested that it might be adipocere or an adipocere-like substance.

Adipocere, also known as grave wax, forms during the natural decomposition process in anaerobic semimoist to wet environments when adipose tissue in the body is transformed (saponifies) into a substance composed of hydroxy fatty acids, and it ranges in consistency and hardness from soft cheese to candle wax (Pfeiffer et al. 1998:368). LAN-62, located near the Ballona Wetlands and Centinela Creek, likely experienced seasonal flooding and had a fairly high water table (see Volume 1, this series). These factors undoubtedly left the soil with a high moisture content, which made the burial area an ideal location for adipocere formation.

All of the burial features that contained this substance were located in the western half of the main burial concentration, and most were located centrally in a broad north–south-oriented band. Furthermore, over half of these burials were predominantly found along the northern and southern periphery of the main burial concentration and were found at comparatively greater depths than were those recovered near the center of the main burial concentration. The presence of this substance at different elevations might be related to differential drainage across the site or water-table fluctuations. Although extensive soil analysis was not conducted in the burial area of LAN-62, redoximorphic features were found in other areas of the site and were associated with yearly fluctuations in the water table. Redoximorphic features are defined as “soil properties associated with wetness that results from the reduction and oxidation of iron and manganese compounds in the soil after saturation with water and desaturation, respectively” (Soil Science Society of America 1996:84). Furthermore, the difference in elevation associated with the burials might be related to the gentle 3–5-percent slope of the original ground surface. Burials located on the leading edge of the slope would have been found at slightly lower elevations than those farther upslope.

Floral/Faunal Activity

Numerous skeletal remains recovered from LAN-62 exhibited evidence of animal activity, in the form of either displacement

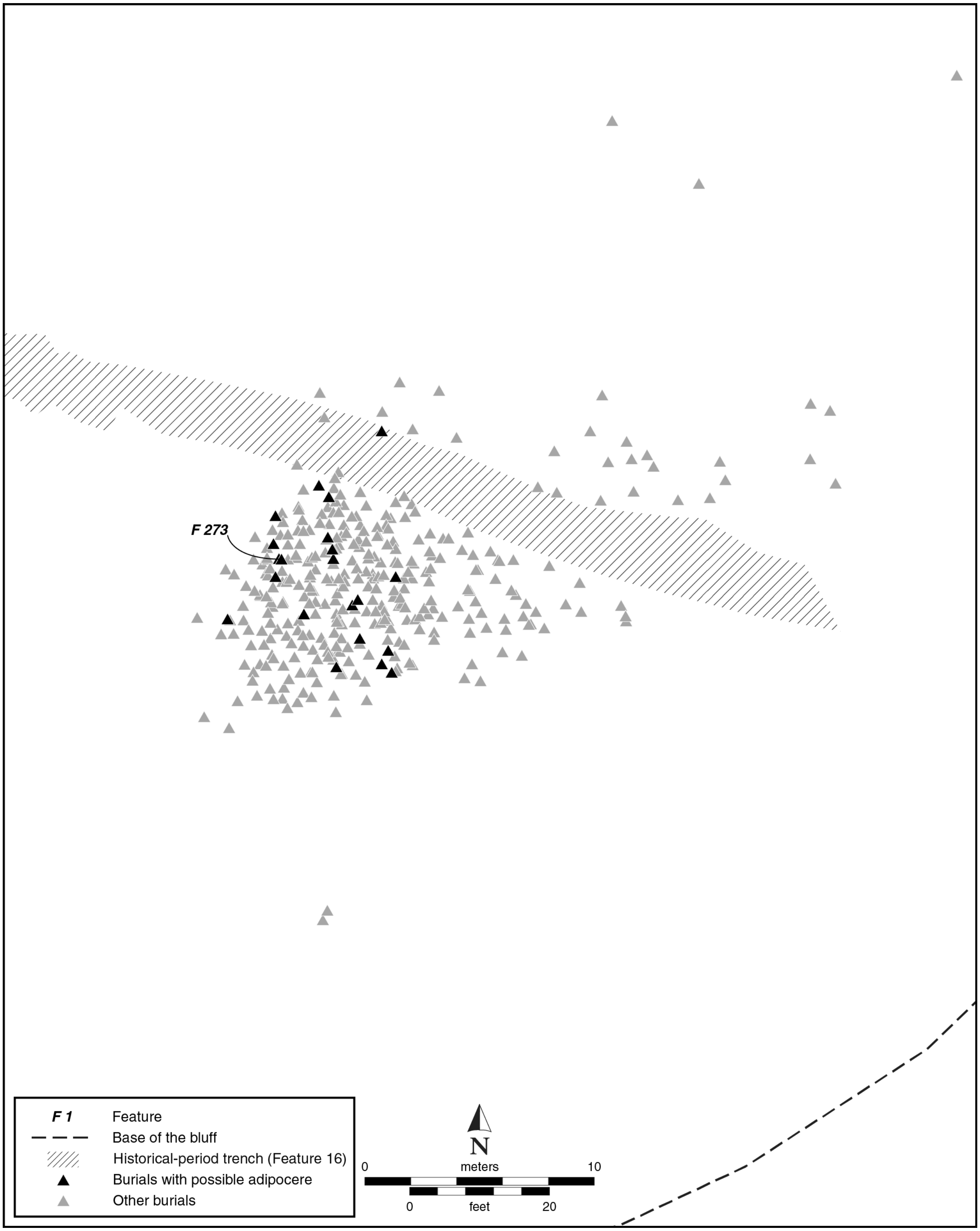

Figure 93. Distribution of burials with possible adipocere formation at LAN-62.

or damage. Although most of the damage to the remains resulted from rodent gnawing, a common occurrence with buried skeletal remains, there were several skeletal elements, both isolated and as part of intact burials, that exhibited marks from non-rodent-scavenger or carnivore gnawing. Many of these gnaw marks suggested disinterment of shallow graves by scavenging animals, but some might have been related to cultural practices, such as leaving the body exposed for mourners to view or for the remains to decompose over a period of time.

Plant- and insect-related damage to the skeletal remains was also noted and included root etching and possible burrow or root holes that perforated some remains. In burial Feature 149, an unsided, unassociated femur fragment of indeterminate sex and age exhibited smooth, floored, U-shaped divots on the external surface of the bone (Figure 94). These marks did not appear to be pathological and resembled the scooped-out appearance of worm tracks that are often found in submerged wood, which is suggestive of their possible origin. Three grooves in a line were noted on the femur fragment, giving it a punctuated appearance (see Figure 94). Unfortunately, although these marks and others found at the site indicated a rich subterranean ecosystem, the exact depths of the burials at the time of interment could not be extrapolated, because of the truncation of the site by Historical period disturbances.

Human Activity

Human activity from prehistoric times to the modern era impacted the burials at LAN-62 more extensively than any other taphonomic mechanism. Because human activity was so pervasive, it will only be addressed here in a summary fashion. Other chapters, especially Chapters 4 and 9, this volume, discuss this aspect of the taphonomic processes in greater detail.

In regard to types of burials, primary inhumation was by far the most-common form of mortuary deposition at LAN-62. A small population of individuals, however, had been cremated, to various levels of intensity, in primary and secondary contexts. This resulted in cremations' exhibiting a range of fragment size, articulation, and degree of burning. Additionally, thermal events led to some incidental burning of nearby inhumations as a result of heat transference through the sediment. Furthermore, burials of all varieties were directly impacted by subsequent burial events, resulting in the fragmentation and dispersal of human-skeletal elements over a wide area. These scattered remains exhibited a wide range of preservation, size, and even articulation. Clearly, the continual use of the burial area at LAN-62 resulted in a constant state of flux, one in which the skeletal remains of an individual may have been disturbed on numerous occasions by subsequent burials, until the burial area ceased to be used. Such behavior is similar to that observed at Chumash burial areas, such as Medea Creek (LAN-243), Humaliwo (LAN-264), and Simo'mo (VEN-26), where discrete family plots were continually used, sometimes to the detriment of skeletal preservation (Gamble et al. 2001; King 1982; Orr 1943, as cited in Martz 1984:157). Regarding use of these family plots, Harrington (1929:172) noted, "if bones were unearthed in the digging of a grave they were respectfully laid aside and carefully reburied before the new interment was completed."

In many instances, burial features directly impacted other burials, resulting in extensive fragmentation and dispersal of skeletal elements. For example, burial Feature 250 consisted of a single primary inhumation (a 25–35-year-old female interred fully flexed on the left side and oriented to the southeast, with the head facing down), four additional individuals, and approximately 80 human-skeletal elements that could not be confidently associated with any of these individuals. Over half of the latter were associated with the appendicular and axial skeletons (see Figure 60). These skeletal remains were found in an 80-cm-diameter, roughly circular burial pit that was clearly delineated by the skeletal remains, which were located around and immediately above the primary inhumation. During the interment of the primary inhumation in this burial feature, several other inhumations and/or a cluster of disarticulated bone had been impacted. Instead of being reburied separately in a discrete concentration, these skeletal remains had been reburied as part of the burial fill associated with the primary inhumation.

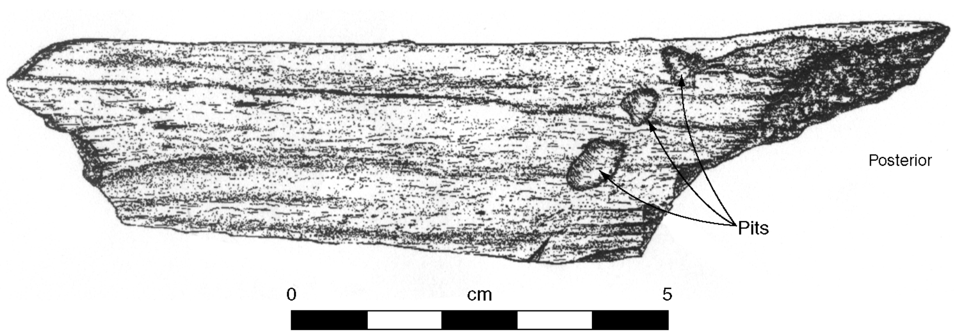

Figure 94. Illustration showing the series of divots or pits observed on the external surface of an unsided femur fragment in burial Feature 149 at LAN-62.

Burial Features 188 and 505 also help to demonstrate how subsequent burial events may have impacted earlier inhumations (see Figures 53 and 86). Burial Feature 188 consisted of a 35–40-year-old female who was interred fully flexed in a prone position and oriented to the northeast, with her head facing southwestward. This burial feature was located perpendicular to and immediately above the primary inhumation of burial Feature 505, a 25–35-year-old female interred semiflexed in a supine position and oriented to the southeast, with her head facing southwestward. The upper thorax and cranium of burial Feature 188 were located within the abdomen/pelvis of burial Feature 505. Furthermore, the ribs, pelvis, right humerus, and left parietal associated with the primary inhumation of burial Feature 505 appeared to have been impacted when the grave for burial Feature 188 was dug. Possible gouge marks (where flat, even pieces of bone approximately 1–2-mm-thick were missing postmortem) were observed on the left innominate superior to the auricular surface approximately 5 cm distal of the sacroiliac joint. The left and right ribs had been broken in a symmetrical sagittal line close to the sternal ends. A possible cut mark was also observed on the medial surface of the distal end of the right humerus, suggesting that the motion that had damaged the ribs might have scraped the humerus. Of the ulnae and radii, only the proximal third of the left ulna and radius was articulated. Fragments of the left and right radii and ulnae, along with elements of the hands of burial Feature 505, were located at her knees. Although aboriginal implements, such as digging sticks, were likely used to dig graves, the presence of a metal hoe blade in burial Feature 438 indicated that other types of tools were potentially available, although this was probably a rarity and not commonly in circulation.

Although the timing between the burial events for burial Features 188 and 505 would be difficult to estimate precisely, interment of the primary inhumation in burial Feature 188 had to have occurred after the primary inhumation in burial Feature 505 had completely skeletonized and the bones had become brittle enough to fragment easily, which could have occurred months or possibly years after deposition.

Not all burials in a close spatial relationship, however, resulted in the disturbance of adjacent inhumations. In burial Feature 173, the two associated primary inhumations appeared to have been interred at or around the same time (see Figure 50). In this particular example, the thorax of the second primary inhumation was located directly above the left forearm of the second primary inhumation. Unlike burial Features 188 and 505, the interment of the second primary inhumation did not result in the disturbance of the first primary inhumation. This behavior was also observed in burial Feature 370, where three primary inhumations were recovered, and in burial Features 180 and 214, in which the skeletal remains of a 32–36-week in utero fetus/infant (burial Feature 180) were found beneath an asphaltum-lined basket immediately above the abdomen and left arm of a young-adult female (burial Feature 214). As with burial Feature 173, no disturbance was associated with these interment events, suggesting that these individuals had been interred together.

Other evidence of disturbance included numerous burial features that consisted of concentrations of disarticulated and fragmented human-skeletal remains. For instance, the cluster of over 50 human-skeletal remains located in the southwestern portion of the main burial area and associated with burial Features 9, 112, and 220 appeared to represent a redeposited band of remains from previously interred, and subsequently disturbed, burials.

Disturbance, however, did not cease when use of the burial area ended. The most-direct evidence of disturbance resulting from nonindigenous human activity was a Historical period trench, nonburial Feature 16, which extended from the northwest to the southeast through the northeastern portion of the burial area. That trench appears to have been an erosion-control ditch dug in association with the construction of the sewer line in the 1920s. The excavation of the trench clearly resulted in damage to burials located near the trench and complete removal of several skeletal elements. In one dramatic example, an articulated left lower leg and foot were recovered 30 cm immediately south of the pelvis of the primary inhumation in burial Feature 300 (see Figure 70). The leg was originally believed to be a separate burial feature, but careful excavation revealed that it was actually from the primary inhumation in burial Feature 300, who was missing the entire right leg and the lower left leg.

The trench also impacted burial Feature 156, because the right side of the primary inhumation appeared to have been crushed and pulled in a southeastward direction. Furthermore, several large fragments of isolated human bone were recovered from an area composed of fill material located immediately north of the southeastern portion of Feature 16. This might represent the spoils pile associated with the trench excavation. The skeletal remains found in this sediment were more than likely associated with the mechanically disturbed burials and might represent either displaced elements from these individuals or an entirely separate individual altogether.

Further likely sources of disturbance to the site consist of early-twentieth-century plowing activities, construction of aircraft facilities by Howard Hughes, pothunting, and archaeological investigations prior to SRI's involvement.

Taphonomy at LAN-211, LAN-2768, LAN-193, and LAN-54

The taphonomic forces affecting the human remains recovered from LAN-211, LAN-2768, LAN-193, and LAN-54 were fairly banal in comparison to those affecting the remains from LAN-62 and consisted primarily of rodent activity and some minor damage incurred during discovery and geodeformation. Of these four sites, only LAN-2768 yielded any burned human remains. They were found scattered and might be associated with a disturbed cremation feature.

The primary inhumations associated with the burial features found at these four sites exhibited a moderate to low degree of preservation (burial integrity) overall. LAN-54 had the best overall preservation, with medium (n = 3) to high (n = 1) burial integrity for the four burials there. LAN-193 and LAN-211 both had similarly poor burial integrity; each had one burial with no burial integrity, one with low burial integrity, and one with medium burial integrity. LAN-2768 had two burials with medium burial integrity and one with low burial integrity.

This indicates that for many of these burial features, less than 75 percent of the skeletal remains could be recovered. Because few burial features were recovered from these sites, it was not possible to perform a detailed analysis of the level of preservation based on demographic information.

Number of Individuals

Traditional methods for estimating the number of individuals in a human-skeletal burial population have relied on the use of MNI equations. The three most commonly used equations for estimating the number of individuals are (1) Max(L, R); (2) (L + R)/2; and (3) L + R – P (Adams and Konigsberg 2004:139; Ringrose 1993:126). For these equations, “Max” refers to the maximum number, “L” represents the number of left-sided skeletal elements, “R” represents the number of right-sided elements, and “P” indicates the number of paired skeletal elements identified from the left- and right-sided skeletal-element pools.

The first equation finds the maximum number of left- or right-sided skeletal elements for a given bone. The number of nonduplicated elements correlates to the MNI in the population. For instance, an inventory of four right femora and three left femora yields an MNI of four. The second equation averages the sum of the left- and right-sided elements for a given element. Both of these formulae, however, have been found to underestimate the number of individuals significantly (Adams and Konigsberg 2004:139).

The third equation tends to generate a higher MNI, because it assumes that each unpaired element is from a different individual. Adams and Konigsberg (2004:139) reported that when compared to the two other formulae, this equation tends to result in an MNI that is less underestimated.

Current research has found the Lincoln/Petersen Index (LI), as used to estimate MLNI, to be of greater use when estimating the number of individuals in a group than any of these three MNI equations (Adams and Konigsberg 2004). This index was originally applied to zoological studies in which a capture-recapture method was used to estimate the population of living animals. Essentially, a sample of animals (*X*) was collected, tagged, and released. At some future point, a second sample (*Y*) was collected. In the second sample, there was the possibility that a number of individuals from sample *X* were likewise captured, forming a subset (*Z*). Assuming that all individuals have the same chance of being captured, one can assume that (*XY*)/*Z* would represent an accurate estimation of the total population.

Even though this method was originally used to estimate living-animal populations, it has equal merit when used to estimate the number of individuals in human- and animal-burial populations from paired elements. In such analyses, researchers have found analogs between the side of an element (*L*, *R*) and the stages of this method, where the initial sample is equivalent to *L*, the second sample is equivalent to *R*, and *P* represents the subset of individuals found in both populations.

The LI can provide accurate estimates in the face of taphonomic biases. This is attributed to the fact that it takes into account random data loss and is not susceptible to variable recovery probabilities as is MNI (Adams and Konigsberg 2004:140, 149). Furthermore, Ringrose (1993:129) has asserted that this formula is of special value when there is a diminished likelihood that the skeletal elements in the assemblage were transported away after the initial deposition and burial. Such a circumstance is likely to occur in discrete burial areas, such as LAN-62, where a large collection of individuals was deposited in the same location over time and remained relatively unaffected by certain taphonomic processes, such as erosion.

Although MNI has been found to be less accurate than MLNI, Adams and Konigsberg (2004:149) have suggested that it should also be calculated for an assemblage, alongside MLNI. Because MNI is heavily dependent on the recovery probability, the degree of disparity between the results might help support the reliability of the estimations or highlight the inability of MNI estimates to cope with data loss.

The MNI for LAN-62 ws estimated using the most-accurate equation described above, $L + R - P$.

$$N = \left\lfloor \frac{(L+1)(R+1)}{P+1} - 1 \right\rfloor$$

Because it has been found to produce considerably less bias when the number of recovered pairs is low, the Chapman variant equation (provided below) as detailed by Adams and Konigsberg (2004:141) was used to calculate the MLNI:

$$MLNI = \left\lfloor \frac{(L+1)(R+1)}{P+1} - 1 \right\rfloor$$

LAN-62

Choice of Elements

Not all elements preserve in an identical manner, potentially hindering their identification. Because of differential preservation, element selection was based on ease of identification and likelihood of preservation. Generally speaking, the larger and denser bones tend to have higher survivability than smaller or more-fragile bones (Waldron 1987:63). Based on that assumption, the element types used in this analysis were individually assessed based on collection methods. Although the petrous portion of the temporal tends to be one of the better-preserved bones because of its great density (Waldron 1987:Table 6.1), cranial elements were not used to calculate MNI or MLNI, because of generally poor preservation compared to femur preservation and because individual cranial elements were generally difficult to track.

Skeletal elements associated with the axial skeleton and extremities were avoided, because they tend to fragment heavily and have very low survivability (Waldron 1987:Table 6.1). Of the long bones, the femur was the obvious choice. Identification of this bone, even in a fragmentary state, is usually very easy, and the size and unique morphology of the femur reduce the chance of misclassification. Furthermore, when compared to other skeletal elements, the femur tends to have a high survivability (Waldron 1987:Table 6.1).

In addition to the femur, the MNI and MLNI for the tibia and humerus were also calculated, to provide some basis for comparison. The survivability of these element types, though not as high as that of the femur, was offset by the fact that these bones are just as identifiable in a fragmentary state as the femur. The ulna, radius, and fibula, on the other hand, were not used, because the shafts of these long bones often appear very similar to one another, and classification error can arise when these bones are found in a fragmentary state.

Regardless of which method is chosen, the basic tenet for estimating MNI and, ultimately, MLNI is to avoid counting the same individual twice (Ringrose 1993:127). To achieve this, a list was generated for each element. The list was then sorted by feature, individual, and side. The list was carefully reviewed to ensure that multiple fragments of the same element from the same side were not included. In many instances, obvious associations between fragments could be made, and the level of completeness recorded for a skeletal element helped to answer additional questions. It was not feasible, however, and was most likely impossible to state definitively whether two fragments were from the same skeletal element. Thus, two estimates of MNI and MLNI were made. The first was based on all entries for a particular element, including entries associated with every completeness score. The second estimate was more conservative, and all fragments were excluded. Left and right elements from the same individual were considered pairs.

Results

The MNI and MLNI for LAN-62 were largely based on the number of femora recovered from the site. As previously stated, MNI and MLNI estimations based on the number of humeri and tibiae were also calculated, to provide some basis for comparison. Based on the number of femora (including fragments), the total MNI for LAN-62 is 425 individuals, with an MLNI of 481. When compared to other elements, however, these estimates were exceedingly high. In fact, these estimates exceeded the tibia and humerus estimates by 130–150 individuals (Table 22). The MNI and MLNI estimates based on the numbers of tibiae and humeri, on the other hand, seemed more similar to one another than to the estimates based on the femora.

What might account for the disparity in estimates? At the basic level, there are many more entries for identifiable, sided femora in the database than there are for identifiable humeri or tibiae. In fact, there are roughly 150 more femora recorded in the database. Furthermore, when these entries were divided based on the level of completeness, the pattern held (Table 23). Simply put, the vast differences in the estimates might ultimately be related to differential preservation. More femora than tibiae and humeri were recovered and identified. This is

Table 22. MNI and MLNI Recovered from LAN-62

Skeletal Element	MNI with Fragments	MLNI with Fragments	MNI without Fragments	MLNI without Fragments
Femur	425	481	349	377
Tibia	306	334	258	269
Humerus	311	354	241	255

Table 23. Distribution of Levels of Completeness Associated with the Humeri, Tibiae, and Femora from LAN-62

Skeletal Element	Complete (n)	Complete (%)	Partial (n)	Partial (%)	Fragment (n)	Fragment (%)	Not Recorded (n)	Not Recorded (%)	Total (n)
Humerus	119	25.8	180	39.0	160	34.6	3	0.6	462
Tibia	118	24.9	221	46.7	132	27.9	2	0.4	473
Femur	168	26.9	283	45.4	166	26.6	7	1.1	624

expected, because the larger size and greater bone density of the femur than those of many other skeletal elements help to increase the survivability of the element. Furthermore, the relative ease in identification of this element increases the number that can be included in an analysis of MNI and MLNI.

Of course, because the ends, and sometimes the shafts, of the femur, tibia, and humerus are easily sided, counting a single element multiple times could conceivably occur, especially with the degree of fragmentation resulting from poor preservation and disturbance. As shown in Table 23, approximately one-third of all entries for femur, humerus, and tibia were fragments. The bone segments represented by these fragments included distal and proximal ends as well as shaft fragments. Often, fragments from multiple segments were recovered from within the same burial feature. Many of these segments were likely from the same individual, but barring genetic testing, an association between these segments could not be made. To test the degree of inflation from inclusion of fragments, a second round of estimates of MNI and MLNI was calculated and excluded fragments. That resulted in a significant overall drop in estimates for all three element types. Once again, the femur provided the highest MNI and MLNI, at 349 and 377, respectively (see Table 22).

These estimates were still much greater than those of the tibiae and humeri, but the gaps between estimates were reduced. Furthermore, the estimates based on the tibiae and humeri were still very similar to each other. Overall, this indicated a fairly uniform drop in MNI and MLNI across these three elements when fragments were excluded. Additionally, the MNI and MLNI calculated from femora (without fragments) were much closer to the number of burial features defined at LAN-62 than previous estimates and were probably more accurate. Although the exact number of individuals buried at LAN-62 will never be known, it is likely somewhere between 349 and 377 and is probably closer to 377, based on conservative estimates.

LAN-211, LAN-2768, LAN-54, and LAN-193

Unlike LAN-62, estimating the number of individuals for the other sites in the PVAHP was comparatively straightforward. With few exceptions, the human remains recovered from these sites came from intact and discrete burial features. Because few isolated human-skeletal elements were recovered in addition to the burials, calculating the number of individuals was much easier.

At LAN-211, the presence of three adult left ulnae clearly indicated that there were at least three adult individuals. Two of these individuals were found in a burial context, and the third was found isolated in the site matrix. Furthermore, a discrete burial feature associated with a perinatal infant represented a fourth individual for LAN-211. Although no ulna was associated with the infant, the demographic information associated with this inhumation did not match that of the other three individuals at the site. Furthermore, an isolated left femur from an infant aged 1–1.5 years was found in the site matrix. This individual was noticeably older than the perinatal infant and was deemed another individual. Therefore, five individuals were identified at LAN-211 (Table 24).

The number of individuals identified at LAN-2768 was based on the presence of three discrete burial features and the scattered cremated remains associated with two additional individuals (see Table 24). One of the individuals represented in the scattered cremated remains was identified by the presence of a burned adult tibial-shaft fragment. Although the remains found in the burial features exhibited only a moderate degree of preservation, each individual had a pair of at least partial tibiae. None of the tibiae exhibited any evidence of thermal alteration. So, it is reasonable to conclude that the burned tibial-shaft fragment originated from another individual. The final individual, also represented by scattered cremated remains, was a child. Because all other individuals found at this site were adult, the remains of the child clearly represent a fifth individual.

Four individuals were identified at LAN-54 through burial contexts, and an additional two individuals were identified by the presence of isolated bone found far from burial features (see Table 24). The lack of large concentrations of burial features and the distance from intact burials (and each other) suggested that the isolated bones found in the sediment associated with LAN-54 were from additional individuals. The number was based on the presence of four discrete burial features. At LAN-193, three individuals were identified based on the presence of three left humeri (see Table 24). These individuals were from intact burial features.

Paleodemography

Introduction

Paleodemography is "the field of inquiry that attempts to identify demographic parameters from past populations derived from archaeological contexts" (Hoppa 2002:9). Meindl and Russell (1998:376) further explained:

Table 24. Numbers of Individuals Identified at Other Sites during the PVAHP

Site No.	No. of Individuals		Total
	Burials	Isolated	
LAN-211	3	2	5
LAN-2768	3	2	5
LAN-54	4[a]	2	6
LAN-193	3	—	3

[a] Two intact inhumations were associated with one burial feature.

> Paleodemography is more than the study of mortality and fertility of archaeological populations. It also includes the estimation of the distribution, density, and age compositions of prehistoric peoples. It considers intrinsic rates of growth and decline, and it may include migration and the age and sex structure of migration as well.

Based on these definitions, the obvious importance of paleodemography to the study of past human populations is readily apparent. Through paleodemographic studies, an understanding of the dynamic changes affecting earlier populations can be gained, be they the effects of disease, conquest, or cultural practices. Yet, as important as this field may be, paleodemography is plagued by a number of assumptions and biases, which, if not taken into account, can skew data, providing a rather tenuous foundation on which inaccurate hypotheses might be based.

Paleodemographers must assume that the forces acting upon current populations likewise acted upon past populations in a similar manner. This is known as the Law of Uniformitarianism—the basic, most fundamental assumption in paleodemography and much of natural science (Hoppa 2002:10). This law further implies that (1) humans have not changed in their biological responses to the environment and (2) the biological development of age-related morphology is the same in all humans, regardless of time and space (Hoppa 2002:11). Without that assumption, paleodemographers simply could not use age-estimation criteria developed using modern human-skeletal comparative collections.

Paleodemography must further assume that the population in question is stationary. In other words, the composition of the population did not change through immigration or emigration and that the age-sex structure remained the same throughout time, with population growth/decline remaining constant (Hoppa 2002:12). Although Acsádi and Nemeskéri (1970) have found that population-structure fluctuations average over time to a growth rate approaching zero, it is imperative that analytical tools are available that allow paleodemographers to capture those fluctuations accurately. That assumption, however, is contrary to a later study by Wood et al. (1992:344), who maintained that populations are not stationary, will change over time, and are more susceptible to fluctuations in fertility rather than in mortality. Because of this, life tables measure fertility more effectively than they measure mortality.

Wood et al. (1992:344) further discussed three additional concerns that paleodemographers and paleopathologists must address during the course of analysis: demographic nonstationarity, selective mortality, and hidden heterogeneity in risks. Demographic nonstationarity refers to the assumption that a population is static and maintains a state of "closure to migration, constant age-specific fertility and mortality, zero growth rate, and an equilibrium age" (Wood et al. 1992:344). Selective mortality presents the notion that a sample does not include individuals who were at risk from a disease at a specific age, only evidence that those individuals died at that age (Wood et al. 1992:344). For instance, two individuals exhibit skeletal responses from an epidemic. However, one individual died during the epidemic, and the second individual survived the epidemic only to die at a later date. Although each individual exhibits lesions, separation of the population into two groups—epidemic victim and epidemic survivor—is impossible. Wood et al. (1992:344–345) also discussed hidden heterogeneity in risks. In other words, a skeletal population is composed of different individuals with unknown degrees of susceptibility to a specific disease. Their susceptibility might have been related to genetics, social status, or temporal changes and may not be readily apparent to the researcher.

Unlike in demography, one of the key components of paleodemographic research, age, is unknown. Researchers must estimate the chronological age of an individual based on their skeletal age, using methods whose underlying biological responses are not fully understood. Furthermore, because of various genetic and environmental influences, secular trends in skeletal development and growth cast further doubt on the eligibility for use as a comparative data set of skeletal reference populations that do not match the sample population temporally (Hoppa 2002:11; Kemkes-Grottenthaler 2002:48). To quote Kemkes-Grottenthaler (2002:48),

> In spite of the strong overall association between maturational and skeletal changes, the aging process is merely universal to the extent that it applies to both sexes and all populations. Beyond that, there is a remarkable interpersonal heterogeneity due to distinctive genetic differences, behavior variation, diverse predispositions, and the individual's lifetime interaction with the environment.

Further misrepresentation of population structure can occur as a result of differential preservation and sex-based age-related changes. Quite often, infants and older individuals, particularly females, are underrepresented in sample populations. For instance, one study conducted by Walker et al. (1988) indicated that an underrepresentation of infant and elderly individuals in the Mission La Purisima skeletal collection could "be attributed in large part to the susceptibility of the remains of people from these age classes to disintegration in the ground" (Walker et al. 1988:187). The highly transportable nature of infant remains by turbative agents, coupled with the fragility of undeveloped bone, resulted in rapid disintegration. A reduction in bone density from age-related osteoporosis, especially among postmenopausal women, likewise weakened the bone structure to a point where bone destruction from diagenic processes occurred rapidly, more so than in younger adults, in whom stronger, denser bones are more common (Ortner 2003:411; Walker et al. 1988:187).

Walker also found that sexual dimorphism continues to develop throughout the life of an individual. For instance, postmenopausal hormonal shifts in women tend to result in an increase in robustness in the crania of older women, and younger males tend to be less robust than older males (Walker 1995:37–40). Such morphological changes can heavily bias a collection when pelvis preservation is lacking and can result in the misclassification of older women as males and younger males as females.

Furthermore, Bocquet-Appel and Masset (1982:Figure 1) have found that paleodemographic profiles of a sample population can mirror the reference population. Current efforts have begun to address these issues through advanced statistical methods, such as the use of parametric and semi-parametric models (Konigsberg and Hermann 2002; Love and Müller 2002; Wood et al. 2002).

Regardless of all these problems, life tables are still useful tools for the bioarchaeologist, if used correctly. Life tables essentially express the probabilities associated with mortality and survivorship for an individual in a given age category within a population (Keyfitz and Flieger 1971:128; Merrett 2003:173). Life tables constructed to analyze the skeletal populations recovered during the PVAHP detailed the following information:

Y_x = number of individuals in each category

d_x = frequency of deaths in an age group (Y_x / ΣY_x) * 1,000

l_x = number of individuals who experienced the event as a proportion of the number of survivors in a cohort. In this instance, the population was standardized with a cohort of 1,000 (e.g., 1,000 were initially born). l_x is calculated by subtracting d_x from the survivors of the cohort from the previous age category (e.g., at age category 1, the d_x is 5, and the l_x is 1,000, but for age category 2, the l_x is 995, or 1,000–5).

Q_x = probability of death for an age category (d_x / l_x)

$Qbar_x$ = probability of death per year (Q_x / the number of years in an age category) (e.g., if the age category is a 5-year increment, then Q_x will be divided by 5)

L_x = person-years lived between an age category (x) and the previous age category (x + n), calculated by $[l_x - (d_x / 2)]$ * number of years in an age category

e_x = estimated life expectancy at the beginning of the age category, or $e_x = (L_x + \ldots + L_{xn}) / I_x$

These equations were taken from Boddington (1987) and Jackes (1986), as reprinted in Merrett (2003).

Population Structure of Non–Mission Period Burials at LAN-62

Unlike other sites excavated in the PVAHP, LAN-62 was associated with a large burial population consisting of numerous males and females of all age groups as well as a large contingent of juveniles ranging in age from fetal to adolescent. Furthermore, the site was relatively intact. Although a Historical period trench cut through the site and impacted several burial features, the trench was located in the northern portion of the site, where burials were arranged in a more diffuse pattern than burials concentrated several meters south of the trench. This placement obviously resulted in a less-severe impact than if the trench had been placed farther south. Although some site truncation was evident from Hughes-era grading, the eastern end of the burial area was removed by Hughes Aircraft Company to construct a runway, and there is evidence that the area was potted (looted) during the 1940s, the main burial area did not appear to have been impacted much, if at all. The site was capped with several feet of fill that protected it from erosion and looting. Furthermore, the eastern end of the burial area exhibited a very low density of burials. In fact, the main source of disturbance came from aboriginal use of the burial area. Several-thousand scattered human remains, likely from a hundred or more burials, were found commingled with approximately 310 intact burials. Continual use of the burial area apparently resulted in the disturbance of earlier graves.

To prevent the inclusion of individuals multiple times, only intact burials were used in the paleodemographic study. Individuals defined by the presence of a small number of scattered remains were excluded. Good demographic information was imperative for this analysis; so, individuals with ambiguous age estimates were also excluded from the life table constructed for the entire site (Table 25). Furthermore, individuals associated with the Mission period were not included in this sample. This reduced the population to 219 individuals. Individuals were placed in age categories based on their mean ages.

Because of good preservation at LAN-62, fetal-age individuals also were recovered. To include these individuals in the life table, months in utero were converted to years, and the life table was adjusted to compensate for this additional age category. Inclusion of these individuals with infants would have resulted in diminished clarity of data. It is important to know how many individuals survived to term as much as it is important to understand how many individuals were born. Furthermore, there were no individuals associated with the 55–59.9- and 60–64.9-years age categories (see Table 25). Such a bias might be related to a combination of preservation issues and limitations in methods used to age adults (i.e., older individuals are more difficult to age because of differences in patterns of degeneration).

Table 25. Life Table for Adult Males and Females and Juveniles in the LAN-62 Non–Mission Period Population

Age (Years)	Y_x	d_x	l_x	Q_x	$Qbar_x$	L_x	e_x
–0.75–0	3	13.7	1,000.0	0.014	0.018	744.9	29.7
0–0.9	11	50.2	986.3	0.051	0.060	961.2	29.3
1–1.9	2	9.1	936.1	0.010	0.016	931.5	29.9
2–3.9	4	18.3	926.9	0.020	0.010	1835.6	29.2
4–6.9	5	22.8	908.7	0.025	0.008	2691.8	27.7
7–11.9	6	27.4	885.8	0.031	0.006	4360.7	25.4
12–15.9	6	27.4	858.4	0.032	0.008	3379.0	21.1
16–19.9	12	54.8	831.1	0.066	0.016	3214.6	17.8
20–24.9	25	114.2	776.3	0.147	0.029	3595.9	14.9
25–29.9	38	173.5	662.1	0.262	0.052	2876.7	12.0
30–34.9	32	146.1	488.6	0.299	0.060	2077.6	10.4
35–39.9	36	164.4	342.5	0.480	0.096	1301.4	8.8
40–44.9	19	86.8	178.1	0.487	0.097	673.5	9.6
45–49.9	9	41.1	91.3	0.450	0.090	353.9	11.3
50–54.9	4	18.3	50.2	0.364	0.073	205.5	13.4
55–59.9	—	—	32.0	—	—	159.8	14.6
60–64.9	—	—	32.0	—	—	159.8	9.6
65–69.9	4	18.3	32.0	0.571	0.114	114.2	4.6
70–74.9	3	13.7	13.7	1.000	0.200	34.2	2.5
Total	219						

Note: n = 219; Agemax = 74.9 years.
Key: d_x = frequency of deaths in an age group; e_x = estimated life expectancy at the beginning of the age category; l_x = the number of individuals who experienced the event as a proportion of the number of survivors in a cohort; L_x = person-years lived between an age category and the previous age category; $Qbar_x$ = probability of death per year; Q_x = probability of death for an age category; Y_x = number of individuals in each category.

Based on the information presented in Table 25, graphs were generated for the survivorship curve and the probability of death per year (Figures 95 and 96). The survivorship curve represents the number of deaths per year for each age category in proportion to a hypothetical cohort of 1,000 individuals conceived in the first age category: –0.75–0 years of age (or conception to birth). This is generated from the l_x column. Based on that information, there appeared to be two rather noticeable peaks in mortality (see Figure 95). The first increase in mortality occurred between birth and 2 years. At that point, the mortality rate of the population spiked from 13.7 deaths per 1,000 individuals during the fetal months to 50.2 deaths per 1,000 individuals at birth. Following the first year of life, that mortality rate plummeted to 9.1 deaths per 1,000 individuals (see Figure 95; Table 25). A trend of gradual decrease in mortality continued from infancy until the late teens, when the mortality rate increased to 54.8 deaths per 1,000 before skyrocketing in early adulthood to 114.2 deaths per 1,000 at 20–24.9 years of age, 173.5 deaths per 1,000 at 25–29.9 years of age, and so on (see Figure 95; Table 25). After that point, mortality remained high until 40–44.9 years of age, when the mortality rate began to decline once more (see Figure 95; Table 25). That relatively gradual loss from birth to young adulthood and a diminished mortality during young childhood is odd. Usually, the transition from breast milk to solid food during the weaning years tended to be exceedingly risky for infants in premodern societies, resulting in an increase in mortality during that time. Such a countertrend might be related to sample bias. Bias in population has been discussed by Cook and Borah (1979), Johnson (1989, 1999), and Walker and Johnson (1992, 1999). In this population, there were fewer than 10 individuals in each age category between 1 and 15.9 years of age. Certainly, the data from mission records indicated that there was a very high infant mortality rate during the Spanish colonial period.

The probability of death per age category, Q_x, can also be used to predict the mortality of a population. At LAN-62, one finds that the probability of death nearly quadrupled from 0.014 during the fetal range (–0.75–0 years) to 0.051 during first year of life before dropping between 1 and 1.9 years of age (see Table 25). The probability of death stayed very low throughout childhood and adolescence before doubling between 12–15.9 and 16–19.9 years of age (see Table 25). It then approximately doubled every age category thereafter

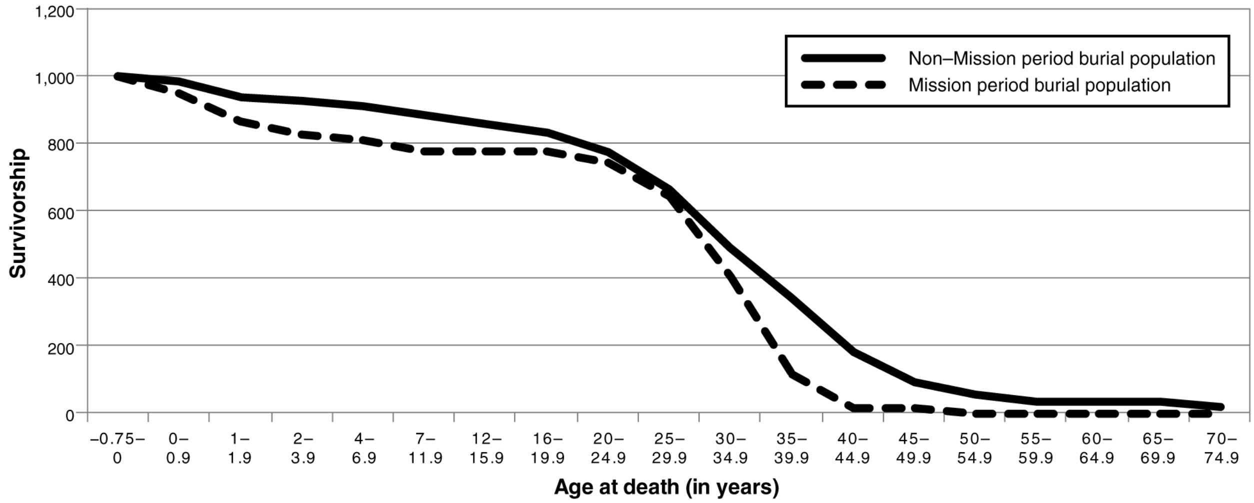

Figure 95. Graph of the survivorship curves for the non–Mission and Mission period individuals at LAN-62.

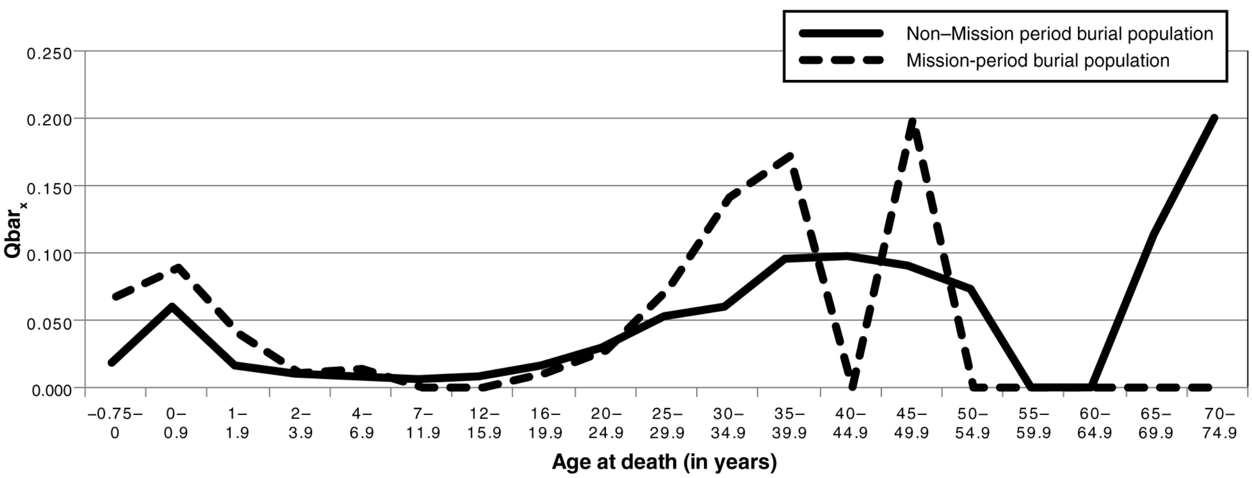

Figure 96. Graph of the probability of death per year for the non–Mission and Mission period burial populations at LAN-62.

from 16 to 29.9 years of age (see Table 25). There was another spike at 35–39.9 years of age before it reached relative stability.

The probability of death per year, Qbar$_x$, was also calculated, to allow for equal comparison between age categories (see Table 25). Figure 96 is a graphic representation of that probability. Based on that information, the probability of death during the childhood years was very low, fluctuating between 0.008 and 0.016 from 1 to 19.9 years of age (see Table 25; Figure 96). The exception to the rule occurred during the first year of life, when the probability of death was 0.060 (see Table 25; Figure 96). Such a probability did not occur again until 25–29.9 years of age, at which point it steadily increased from 0.052, with some stability and reduction between 40 and 54.9 years of age, until reaching 0.200 for the final age category, 70–74.9 years of age (see Table 25; Figure 96). Such a pattern supports previous trends associated with the survivorship curve and the probability of death per age category in that, essentially, at LAN-62, once an individual made it through the initial year of life, the probability of death during the formative years was low by comparison until early adulthood, when the probability of death increased dramatically.

For the population of individuals associated with LAN-62, the mean age distribution was examined for the adult males and females as well as juveniles. Possible male and female individuals were included with individuals with more-definitive sex estimations. Of the approximately 219 individuals represented in the life table, there were only 194 juveniles and adults with unambiguous age and sex information: 90 females, 60 males, and 44 juveniles. Because there were many more females than males and juveniles, frequencies were calculated and graphed so that these populations could be compared equally (Figure 97). Several patterns are readily apparent upon viewing this graph. First of all, among adult females at LAN-62, the population appears skewed toward young adults, and many are associated with the 23–28- and 28–33-year mean-age ranges (see Figure 97). The largest percentages of adult males, on the other hand, were associated with the 18–23- and 33–38-year mean-age ranges (see Figure 97). Few individuals were associated with the 38–43-, 48–53-, and 68–73-year mean-age ranges, and no individuals exhibited a mean-age range of 53–68 years (see Figure 97). Figure 97 further illustrates the trends in the population profile of the juvenile individuals recovered from LAN-62 that were revealed in the life table for the site (see Table 25). The most-common age range among juvenile individuals represented at LAN-62 was the 12–18-year mean-age range, followed by individuals in the birth-to-1-year mean-age range. There also appears to have been a gradual increase from 1 to 8 years of age.

Summary statistics for this same group of 90 females and 60 males, representing a 1.5:1 ratio of females to males, revealed that the two demographic groups were nearly identical (Table 26). Although the female population was slightly younger on average than the male population, the median age of males was 5 years older than that of females. Chapter 7, this volume, provides further insight into the male-female distribution at LAN-62, as well as information regarding variation between the sexes through analysis of nonmetrical characteristics.

As noted above, a large percentage of this population was composed of adult females. To test whether the overabundance of adult females was the result of vagaries of sampling, a one-sample t test was conducted. Based on that test, the difference observed in the percentages of adult males and females in this population and the expected even-sex ratio (50:50 male-to-female ratio) had extremely low significance ($t = 0.004$; $p > 0.5$). The sample was not large enough to enable us to say with any confidence that there was an uneven distribution of sex.

Population Structure of the Mission Period Burials at LAN-62

A much smaller Mission period subset of the burial area was identified in FRED through observed feature relationships and clearly associated artifacts (see Chapter 4, this volume). As with the analysis above, only intact, primary burials were used. This resulted in a sample size of 59 individuals.

The population associated with the Mission period subset followed a pattern of mortality similar to that of the non–Mission period burial population (see Table 25). When survivorship was analyzed, like the non–Mission period burial population, the Mission period subset exhibited two declines in population (see Figure 95). The first occurred between birth and the first year, when mortality increased from 50.8 deaths per 1,000 individuals during the fetal months to 84.7 deaths per 1,000. Mortality diminished after the first year (33.9 deaths per 1,000) and continued to drop steadily until late adolescence/early adulthood. At that point, mortality began to increase dramatically from 20 to 24.9 years, when it effectively tripled from 33.9 deaths per 1,000 during 16–19.99 years to 101.7 deaths per 1,000. That trend continued over the next 5 years, when mortality more than doubled to 237.3 deaths per 1,000 during 25–29.9 years. Mortality peaked at 288.1 deaths per 1,000 between 30 and 34.9 years and began to plummet thereafter.

The probability of death per age category, Q_x, for the Mission period subset was also similar. Like the non–Mission period burial population, one finds that the probability of death increased from the fetal range (–0.75–0 years) to the first year of life, though not to the degree seen in the non–Mission period burial population, before dropping dramatically between 1 and 1.9 years of age (Table 27). The probability of death stayed very low throughout childhood and adolescence, even dropping to zero from the ages of 7 to 15.9 years, before tripling between 16 and 19.9 years of age and 20–24.9 years of age (see Table 27). It then markedly increased in every age category thereafter to 35–35.9 years (see Table 27). The probability of death plummeted to zero between 40 and 44.9 years, but that was likely the result of ambiguities in the data set.

As with survivorship and probability of death per age category, trends seen in probability of death per year, $Qbar_x$, for the Mission period subset were also very similar to those observed for the non–Mission period burial population (see Table 27). Figure 96 is a graphic representation of that probability for the Mission period subset. Juvenile individuals enjoyed low probability of death per year, ranging from 0 to 0.039, a trend seen similarly among the non–Mission period burial population. However, unlike the non–Mission period burial population, which exhibited low probabilities from ages 1 to 19.9, for the Mission period subset, the range also included young adults between the age of 20 and 24.9 years. Furthermore, the first year of life was equally deadly, if not more so, for the Mission period subset, with a $Qbar_x$ of 0.089. At 25 years of age, the probability of death per year began to increase again. In fact, between 20–24.9 and 25–29.9 years, the $Qbar_x$ tripled and then doubled from 25–29.9 to 30–34.9 years. At 35–39.9 years, the $Qbar_x$ peaked before dropping to zero. Such a decline was possibly the result of ambiguities in the data sample, because the $Qbar_x$ spiked dramatically to 0.200 between 45 and 49.9 years. Interestingly, when the $Qbar_x$ for fetal individuals for both populations is compared, one finds that for the Mission period subset, an individual in this age group was approximately twice more likely to die than were fetal individuals in the non–Mission period burial population (see Tables 25 and 27).

As with the non–Mission period burial population, the mean-age distribution was examined for the adult males, females, and juveniles of the Mission period subset. Of the individuals represented in the life table, only 33 individuals were considered, because of ambiguities in age and sex estimations.

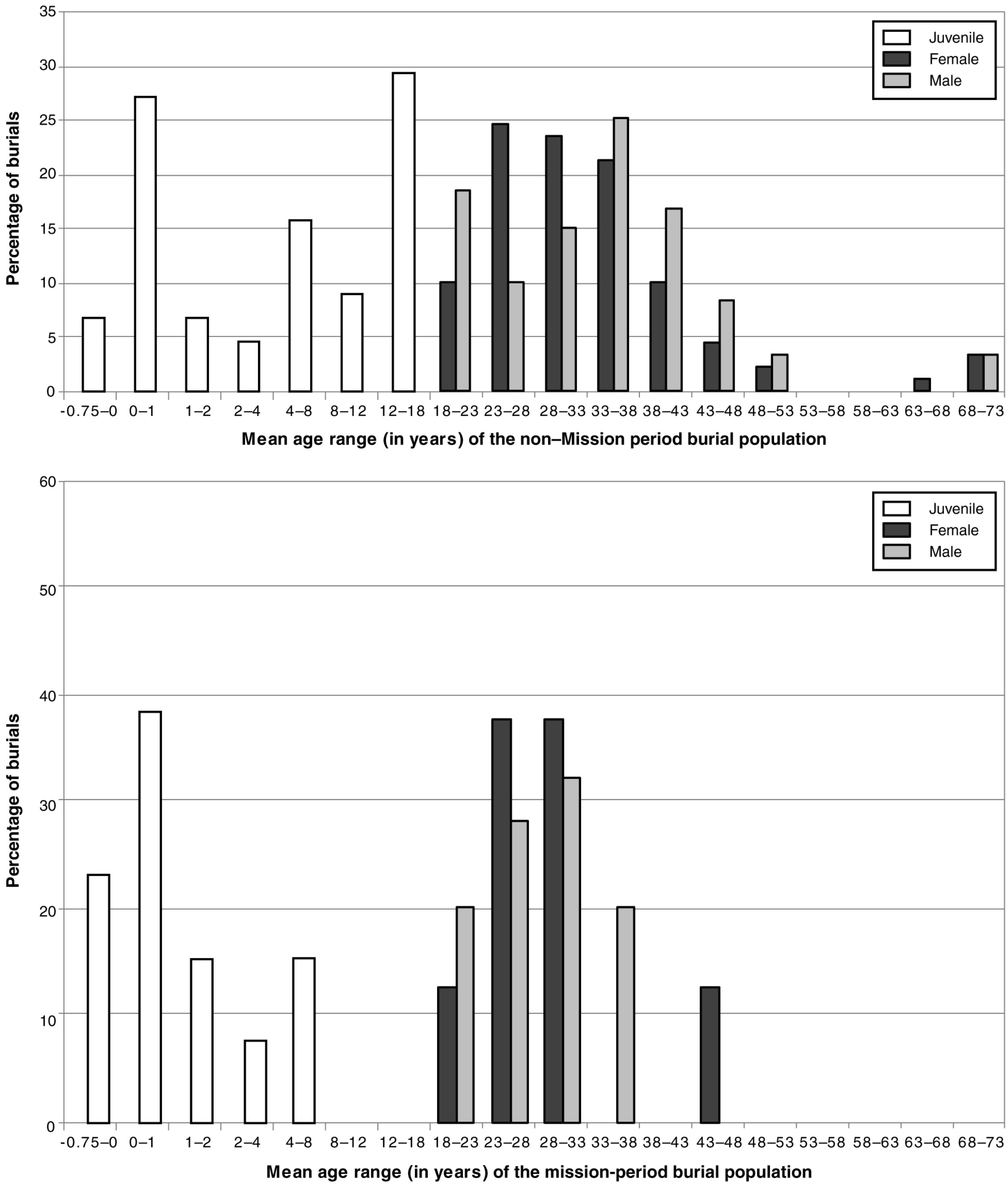

Figure 97. Graphs of the percentages of adult males, females, and juveniles recovered from the non–Mission and Mission period burial populations at LAN-62.

Table 26. Summary Statistics for Adult Males and Females in the Non–Mission Period Burials at LAN-62

Sex	n	Age Range				
		Minimum Age	Maximum Age	Mean Age	Median Age	Standard Deviation
Male	60	18.00	72.00	34.66	35.00	10.82
Female	90	18.00	72.00	33.30	30.00	10.81

Table 27. Life Table for All Adult Males and Females and Juveniles in the Mission Period Population at LAN-62

Age (years)	Y_x	d_x	l_x	Q_x	$Qbar_x$	L_x	e_x
–0.75–0	3	50.8	1,000.0	0.051	0.068	730.9	24.5
0–0.9	5	84.7	949.2	0.089	0.089	906.8	25.0
1–1.9	2	33.9	864.4	0.039	0.039	847.5	26.4
2–3.9	1	16.9	830.5	0.020	0.010	1,644.1	26.5
4–6.9	2	33.9	813.6	0.042	0.014	2,389.8	25.0
7–11.9	—	—	779.7	—	—	3,898.3	23.0
12–15.9	—	—	779.7	—	—	3,118.6	18.0
16–19.9	2	33.9	779.7	0.043	0.011	3,050.8	14.0
20–24.9	6	101.7	745.8	0.136	0.027	3,474.6	10.6
25–29.9	14	237.3	644.1	0.368	0.074	2,627.1	6.8
30–34.9	17	288.1	406.8	0.708	0.142	1,313.6	4.4
35–39.9	6	101.7	118.6	0.857	0.171	339.0	3.9
40–44.9	—	—	16.9	—	—	84.7	7.5
45–49.9	1	16.9	16.9	1.000	0.200	42.4	2.5
50–54.9	—	—	—	—	—	—	25.0
55–59.9	—	—	—	—	—	—	20.0
60–64.9	—	—	—	—	—	—	15.0
65–69.9	—	—	—	—	—	—	10.0
70–74.9	—	—	—	—	—	—	5.0
Total	59						

Note: n = 59; Agemax = 49.9 years.
Key: d_x = frequency of deaths in an age group; e_x = estimated life expectancy at the beginning of the age category; l_x = number of individuals who experienced the event as a proportion of the number of survivors in a cohort; L_x = person-years lived between an age category and the previous age category; $Qbar_x$ = probability of death per year; Q_x = probability of death for an age category; Y_x = number of individuals in each category.

In general, the Mission period subset exhibited trends similar to those of the non–Mission period burial population (Table 28; see Table 26). Figure 97 represents the frequency of adults and juveniles by age for this subset. At a roughly 3:1 ratio, there were many more females (n = 25) than males (n = 8) identified. Furthermore, like the non–Mission period burial population, this subset consisted mostly of young adults. In fact, when the summary statistics of this population and the non–Mission period burial population are compared, one finds that on a whole, the Mission period subset was younger, having mean ages of females and males that were approximately 5 years younger than those of the non–Mission period burial population. Because no old adults were identified in the Mission period subset, the maximum age (47.5 years) was nearly 25 years younger than the maximum age observed in the non–Mission period burial population (72 years).

In regard to juveniles, for both populations, individuals aged between birth and 1 year exhibited the highest frequency (see Figure 97). The greatest difference, however, was in the overall distribution of ages. Where the non–Mission period burial population represented juveniles from fetus to adolescence, the Mission period subset exhibited a complete lack of individuals older than 8 years (see Figure 97). At many sites, such gaps might have been related to sampling bias, but because of the preservation of the human remains, the relative intactness of LAN-62, and the

Table 28. Summary Statistics for Adult Males and Females in the Mission Period Subset at LAN-62

Sex	n	Reported Age Range		Mean Age	Median Age	Standard Deviation
		Minimum Age	Maximum Age			
Male	8	18	37.5	29.25	28.25	8.14
Female	25	25	47.5	28.10	30.00	5.19

precise methods used to excavate the site, that is probably unlikely. The relative lack of juveniles in the Mission period sample may have been the result of three possible scenarios that are not necessarily mutually exclusive: (1) taphonomic processes that make juvenile remains less likely to survive (Walker et al. 1988), (2) the fact that children were more likely to be baptized at the missions than adults and therefore were more likely to be buried there than at their native *rancherías*, (3) decreased fertility in women during the Mission period because of the spread of venereal diseases into the native population.

Population Structure Based on Baptismal Records

As indicated in the introduction, paleodemographers must cope with a suite of problems inherent to the nature of the field. One of these problems is the fact that basic demographic information (e.g., age and sex) must be estimated from skeletal remains that have no adequate reference sample. Furthermore, for many skeletal populations, especially those of prehistoric origins, no demographic information (e.g., census data) is available for use in tandem with the skeletal data. For LAN-62, however, researchers were fortunate to have access to baptismal records for Mission San Gabriel. That information was provided by the ECPP, a public database developed by the Huntington Library (http://www.huntington.org/Information/ECPPmain.htm). Because glass-bead chronology ties many of the burials in the Mission period burial subset to a time range spanning the 1770s to the 1810s, only baptisms occurring between 1771 and 1815 were included in this analysis. Only individuals for which age and sex were recorded were used in this analysis. This resulted in a data set of nearly 2,300 males and approximately 2,400 females. The origins of these individuals were various villages located within the jurisdiction of Missions San Gabriel and San Fernando Rey, including Guaspet, the village most likely associated with LAN-62. (Lists of Guaspet baptisms are provided as appendixes to Chapter 9, Volume 5, this series.)

Like skeletal data, data recovered from historical-period documents have problems inherent to the nature of the material. Although the sex of an individual is visually self-evident, the age of the individual might be estimated by the record keeper. Because of that and because this analysis placed individuals in 5-year age ranges, very young individuals, such as those aged a few days or months, had their ages rounded up to the nearest year.

Using these data, a population pyramid was constructed (Figure 98). Note that the population pyramid reconstructed in Figure 98 is not a snapshot in time but, rather, an overall picture of the ages of recruited individuals at the time they were baptized throughout the period under study (A.D. 1771–1815). Walker and Johnson (1992) demonstrated through reconstructed population pyramids for 10-year intervals that there was considerable change in population structure both within native *rancherías* and within mission communities over time. Two trends immediately stand out in the population pyramid illustrated in Figure 98. First of all, much of the population was very young. In fact, nearly 50 percent of the males and females were less than 5 years of age. For individuals between 5 and 10 years of age, the population composition dropped dramatically to between 11 and 14 percent and continued to decline steadily until there were relatively few older individuals.

Furthermore, unlike the male-to-female ratios for the base burial population and the Mission period burial subset, the baptismal records revealed that the living population was closer to a 1:1 ratio. There are several likely reasons for that disparity. First of all, because of the nature of sexually dimorphic morphological characteristics (i.e., their development is linked to the age of the individual), no sex data were available for the juveniles in the burial populations. Additionally, because of inherent biases in the methods and preservation issues, a portion of adults might have been misclassified. Finally, there were simply more individuals represented in the baptismal records than were recovered from LAN-62. Thus, differences might be associated with sample bias. As previously indicated, accurate age and sex information was not available for some individuals, because of preservation, and the Mission period burial subset was based largely on associated artifacts and spatial information. So, individuals lacking these data could not be included in this subset. It is interesting that the 1:1 ratio of male to female recruits from native *rancherías* was quite at variance from the pattern observed for the Chumash region, where significantly more adult females than males were baptized (Johnson 1989, 1999; Walker and Johnson 1992, 1994).

Such patterns are similar to those seen in the baptismal records of neophytes at Mission San Fernando Rey, where 41.5 percent of the 2,081 baptized individuals died before 5 years of age (Johnson 1999:Table 7.8, reproduced in this volume as Table 29)—a markedly high number, considering that all other 4-year age groups in this population (e.g., 5–9 or 10–14) had percentages ranging from 2.1 to 4.8 percent.

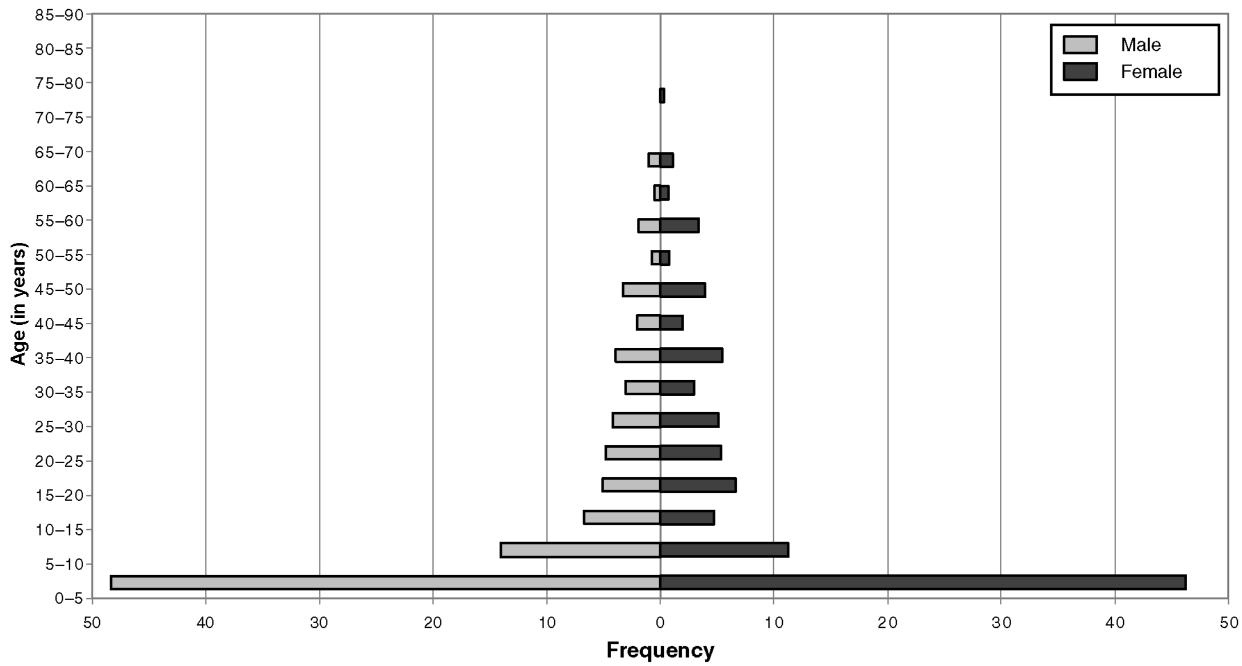

Figure 98. Graph of the population pyramid constructed from baptismal records from Mission San Gabriel (A.D. 1771–1815).

Table 29. Ages at Death of Neophytes Baptized at Mission San Fernando Rey

Age Group (Years)	Males (n)	Females (n)	Total (n)	Percentage of Total Deaths in Age Group
0–4	448	416	864	41.5
5–9	55	45	100	4.8
10–14	17	29	46	2.2
15–19	22	54	76	3.7
20–24	28	50	78	3.7
25–29	25	62	87	4.2
30–34	38	46	84	4.0
35–39	41	48	89	4.3
40–44	39	34	73	3.5
45–49	41	32	73	3.5
50–54	37	35	72	3.5
55–59	34	27	61	2.9
60–64	38	51	89	4.3
65–69	39	43	82	3.9
70–74	37	35	72	3.5
75–79	20	23	43	2.1
80–84	19	26	45	2.2
85+	10	37	47	2.3
Total	988	1,093	2,081	100

Note: From Johnson (1999:Table 7.8).

Table 30. Summary Statistics for Adult Males and Females from Mission San Gabriel Baptismal Records (A.D. 1771–1815)

Sex	n	Minimum Age	Maximum Age	Mean Age	Median Age	Standard Deviation
Male	2,289	18	90	36.71	34	14.25
Female	2,409	18	90	37.65	35	14.95

Additionally, at Mission San Fernando Rey, slightly more males between birth and 9 years of age were dying than females, whereas roughly twice as many female neophytes between the ages of 10 and 29 were dying than males. Between the ages of 30 and 79 years, the numbers of male and female deaths were roughly the same. Beyond 80 years of age, the number of female deaths once again surpassed the number of male deaths.

When the summary statistics for this population are compared to the burial populations, one finds that the living population was generally older (Table 30). The mean ages for the males and females represented in this sample were 7–9 years older than those of the males and females in the Mission period burial population, and the maximum age was approximately 20 years more, although that distinction was likely the result of inaccuracies in aging the older individuals. Such skewing toward the younger ages might have been related to inherent methodological biases associated with paleodemography (see Paleodemography: An Introduction, above).

Further Paleodemographic Analysis: Survivorship and Mortality Models

The following is a comparison of the demographic profiles derived from the excavated skeletal data from LAN-62 and mission records compiled from the ECPP database. A subset of the mission-record sample consisting of 77 entries for people considered to have been first generation from Guaspet (or some derivation of that name—e.g., Guasna, Guaspez, or Guahapet) was culled for a more-refined comparison of individuals who may represent the LAN-62 skeletal sample. As with previous analysis, these data were obtained from both missions that recruited in Guaspet: Missions San Gabriel and San Fernando Rey.

To compare the skeletal data (age-at-death distribution) and the burial records (mission and Guaspet records) in an empirical fashion, estimated survivorship and hazard functions for each sample were calculated and tested for significant differences. The individual parameters for these functions were each estimated using *MLE* (Holman 2000), a DOS-based programming language for estimating the parameters of likelihood models (Holman 2000:1). A four-parameter Siler model was used to assess the entire age-at-death distribution of both samples, as follows:

$$S(a) = \exp\left(-\frac{\alpha_1}{\beta_1}(1-e^{-\beta_1 a}) + \frac{\alpha_3}{\beta_3}(1-e^{\beta_3 a})\right)$$
$$h(a) = \alpha_1 \exp(-\beta_1 a) + \alpha_3 \exp(\beta_3 a)$$

where *a* is a random variable representing an exact age at death, α_1 and β_1 are parameters representing the juvenile mortality, and α_3 and β_3 are parameters representing the mortality of older individuals (Wood et al. 1992). Following Jantz and Owsley (2001), the baseline hazard parameter (α_2) was excluded from the analysis, because it can only rarely be estimated in paleodemographic analyses (Jantz and Owsley 2001).

To examine adult-only and sex-specific mortality and survivorship, the following two-parameter Gompertz model was used:

$$S(a) = \exp\left[\frac{\alpha}{\beta}(1-e^{\beta a})\right]$$
$$h(a) = \alpha \exp(\beta a)$$

Here *a* is a random variable representing an exact age at death, and α and β represent the scale and shape parameters, respectively (Holman 2000). Finally, a likelihood-ratio test of the computed functions was assessed for differences in the modeled functions. If the differences in the functions were found to be significant, they were examined, in an effort to identify the source of these differences.

Using a maximum-likelihood method (i.e., the four-parameter Siler model above), a mean age at death for the LAN-62 skeletal sample of 27.8 years (absolute error <0.001) and a mean age of living individuals of 18.2 years (absolute error <0.002) were calculated. The living-age distribution is presented in Figure 99.

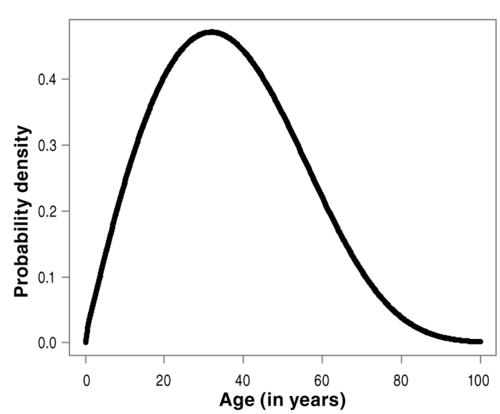

Figure 99. Graph of the living-age distribution of the LAN-62 skeletal population.

The crude birth rate (and death rate, assuming a stationary population) is equal to the inverse of the mean age at death (~0.03). These calculations assume a stationary population, although it is likely that the LAN-62 population was in decline during this period. Unfortunately, it is unclear whether this was, in fact, the case; so, adjustments for growth rate were not made for this analysis. It is interesting to note that the estimates derived from hazards analysis are not dramatically different from those derived from the life-table analysis.

Four independent comparisons were made. First, the LAN-62 skeletal data were compared to both the entire burial-record sample from Missions San Gabriel and San Fernando Rey and the Guaspet sample culled from the full set of records from the two missions. Next, we examined the age-at-death distributions for individuals older than 4 years, using a two-parameter Gompertz model to test the influence of infant mortality on the overall model. Finally, we examined the sex-specific mortality of the LAN-62 skeletal data set, using the two-parameter Gompertz model outlined above.

The Siler competing-hazard models converged normally for all three samples (Holman 2000). However, the ratios of infants to children and mid-range juveniles in the LAN-62 skeletal sample and the Guaspet sample resulted in extreme values for the estimated infant-mortality parameters, α_1 and β_1, particularly for those two groups (Table 31). The likelihood-ratio tests were significant in comparisons between the LAN-62 skeletal data and the mission ($\chi^2 = 158.96$; $p = .000$; $df = 5$) and Guaspet ($\chi^2 = 420.07$; $p = .000$; $df = 5$) records; Figures 100 and 101, respectively, demonstrate these differences. Survivorship lowered considerably after 25 years of age for the LAN-62 skeletal series when compared to the mission records. Figure 101 presents a comparison plot of survivorship for the LAN-62 skeletal sample and the Guaspet records. One possible explanation for the survivorship distribution is the overnumeration of infants in the Guaspet records. In that data set, nearly 30 percent (n = 14) of the entire sample fell into the 0–1-year age class. Moreover, 23 percent (n = 11) of the Guaspet sample was between 1 and 16 years of age, but the age class for 7–12-year-old individuals was empty.

To test whether infant overnumeration at LAN-62 was the cause of the significant differences between the LAN-62 skeletal sample and the Guaspet record sample, individuals under 4 years of age were removed from both samples, and a two-parameter Gompertz model of mortality was fitted to the reduced samples (Table 32). The models each converged normally. The likelihood-ratio test comparing the two distributions was significant ($\Lambda = 12.1$; $p = .001$; $df = 2$) and demonstrated that survivorship was much lower in the skeletal sample. The relatively small sample of Guaspet records likely affected these results to a degree. Examination of the survivorship curve revealed a clear pattern, however. The Guaspet individuals had a relatively lower mortality through middle age than the LAN-62 skeletal sample but a higher survivorship through old age.

Finally, a comparison of sex-specific survivorship and hazard models of the LAN-62 skeletal data was performed. Within the skeletal sample, females outnumbered males nearly 3 to 1. The age-at-death distributions for males and females (and a pooled, combined age-at-death distribution) were calculated using a two-parameter Gompertz model. The parameters for these models are provided in Table 33. Mortality did not significantly differ by sex for the LAN-62 skeletal data ($\Lambda = 1.5$; $p = .90$; $df = 2$). In other words, the probability that a male would die at any age was roughly equal to the probability that a woman would die at that same age. Examination of the survivorship curve demonstrated a slightly higher (but statistically insignificant) survivorship for males than for their female counterparts (Figure 102).

Paleodemographic Analysis of Other PVAHP Sites

Other sites excavated during the PVAHP (LAN-54, LAN-193, LAN-211, and LAN-2768) had few associated burials. Thus, it was not possible to perform a proper analysis of population structure such as the one conducted for LAN-62. Furthermore, inclusion of these burials with the population used to conduct the paleodemographic analysis of LAN-62 was also avoided, to prevent dilution of data. Table 34 summarizes the paleodemographic information for these additional sites. As with previous analyses, each individual was placed in an age category (i.e., young adult, middle-aged adult, old adult) based on the mean of the age range associated with that individual, and possible male and female individuals were included with more definitively male and female individuals.

Although this information is rather limited, a few observations can be made. Overall, there was a fairly normal (for archaeological populations) distribution: there were few juveniles and old adults, and most of the individuals were young and middle-aged adults. Additionally, as with LAN-62, the majority of adult individuals with estimated sex were female. In fact, there was a 3:1 ratio of females to males when the male and female adult populations for all sites but LAN-62 were considered, a ratio similar to that seen in the Mission period LAN-62 burial population.

Table 31. Parameter Estimates of the Siler Model for the LAN-62 Burial Population

Parameter	Skeletal Sample	Mission Records	Guaspet Records
α1	17.489	0.016	13.525
β1	333.431	0.086	307.363
α2	excluded	excluded	excluded
α3	0.009	0.004	0.032
β3	0.058	0.054	0.008
ln(L)	–536.419	–1,126.109	–107.472

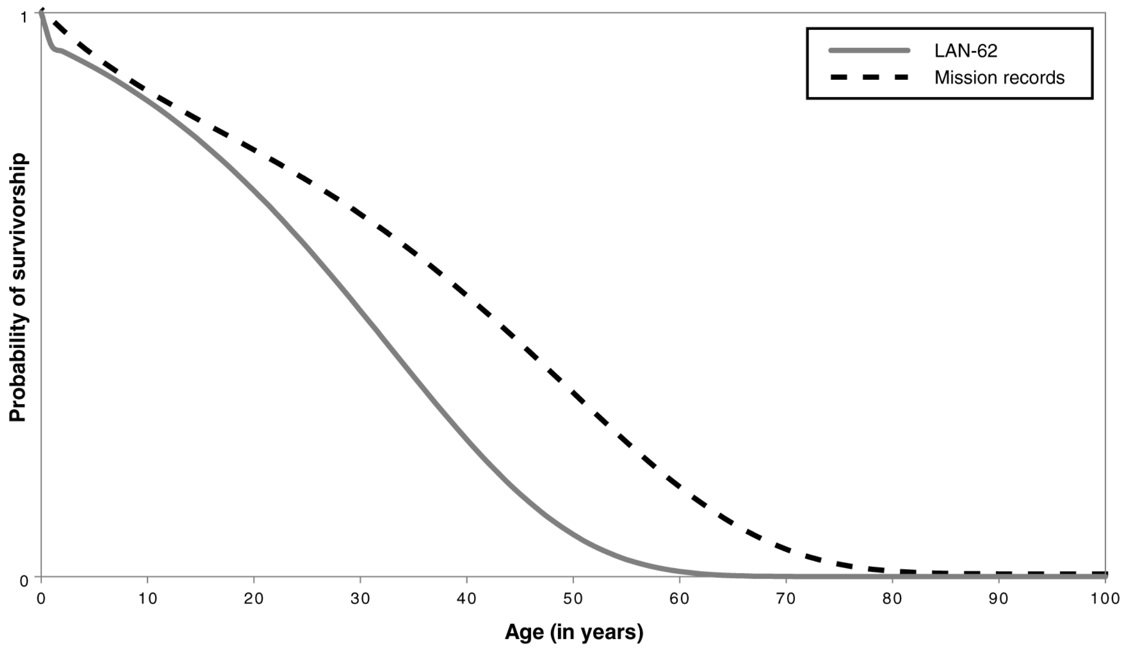

Figure 100. Graph of survivorship for the parameter estimates from the Siler model for the LAN-62 skeletal data and the entire Missions San Gabriel and San Fernando Rey burial-record sample.

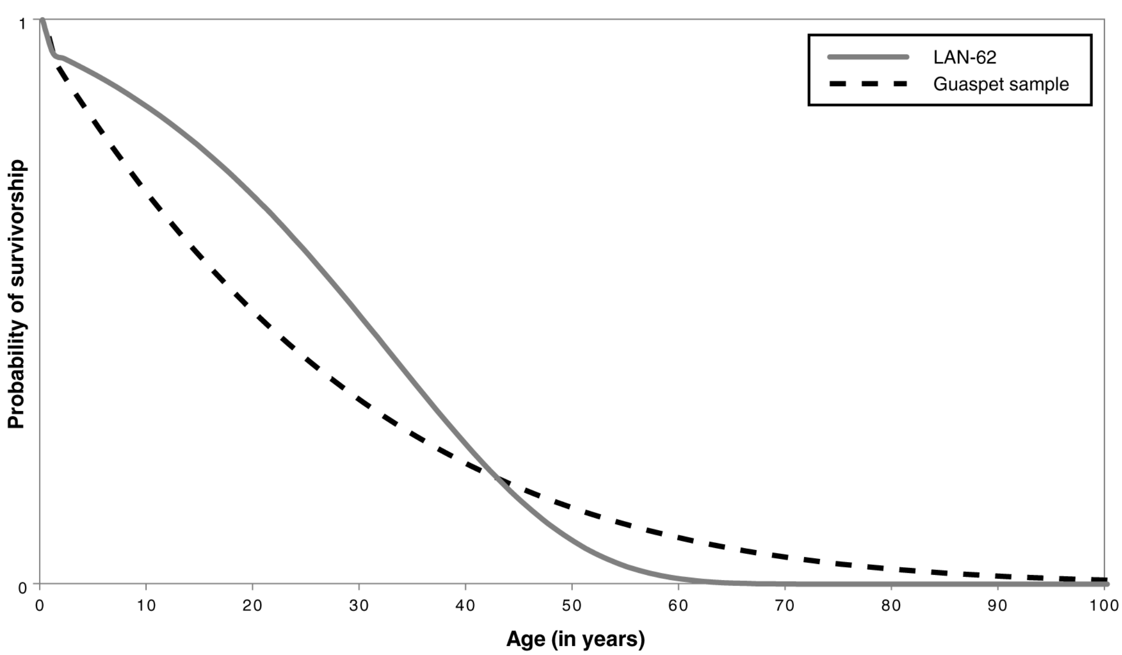

Figure 101. Graph of survivorship for the parameter estimates from the Siler model for the LAN-62 skeletal data and the Guaspet burial-record sample.

Table 32. Parameter Estimates for the Gompertz Model for the LAN-62 and Guaspet Record Samples

Parameter	Skeletal Sample	Guaspet Records
α	0.007	0.010
β	0.062	0.034
ln(L)	–452.925	–59.170

Note: Likelihood Ratio Test: *ln(L)* combined samples = –1,742.006; Λ = 12.1; *p* = .001; *df* = 2.

Table 33. Parameter Estimates of the Gompertz Model for LAN-62 Sex-Specific Mortality

Parameter	Males	Females
α	0.003	0.005
β	0.088	0.080
ln(L)	–104.077	–177.108

Note: Likelihood-ratio test: *ln(L)* combined samples = –1742.006; Λ = 1.5; *p* = .90; *df* = 2.

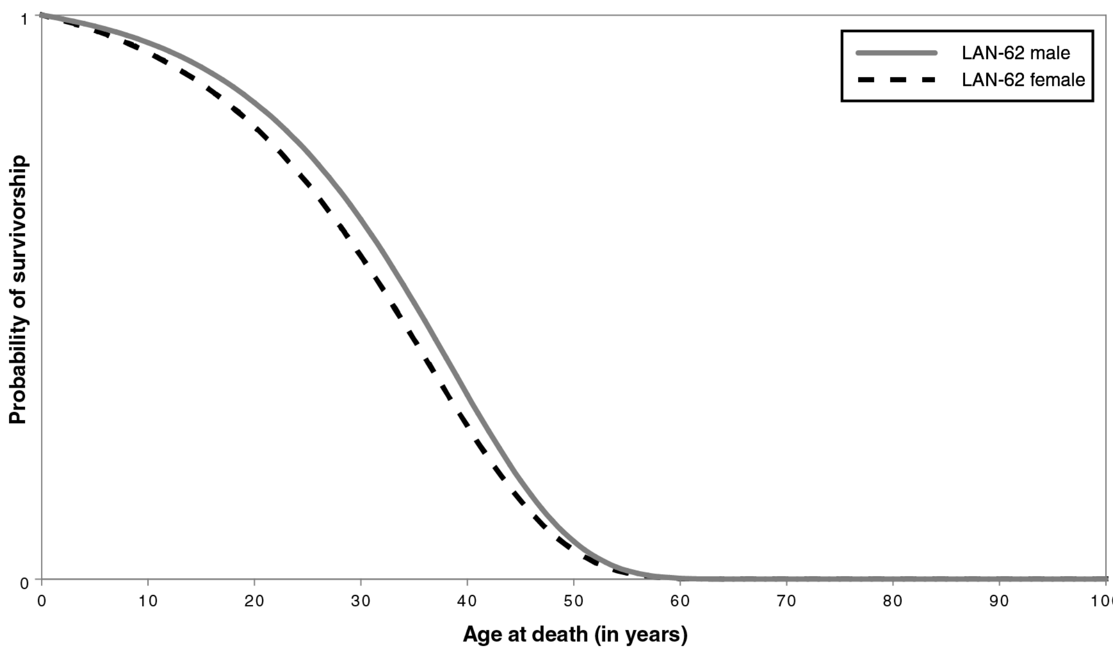

Figure 102. Graph of male and female survivorship derived from the analysis of the LAN-62 skeletal material.

Table 34. Paleodemographic Information for Skeletal Remains from LAN-54, LAN-193, LAN-2768, and LAN-211

Site No.	Fetus (n)	Infant (n)	Child (n)	Subadult (n)	Male (n)					Female (n)					Indeterminate Sex (n)					Total (n)
					YA	MA	OA	AD	Ind	YA	MA	OA	AD	Ind	YA	MA	OA	AD	Ind	
LAN-54	—	—	—	—	—	—	—	—	—	2	2	—	—	—	—	1	—	1	—	6
LAN-193	—	—	—	—	—	—	1	—	—	2	—	—	—	—	—	—	—	—	—	3
LAN-2768	—	—	1	—	—	—	1	—	—	1	1	—	—	—	—	—	—	1	—	5
LAN-211	1	1	—	—	1	—	—	—	—	—	—	—	1	—	—	—	—	1	—	5
Total	1	1	1	—	1	—	2	—	—	5	3	—	1	—	—	1	—	3	—	19

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; OA = old adult; YA = young adult.

Conclusion

Although many burials were excavated during the PVAHP, the sheer number of burials and the level of complexity observed at LAN-62 were unparalleled. Not only were burials concentrated in an area tens of centimeters deep, but most of the burials were intrusive to or impacted by other burials as well as nonburial features. For hundreds of years, the burial area was affected by forces of taphonomy at a micro- and macroscopic level—and human activity was associated with some of the more dramatic instances—ultimately resulting in vastly disparate preservation across the site and within each feature.

Because of variable preservation, achieving an estimate of the number of individuals interred at LAN-62 over the course of time was both challenging and daunting. Unlike for many other burial areas, a simple element count proved inadequate. Instead, complex statistical methods were used to produce the MNI and the MLNI for LAN-62, which were estimated to be 349 and 377, respectively.

Once the problem of estimating the number of individuals represented in the burial area was solved, researchers were able to address questions regarding the population structure of the burial area. Several trends were noted. First of all, female individuals greatly outnumbered the males. Depending on the sample, the ratio ranged from 1.5 to 1, for the non–Mission period burial population at LAN-62, to approximately 3 to 1, among the Mission period burial population. However, when comparing baptismal records from Missions San Gabriel and San Fernando Rey, which included people from the village of Guaspet, one finds that the female-to-male ratio was in reality closer to 1 to 1. Such disparity was likely linked to a variety of reasons, including the lack of sex data for juveniles in the burial population, misidentification because of sexual dimorphism, preservation bias, and larger population represented in the baptismal records. Observations at LAN-62 seemed to mirror those by Walker and Johnson (1992), who documented a dramatic decrease in the number of Chumash women of childbearing age during the Mission period, leading to an imbalance in the sex ratio of men over women by 1822.

Additionally, few children and young adolescents were represented. After infancy, the number of individuals represented declined to almost zero until late adolescence. For the Mission period population, a complete lack of individuals aged between 2 and 4 years as well as older than 8 years was also noted. Furthermore, both males and females tended to die relatively early in life; few individuals represented older generations. The non–Mission period burial population consisted mostly of young adults. When the summary statistics of the Mission period burial population and the non–Mission period burial population are compared, one finds that on a whole, the Mission period subset was younger; the mean ages of females and males were approximately 5 years younger than those of the non–Mission period burial population. Because no old adults were identified in the Mission period subset, the maximum age (47.5 years) was nearly 25 years younger than the maximum age observed in the non–Mission period burial population (72 years).

When the summary statistics for these populations are compared to the population represented in the baptismal records, one finds that the living population was generally older. The mean ages of the males and females represented in the baptismal records were 7–9 years older than those of the males and females in the Mission period burial subset, and the maximum age was approximately 20 years more, although that distinction was likely the result of inaccuracies in aging the older individuals. Such skewing toward the younger ages might have been associated with inherent methodological biases associated with paleodemography (see Paleodemography: An Introduction, above).

To compare the skeletal data and the burial records in an empirical fashion, estimated survivorship and hazard functions for each sample were calculated and tested for significant differences. Using a maximum-likelihood method (i.e., the four-parameter Siler model discussed above), a mean age at death for the LAN-62 skeletal sample of 27.8 years (absolute error <0.001) and a mean age of living individuals of 18.2 years (absolute error <0.002) were calculated. The crude birth rate (and death rate, assuming a stationary population) was equal to the inverse of the mean age at death (~0.03). It is interesting to note that the estimates derived from hazards analysis were not dramatically different from those derived from the life-table analysis.

Adult-only and sex-specific mortality and survivorship were examined using a two-parameter Gompertz model. That analysis found that although females outnumbered males 3 to 1 in the LAN-62 Mission period burial population, mortality did not significantly differ by sex for the LAN-62 skeletal data ($\Lambda = 1.5$; $p = .90$; $df = 2$). In other words, the probability that a male would die at any age was roughly equal to the probability that a woman would die at that same age.

Human Variation

Joseph T. Hefner, Christopher L. Nagle, and Patrick B. Stanton

Introduction

This chapter details the many metrics used to define human variation observed in the skeletal material associated with burials from LAN-62 recovered during the PVAHP. Included is a brief discussion on the analysis of biodistance and logistic regression of sexually dimorphic nonmetrical and metrical skeletal data. Because of the small population size, an in-depth analysis of the metrical data collected from burials from PVAHP sites other than LAN-62 is not included.

Nonmetrical Observations

As mentioned in Chapter 3, this volume, standard nonmetrical cranial epigenetic data were recorded for this project. Compared to other collected data, however, the data set was rather limited because of preservation. Furthermore, few comparative samples were available for study. Regardless, the data were collected for future research and can be found in Appendix I, this volume.

Craniometric Analysis and Biodistance

In an attempt to identify the skeletal population from LAN-62, we compared cranial indexes calculated from craniometric data recovered during the PVAHP to other southern Native Californian populations. From Bass (1995:70), the cranial index is calculated from the following formula:

cranial index = (maximum cranial breadth × 100)/ maximum cranial length

The resulting index can be classified into four groups: dolichocrany (narrow or long head; <74.99), mesocrany (average or medium head; 75–80), brachycrany (broad or round head; 80–84.99), and hyperbrachycrany (very broad head; >85) (Bass 1995:70).

In 1926, using metrical data from living and prehistoric Native Californian samples, Edward Gifford was able to identify seven cranial shapes throughout the state: Yuki, San Francisco, San Joaquin, Buena Vista, Santa Barbara, Great Basin, and Santa Catalina. Of these seven types, the Santa Catalina type—associated with individuals in the Los Angeles and southern Channel Islands—and the Santa Barbara type—associated with Santa Barbara and the northern Channel Islands—seemed most appropriate for the comparison (Gifford 1926a:241). Furthermore, Gifford then created three physical types to describe cranial shape in living individuals: Yuki, Western Mono, and Californian. Gifford (1971:102–103) wrote:

> The Yuki type centers in Mendocino County in north-central California, while the Western Mono type is represented by living peoples in the southern Sierra Nevada and probably by the extinct inhabitants of the Los Angeles coast and of Santa Catalina and San Clemente Islands. The Californian type may be regarded as the one truly typical of the state, for in its three subtypes it occurs throughout the length and breadth of the state, except for the relatively small regions occupied by the Yuki and Western Mono types.

Gifford (1926a:247) found considerable overlap in the areas occupied by the living Western Mono groups and the prehistoric populations exhibiting the Santa Catalina cranial shape and, in fact, commented that Western Mono individuals are probably the nearest, closest living relatives of those earlier people. According to Gifford (1971:103), Yuki crania exhibit a “relatively narrow head and broad nose”; the Western Mono crania are “high-faced, relatively narrow-headed, and medium nosed”; and the California shape has a “broad head and high face.” The Western Mono/Santa Catalina individuals are characterized by a rather dolichocranic skull (cranial index = 72). By contrast, the Santa Barbara–shape crania were more mesocranic (cranial index = 78).

In an attempt to classify the individuals recovered from LAN-62, cranial indexes were calculated and compared to an analysis of skeletal remains from Yaanga (LAN-1575/H) and the prehistoric component from the Humaliwo site (LAN-264), as well as Gifford's data from Santa Catalina Island and San Clemente Island (Goldberg 1999:136).

At LAN-62, although many burials were generally well preserved, only seven crania were intact enough to calculate cranial indexes (Table 35). In many instances, although the cranial elements were represented, ground pressure had crushed or warped the crania, and one or both of the measurements required for calculation of the cranial index could not be recorded. Of the seven crania, six could best be defined as dolichocranic, and the seventh individual was more mesocranic. Interestingly, the mesocranic individual was one of two primary individuals represented in a double burial; no cranial index was available for the second primary individual. The mean cranial index for these seven crania was 69.11, with a standard deviation of 6.80 (see Table 35). Although the mesocranic individual might represent general skeletal variation, it may likewise indicate that individuals from other neighboring groups might be represented at LAN-62. Unfortunately, the sample size was too small to make any definitive statements, and mitochondrial-DNA analysis was not allowed. Regardless, relative proximity to Chumash territory and to Gabrielino/Tongva villages even closer to the Chumash border, as well as similarities in mortuary practices at LAN-62 to those of the Chumash, indicated that the cultural lines were not impenetrable but were more likely semipermeable. It is not outside the realm of possibility that some intermarrying might have occurred.

Though certainly not a representative sample, these seven individuals did provide some clues that helped describe the skeletal population. Goldberg reported that the individuals associated with LAN-1575/H were overall dolichocranic and had a mean cranial index of 68.81—very close to the mean associated with the LAN-62 population. She compared these to the prehistoric component from LAN-264 and Gifford's data from Santa Catalina and San Clemente Islands and found that of the three samples, the individuals from LAN-1575/H were more similar to the island populations (with mean cranial indexes of 71.48 and 74.47, respectively) than the Humaliwo population, which had a mean cranial index of 78.74. Based on this information, the individuals recovered from LAN-62 appeared more similar, skeletally, to those recovered from LAN-1575/H than those from LAN-264.

To further test those conclusions, DISPOP (available at http://web.utk.edu/~mspradle/), a DOS-based program that performs Mahalanobis-distance analysis and canonical-variate analysis using W. W. Howells's craniometric database, was used to compare all craniometric information from LAN-62 to data from five Native American samples: Arikara, Blackfoot, pooled California, Santa Cruz Island (Chumash), and Windover (an Archaic period population from Florida). The pooled California sample consisted of a population of southern Native Californian burials from LAN-54, Zuma Creek (LAN-174), the Los Altos site (LAN-270), LAN-1575/H, LAN-3057, ORA-119-A, and ORA-1587. This sample is assumed to represent Gabrielino/Tongva individuals. The Arikara, Blackfoot, and Windover samples were obviously far removed from the project area, but those groups were included in this analysis to act as a passive sample for comparison to the LAN-62 data set; if the LAN-62 data set was to classify into one of these groups, then measures could be taken to reevaluate the LAN-62 data. Because LAN-62 was located in Gabrielino/Tongva territory near the Chumash territorial border, inclusion of the Santa Cruz Island population, which was historically under the control of the Chumash, and a pooled population of burials from southern California sites was necessary to help answer the question, were the people of LAN-62 Gabrielino/Tongva, Chumash, or both?

Forty-six individuals from LAN-62 were complete enough to include in this analysis. Initial research goals were to compare the Mission period subset, the burials north of the trench (nonburial Feature 16), and burials south of the trench to the reference groups. Unfortunately, only one individual from the Mission period subset was complete enough to include in this analysis, and the burials north and south of the trench were found to be essentially identical. So, the three data subsets were consolidated and tested for overall homogeneity.

Empirically demonstrating the level of variation within an archaeological population presents a number of problems that make a traditional statistical approach difficult. Although the provenience of the population is known, the initial hypothesis to be tested is whether each individual represents a member of the same group. In that case, each cranium initially must be treated as a unique group with a sample size equal to one.

Table 35. Cranial Indexes of Individuals from LAN-62

Feature No.	Individual	Age (Years)	Sex	Cranial Index	Description
77	AI2	35–50	male	73.78	dolichocranic
109	P	18–99	male	71.74	dolichocranic
121	P	indeterminate	female	63.64	dolichocranic
173	P1	35–45	female	79.19	mesocranic
237	no individual	35–99	male	63.16	dolichocranic
249	P	18–99	female	71.76	dolichocranic
284	P	indeterminate	female	60.47	dolichocranic

Key: AI = additional individual; P = primary individual.

Therefore, the actual level of homogeneity within the sample needs to be understood.

To measure homogeneity, the Mahalanobis distance (D^2) is calculated between all pairs of crania, using a vector of cranial measurements and a pooled within-group variance/covariance matrix (VCVM). Recall that the sample size is initially one for each group; so, the VCVM used to calculate D^2 must be replaced with one that represents a hypothetical genetic structure similar to the population from which the crania are thought to derive (Jantz and Owsley 2001).

A conservative approach has been recommended by Jantz and Owsley (2001), who used a pooled within-group covariance matrix derived from the Howells set. That VCVM seemed appropriate, because it incorporates populations selected from around the world and can be customized to populations believed to be similar to the population of Playa Vista (see above); however, for that same reason, the resulting covariance may be slightly inflated (Jantz and Owsley 2001). The VCVM derived from the Howells set was used to estimate the interindividual Mahalanobis distances. Using the Defrise-Gussenhoven (1967) test, the level of population homogeneity was measured. That test is based on the expectation that the distance between two individuals drawn at random from the same population follows a predictable distribution (i.e., $\sqrt{(2p-1)}$, with a variance of 1). That random expectation is then used to decide whether the distance between two crania is greater than would be expected if they were drawn from a different group. If a pairwise distance is greater than the calculated threshold value of random expectation, then the two crania may have been drawn from different population groups and, therefore, would suggest population heterogeneity.

Because of the nature of archaeological materials (e.g., fragmentary and damaged), the number of available measurements was limited. Ten standard craniometric measurements were available for the 46 individuals, however. The random expected distance for the Defrise-Gussenhoven test was 4.58. Any distance greater than 1.65 standard deviations above that value (6.54) would be significant at the 0.05 level or below. In any population, we would expect approximately 5 percent of the sample to fall above that value. The mean distance among the LAN-62 crania was 4.49 (s = 1.34). In this analysis, there were 1,035 pairwise combinations among the 46 anatomical crania; therefore, presentation of the entire data matrix would be cumbersome and uninformative. Overall, the LAN-62 sample was homogenous, a finding that justified pooling all three samples for further analyses. Only two individuals had D^2 distances greater than expected to almost every other individual. Possible explanations for those differences may include several possibilities: measurement error introduced during data collection, those individuals were outliers (a distinct possibility), or they were, in fact, drawn from another group(s).

To explore the range in variation of the LAN-62 sample and to document cranial variability of that population fully, the craniometric data from LAN-62 were compared to multiple Native American groups (outlined above) using canonical-variate analysis. Figure 103 presents the first two principal components. Notice that LAN-62 is situated closest to the California groups. That relationship is further illustrated in Figure 104, a dendrogram representing the derived between-group distances. As one can see, the LAN-62 population was closest to the pooled California sample, a finding not entirely unexpected.

Nonmetrical Sex Estimation

Introduction

In the following section, sex estimation for an adult sample (n = 355) of human-skeletal remains from Playa Vista is explored using logistic regression (Table 36). Because of the archaeological context from which they were recovered, most of the skeletons were fragmentary and lacked pelvic elements (usually considered the most-reliable criteria upon which to base determinations of sex for skeletal remains) and intact skeletal elements for metrical observations, such as head diameters of the humerus and femur. The purpose of the analysis was to develop several univariate and multivariate models for the estimation of sex using five nonmetrical cranial variables (i.e., nuchal crest, mastoid process, supraorbital margin, glabella, and mental eminence [see Walker (2008:41) for illustrations]) that have been used with success in a number of other studies, in lieu of other criteria (Konigsberg and Hens 1998; Walker 1995, 2005, 2008).

Methods

In an effort to develop logistic-regression equations useful for estimating sex from nonpelvic skeletal material, a subset of the total sample of adult individuals (n = 355) was removed, to serve as a “trainer” set for the construction of logistic-regression models. The trainer set comprised 73 individuals (Table 37) with enough pelvic data to confidently sex the skeletons (i.e., the ventral arc, the sub-pubic concavity, the ischiopubic-ramus ridge, the greater sciatic notch, and the preauricular sulcus [see Buikstra and Ubelaker (1994) for definitions and illustrations]). The trainer set was then used to develop univariate and multivariate sex-estimation models that could then be applied to a validation set, using the nonmetrical cranial variables outlined above.

Logistic regression (Agresti 2007:99–136; Garson 2008) is a type of regression analysis used when the dependent variable is dichotomous (e.g., male or female, present or absent) and the independent variables are either continuous or categorical. Continuous variables cannot be used as dependent variables in logistic regression, and there can be only one dependent variable. In this analysis, there are five ordinal, categorical

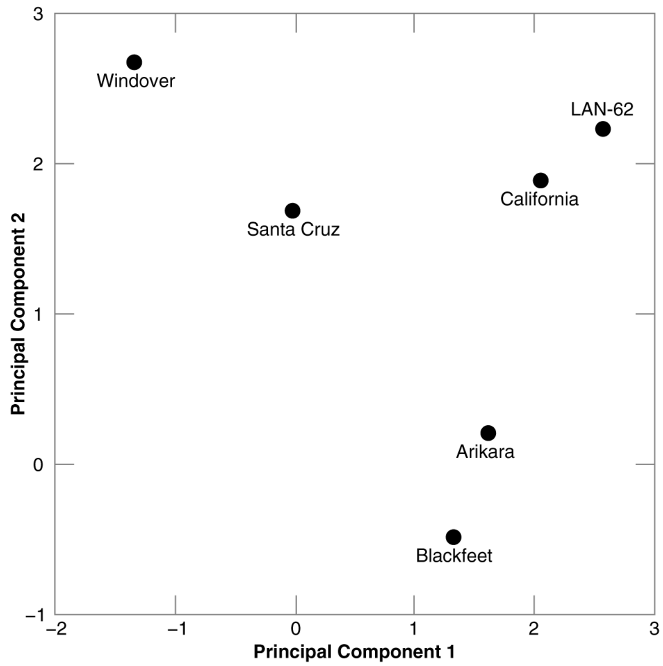

Figure 103. Canonical-variate-analysis results for the LAN-62 skeletal population and the comparative skeletal populations.

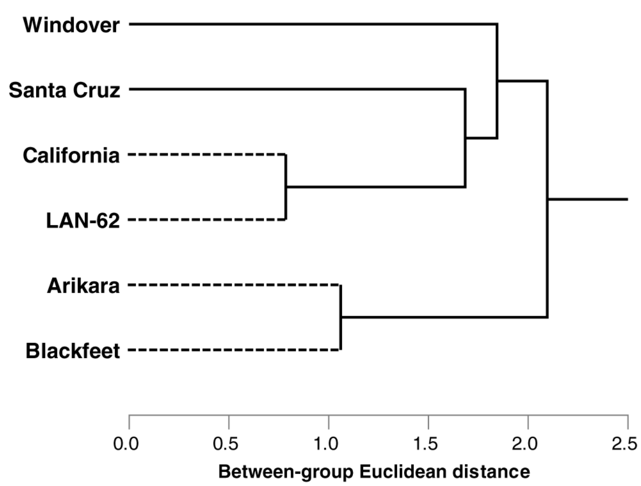

Figure 104. Dendrogram representing the derived between-group distances for LAN-62 and the comparative skeletal populations.

Table 36. Descriptive Statistics for the LAN-62 Adult Sample Used in the Logistic-Regression Analysis

Statistic	All Remains in the Sample	Ventral Arc	Subpubic Concavity	Ischiopubic Ramus	Greater Sciatic Notch	Preauricular Sulcus	Nuchal Crest	Mastoid Process	Supraorbital Margin	Glabella	Mental Eminence
No. of observations	355.00	17	25	17	78	31	72	103	65	51	78
Minimum age	18.00	1	1	1	1	—	1	1	1	1	1
Maximum age	72.00	3	3	3	5	4	5	5	5	5	5
Median age		1	1	1	2	2	3	2	3	2	3
Mean age	31.12										
Age standard deviation	10.97										

Table 37. Descriptive Statistics for the LAN-62 Sample Used in the Training Set

Statistic	All Remains in the Sample	Ventral Arc	Subpubic Concavity	Ischiopubic Ramus	Greater Sciatic Notch	Preauricular Sulcus	Nuchal Crest	Mastoid Process	Supraorbital Margin	Glabella	Mental Eminence
Females											
No. of observations	48.00	10	17	10	45	20.0	17	29	17	14.0	22
Minimum age	19.00	1	1	1	1	—	1	1	1	1.0	1
Maximum age	69.50	2	3	1	3	4.0	4	3	4	3.0	4
Median age		1	1	1	2	2.0	1	2	2	1.0	2
Mean age	33.14										
Age standard deviation	10.28										
Males											
No. of observations	25.00	6	8	7	24	8.0	13	16	13	8.0	12
Minimum age	21.00	2	2	2	1	—	1	1	1	2.0	2
Maximum age	69.50	3	3	3	5	4.0	5	5	5	4.0	5
Median age		3	3	3	4	3.5	4	3	4	3.5	4
Mean age	36.00										
Age standard deviation	10.58										

independent variables. All independent variates (variable values) must be present for each case or observation in a logistic regression; otherwise, the case is excluded from the analysis.

Logistic regression can be used to predict a dependent variable on the basis of categorical independent variables and to determine the percentage of variance in the dependent variable that is explained by the independent variables. The effect of predictor variables is usually explained as a log-odds ratio. To that end, logistic regression applies a maximum-likelihood-estimation method after a logit transformation of the dependent variable (the natural log of the odds of the dependent variable, occurring or not). In this way, logistic regression estimates the odds that a certain event will occur—in other words, whether a skeleton is male or female, based on the suite of nonmetrical cranial traits expressed for that individual.

Unlike the more traditional Ordinary Least-Squares Regression, logistic regression makes assumptions about the distribution of the data. For example, logistic regression does not assume that the relationship between the independent variables and the dependent is linear. Logistic regression also does not require normally distributed variables, or homoscedasticity (equality of the variances). It does, however, require that observations be independent and that the independent variables be linearly related to the logit of the dependent variable. The predictive success of a logistic regression can be assessed by looking at the classification table. Goodness-of-fit tests, such as the likelihood-ratio test, are available to assess model appropriateness. The Wald statistic also may be used to test the significance of the individual independent variables used in the model.

Univariate-Logistic-Regression Results

Univariate logistic regressions were first computed for each of the five independent variables, to determine which showed the greatest promise for inclusion in the multivariate models. To maximize the sample size for the univariate logistic regression, the training set was also examined, to determine which variable(s) were most abundant. The mastoid process (n = 46) and the mental eminence (n = 36) were both sufficiently present for inclusion in a univariate-logistic-regression model. Tables 38 and 39 present the parameter estimates from the logistic-regression analysis for each of these variables, respectively. The cross-validated classification matrices for each univariate model are presented in Tables 40 and 41. Not surprisingly, in the univariate model based on the training set, the mastoid process provided a more reliable estimation of sex (correct classification = 87.0 percent) than the mental eminence (correct classification = 69.4 percent).

These results strongly suggest that a single variable from the cranium (i.e., the mastoid process) could profitably be used to construct a predictor model for sexing skeletons that lack pelvic skeletal elements, at least for the LAN-62 data set. To test that hypothesis, a validation subset of the original data set—one with both pelvic and cranial data—was used to test the efficacy of the univariate-logistic-regression equation using the mastoid process. The following equation was applied to all individuals in the validation set that each had both a mastoid process and at least one pelvic trait:

$$sex = -4.861 + (mastoid\ score)*1.861$$

Assuming that the analyst's assessment of sex using pelvic morphology was correct, the univariate model estimated sex correctly for 85.2 percent of the individuals in the validation sample (Table 42). The individuals misclassified had mastoid scores between 2 and 3—a seemingly ambiguous area in sexual dimorphism for that trait.

Multivariate-Logistic-Regression Results

The overall aim of the analysis presented here was to develop a multivariate predictor model for sexing the human-skeletal remains from LAN-62 that lacked pelvic skeletal elements. Accordingly, a number of logistic regressions that included two or more of the more-promising variables were attempted. Unfortunately, there were a lot of missing values in the data set, both within the trainer subset and among the remaining group of skeletons of unknown sex. Because a case is excluded from the analysis if all independent variates (variable values) are not present, the effect of missing values in the data is to diminish dramatically the number of cases available for analysis. When attempting to combine two or more variables to build a prediction model with the trainer subset, the pattern of missing values causes the number of possible cases to drop.

However, it was possible to construct two multivariate models. The standard errors, *p*-values, and likelihood-ratio tests defined for the models support their inclusion in this analysis and do not suggest that the limited sample sizes seriously affected the results. The parameter estimates derived from the logistic-regression analysis and the cross-validated classification accuracies for the training set are presented in Tables 43–46. The two-variable model using the mastoid process and the nuchal crest correctly classified nearly 89 percent of the training set. The three-variable model using the mastoid process, the mental eminence, and the supraorbital margin correctly classified 80 percent of the training set. The difference in classification accuracy between the two- and three-variable models was likely an artifact of the relative reduction in the overall sample size for the three-variable model.

Using an approach similar to the univariate-validation method (i.e., a validation subset of the data with each required variable for the model and at least one pelvic trait for sex estimation), classification accuracies nearing 90 percent were achieved with both models. The distribution of the log-odds ratios (Figure 105) was bimodal but clearly demonstrated a

Table 38. Parameter Estimates for Univariate Logistic Regression Using the Mastoid Process

Parameter	Estimate	Standard Error	Z	p-value	95% Confidence Interval	
					Lower	Upper
Constant	−4.861	1.346	−3.613		−7.498	−2.224
Mastoid process	1.861	0.554	3.361	0.001	0.776	2.947

Note: *LL(0)* = −30.301; *df* = 1; *p* <.001.

Table 39. Parameter Estimates for Univariate Logistic Regression Using the Mental Eminence

Parameter	Estimate	Standard Error	Z	p-value	95% Confidence Interval	
					Lower	Upper
Constant	−3.081	1.150	−2.679	0.007	−5.336	−0.827
Mental eminence	0.901	0.352	2.563	0.010	0.212	1.591

Note: *LL(0)* = −24.057; *df* = 1; *p* = .003.

Table 40. Classification Matrix for Logistic Regression Using the Mastoid Process

Actual Choice	Predicted Choice		Actual Total
	Female	Male	
Female	13	4	17
Male	2	27	29
Predicted total	15	31	46
Correct	0.765	0.931	
Total percentage correct	87.00		

Table 41. Classification Matrix for Logistic Regression Using Mental Eminence

Actual Choice	Predicted Choice		Actual Total
	Female	Male	
Female	8	6	14
Male	5	17	22
Predicted total	13	23	36
Correct	0.571	0.773	
Total percentage correct	69.40		

Table 42. Classification Matrix for Logistic Regression Using the Mastoid Process and the Validation Sample

Actual Choice	Predicted Choice		Actual Total
	Female	Male	
Female	33	6	39
Male	2	13	15
Predicted total	35	19	54
Correct	0.846	0.867	
Total percentage correct	85.2		

Table 43. Parameter Estimates for the Two-Variable Logistic Regression

Parameter	Estimate	Standard Error	Z	p-value	95% Confidence Interval	
					Lower	Upper
Constant	−8.654	3.814	−2.269	0.023	−16.129	−1.178
Mastoid process	1.857	1.235	1.504	0.133	−0.563	4.277
Nuchal crest	1.556	0.672	2.316	0.021	0.239	2.872

Note: *LL(0)* = −17.323; *df* = 2; $p < .001$.

Table 44. Classification Matrix for the Two-Variable Logistic Regression

Actual Choice	Predicted Choice		Actual Total
	Female	Male	
Female	8	2	10
Male	1	15	16
Predicted total	9	17	26
Correct	0.8	0.938	
Total percentage correct	88.50		

Table 45. Parameter Estimates for the Three-Variable Logistic Regression

Parameter	Estimate	Standard Error	Z	p-value	95% Confidence Interval	
					Lower	Upper
Constant	6.034	3.428	1.760	0.078	−0.685	12.754
Mastoid process	−0.627	1.906	−0.329	0.742	−4.363	3.109
Mental eminence	−1.300	1.426	−0.911	0.362	−4.095	1.495
Supraorbital margin	−0.540	1.381	−0.391	0.696	−3.246	2.166

Note: *LL(0)* = −9.561; *df* = 3; $p < .01$.

Table 46. Classification Matrix for the Three-Variable Logistic Regression

Actual Choice	Predicted Choice		Actual Total
	Female	Male	
Female	5	1	6
Male	1	7	8
Predicted total	6	8	14
Correct	0.767	0.825	
Total percentage correct	80		

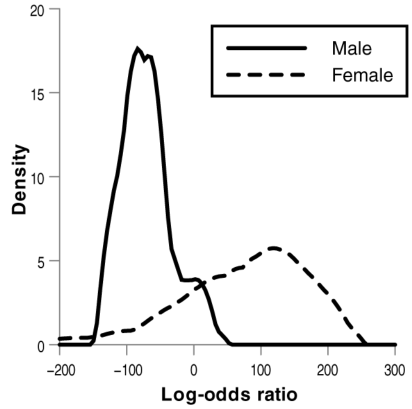

Figure 105. Graph of the distribution of the log-odds ratios using the multivariate logistic-regression model.

Table 47. Summary Statistics for Living-Stature Estimations of Adult-Male and Female Individuals from LAN-62

Sex	n	Mean Stature (cm)	Median Stature (cm)	Standard Deviation	Minimum Stature (cm)	Maximum Stature (cm)
Female	32	147.64	147.99	6.18	134.08	165.02
Male	25	158.74	158.80	4.87	146.34	173.52

much larger range in variation for the male sample than for the female sample and suggested that several of the "male" individuals may have, in fact, been "female." The general robustness of Native Californians may also have had an effect on the number of females misidentified as males; however, that aspect of sexual dimorphism was not explored in the current analysis. Each of the multivariate models performed as well as either of the univariate models. Of course, the small sample size of the trainer set (particularly for adult males) may also have affected the final model. Although the parameter estimates and associated significance values for the multivariate models did not suggest that sample size was an issue, that possibility should not be ignored.

Stature

As previously mentioned in Chapter 2, this volume, stature was calculated using Genovés's formulae for stature estimation among Mesoamericans, because of all available formulae, these were based on a reference population that more closely matched that of southern Native Californians (Genovés 1967:Table 14). Although Genovés's research had demonstrated that the tibia was slightly better for estimating stature for this population, major differences between the collection protocol for tibia length during the PVAHP and the protocols used by Genovés prevented the use of the associated formulae (Genovés 1967:74). Because of those differences, stature was estimated based on the length of femur. For a review of the actual formulae, see Chapter 3, this volume. The living height of an individual was estimated by further subtracting 2.5 cm from the results of those formulae (Genovés 1967:Table 14). As previously mentioned, the reason behind this seemingly counterintuitive procedure was related to the sample population. The stature of cadavers, which were used to develop the stature formulae, has been found to be consistently taller than the living stature of the same individuals (Genovés 1967:69), and Trotter and Glesser (1952:512) found the increase to be approximately 2.5 cm.

Stature was calculated from the maximum length of the left femur, unless it was absent, in which case the right femur was substituted. Furthermore, accurate measurements were preferred over approximate measurements. The hierarchy used to select femora to calculate stature was left, right, possible left, and possible right. Stature was not estimated for individuals for whom sex could not be estimated.

Although hundreds of femora were recovered during the PVAHP, very few were complete enough to estimate living stature. At LAN-62, 57 femora from 32 females and 25 males were analyzed. Roughly half the measurements were from approximated maximum femoral lengths. Table 47 presents the summary statistics associated with the adult-male and female individuals for which living stature was estimated. Based on that information, one finds that the mean living stature for female individuals was approximately 11 cm shorter than that of males. The apparent differences in adult-male and female statures at LAN-62 were highly statistically significant ($t = -7.55$; $p = <.001$), and any vagaries observed in sampling were less than 0.1 percent. As evidenced by the standard deviation for each sex, living-stature estimations for female individuals were spread across a slightly larger range than those for male individuals. That, however, might have been the result of a slightly larger female sample size.

Conclusions

An important research question for the PVAHP concerns understanding of the ethnic and cultural identities of the populations residing in the Ballona Wetlands. Historically, this area was settled by the Gabrielino/Tongva, and the Chumash were located only a few miles north of the project area. Cranial indexes derived from seven individuals from LAN-62 were compared to the remains of individuals from LAN-1575/H, LAN-264/H, and the southern Channel Islands. All but one of the seven individuals resembled the individuals recovered from LAN-1575/H and the southern Channel Islands, which have Gabrielino/Tongva associations, more closely than the individuals associated with LAN-264/H. That was further corroborated by Mahalanobis-distance and canonical-variate analyses, using data sets from W. W. Howells's craniometric database and comparing them to all craniometric information from LAN-62.

As with estimating ancestry, estimating sex from the skeleton is often a population-specific task that is heavily reliant on an analyst's experience with the population under study. Proper methods must be used, and appropriate samples must be identified, if any success is to be achieved. Pelvic traits are generally preferred over traits from any other region of the skeleton. Given the archaeological nature of the LAN-62 remains and the degree of taphonomic destruction in the pelvic region, however, nonmetrical cranial traits were, at times, the only available indicators for sex estimation.

For this skeletal sample, the univariate logistic regressions clearly suggested that several nonmetrical cranial variables can be used to estimate sex in a statistical framework when the more-reliable pelvic traits are not available. Moreover, the two multivariate logistic regressions using these nonmetrical cranial traits are worthwhile and should be explored more fully with larger samples. These results lend credence to the findings of earlier studies that have used these same variables from other skeletal populations.

Dental Analysis

Lorrie Lincoln-Babb

Introduction

This chapter details the analysis of the dental remains recovered in the BLAD during the PVAHP and provides crucial data about an archaeological population, including diet, health status, task-related activities, and female/male variation in behavior and affinity. Although skeletal remains were recovered from all PVAHP sites, only those recovered from LAN-62 are discussed in this analysis. SRI staff osteologists inventoried a number of the teeth from this burial population, but only those thoroughly examined and recorded by the author were considered in this analysis. The burial population of inhumations, cremations, and partial cremations at LAN-62 provided an adequate study sample that included all age cohorts and a fairly equal representation of the sexes. The dentitions of 211 of these individuals were fully documented, and the findings are presented herein. Individuals within the burial area from all time periods were included in this sample.

Methods

Dental-recording forms that fully encompassed the range of potential pathological conditions, dental morphologies, and general dental variation were used. Documentation was accomplished through specific coding criteria and written descriptions, as outlined in detail below.

Sample selection was based on both the quality of preservation for each individual and the necessity of obtaining representative samples of the dentitions from children and adult males and females. To those ends, a master list of the burials with dental remains recovered at LAN-62 was generated, and the level of burial integrity and the age and sex of each individual was noted. Individuals with a high level of skeletal integrity were considered prime candidates for dental documentation, and moderate to low levels of burial integrity followed in decreasing importance. Many burials were not well preserved (had moderate to low degrees of integrity), necessitating the inclusion of less-than-ideal individuals to achieve representative samples of children and adults. Sex identification was a principal concern in the selection process, in light of our goal of compiling equitable samples of male and female dentitions. Because of the nature of the LAN-62 interments, multiple individuals were frequently recovered from one burial feature, which necessitated the examination of all teeth recovered from those burial features, to ensure the proper assignment of teeth to each individual.

A concentration of burials was recognized during the data recovery excavations at LAN-62 (Figure 106), and it is from that burial population that the studied dentition originated. The dental sample consisted of 63 adult males, 74 adult females, and 28 individuals of indeterminate sex that were at least 15 years of age at the time of death. The disparity in sample size for each sex was partly due to the burial-population composition (i.e., more females were identified than males) and the overall preservation of the skeletal material. Dental morphological data were also recorded for 46 subadult individuals less than 15 years of age. Thus, dental analyses were completed for a total of 211 individuals. Appendix G, this volume, documents that sample and includes counts for the numbers of teeth present, observed pathological-condition data, and generalized dental wear.

The dentition of each individual was assessed in the field laboratory. When needed, a 10× hand lens was used to enhance observations. Only the permanent teeth of individuals aged 15 years and older were considered when generating frequencies of carious lesions and other age-related dental pathologies. That "cut-off" age is used by many dental anthropologists, because it allows for some measure of exposure to daily food and activities that may be reflected in the dentition. The length of time that a tooth is present in the oral cavity (i.e., erupted) has bearing on that tooth's susceptibility to pathological conditions. The permanent dentition, excluding the third molars, has typically completed eruption by 12–15 years of age. Pathological conditions observed for those younger than 15 years were recorded if encountered; however, the primary purpose of including the subadult sample in the dental analysis was the assessment of morphological dental traits. Newly erupted and developing permanent teeth generally have no attrition (e.g., wear) to the crowns and are ideal for this type of analysis.

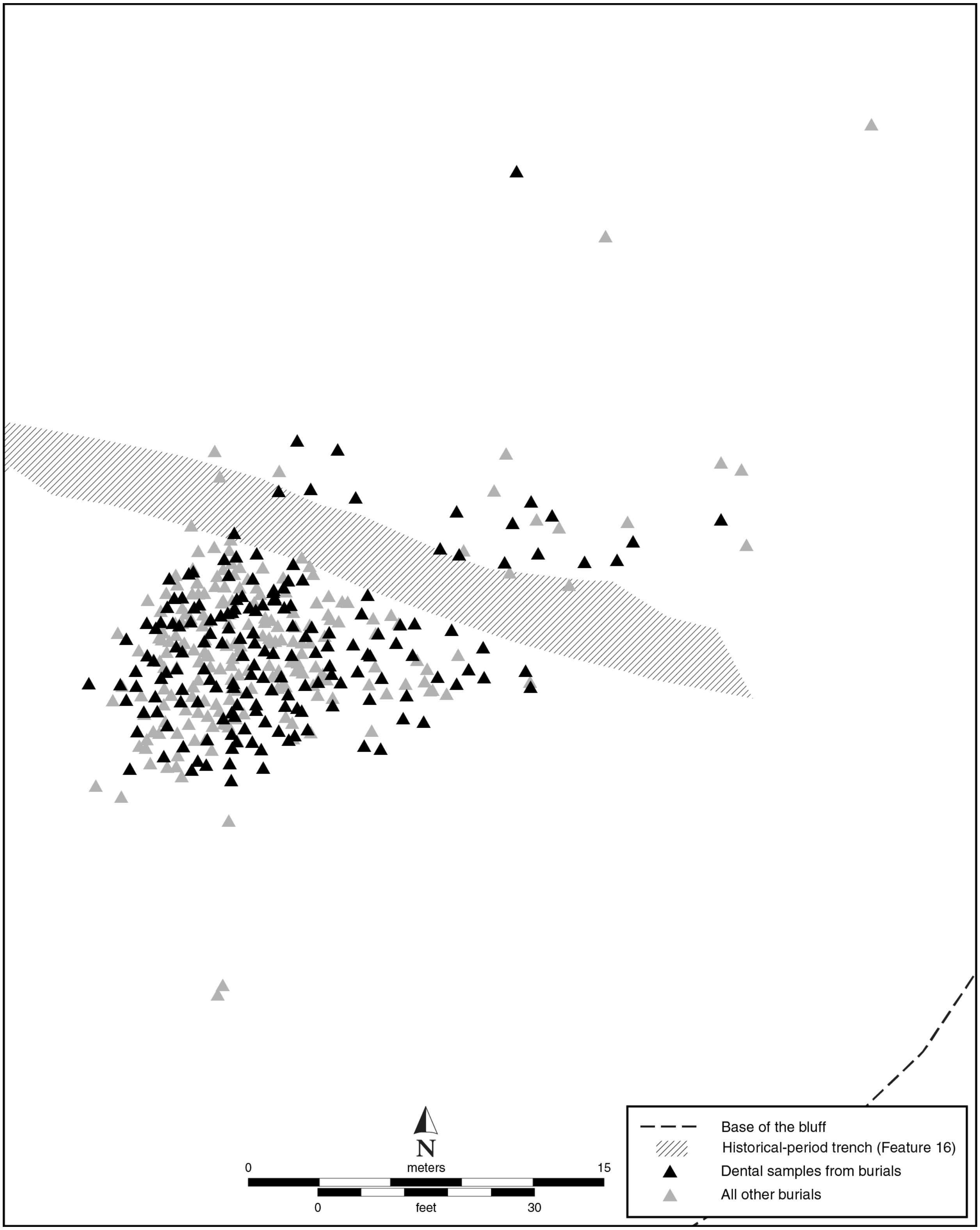

Figure 106. Distribution of the dental samples at LAN-62.

A number of pathological conditions were considered in this analysis, including carious lesions, enamel hypoplastic defects, abscessing, alveolar-bone condition, calculus, and dental chipping. The criteria for identification of dental pathological conditions presented in the *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994) were largely followed. Dental-wear patterns and degrees of attrition were assessed according to the method developed by Molnar (1971).

Observations were also made concerning ante- and postmortem tooth loss, dental anomalies, and dental morphology. Minimally worn permanent teeth were inspected for the presence, absence, and degree of expression of dental morphological traits. Dental morphological traits include the number and size of cusps and roots, the presence of ridges, dental crenulations, and fossae. Each of these traits was recorded following the written descriptions, cast representations, and recording-form content of the ASU Dental Anthropology System (Turner et al. 1991).

All data collected during the dental analysis were entered into the SRI database for osteology and dentition by SRI staff osteologists. The database was accessed, and the feature data were subject to QA. Inconsistencies were occasionally encountered during that process, especially in regard to the number of teeth observed and the age estimates provided by the osteologists. These differences were remedied in the database.

Although poor preservation limited the number of individuals from LAN-62 that could be fully considered in the dental analysis, sufficient data were gathered from the dental remains to draw conclusions regarding the lifeways of indigenous people of southern California. It is also possible to suggest some potential effects of the early days of missionization and to assess aspects of the genetic affiliation of the population.

Previous Research

Extensive research over the past century has documented the lifeways, material culture, and social organization of the aboriginal inhabitants of California (Heizer and Whipple 1971; Kroeber 1976; McCawley 1996). These attributes of native groups have been examined in depth, but extensive comparative data concerning the skeletal biology and dentition of California indigenous people are less than ideal. The vast majority of bioarchaeological studies have primarily focused on the early populations of central California and the Santa Barbara Channel area (Kerr et al. 2002; Lambert 1994; Walker 1978; Walker and Erlandson 1986; Walker et al. 1996). Very few reports discussing the prehistoric and early-historical-period inhabitants of the southern part of the state, specifically the Ballona region, exist in a form appropriate for making comparisons. The human remains recovered from the Ballona Lagoon area in the late 1940s and 1950s by several research groups were not thoroughly documented, and descriptions of these features are not available (Vargas et al. 2005). Less than 20 prehistoric burial features with human remains were recovered from the nearby West Bluffs (at the Del Rey Hills site [LAN-63]) in 2003 by SRI. Poor preservation, disturbed contexts, and only 25 recovered teeth made these remains unsuitable for comparative purposes (Yoshida et al. 2005). Consequently, contemporaneous or local comparative data are largely lacking for the LAN-62 population.

The inhabitants of Los Angeles County at the time of Spanish contact and perhaps centuries earlier were the Gabrielino/Tongva people (McCawley 1996). Several research cohorts believe that this indigenous group also inhabited four southern Channel Islands during the prehistoric period, including San Nicolas (Altschul and Grenda 2002; Ezzo 2002; McCawley 1996). Approximately 450 individuals from various California museum and military collections were studied in a bioarchaeological analysis of the San Nicolas Island prehistoric burial collection (Ezzo 2002). From that population, 181 individuals had preserved dentitions suitable for analysis (Kerr et al. 2002). The burials were recovered over an approximately 50-year period from a total of 46 archaeological sites on San Nicolas Island. Only 19 of those sites could be assigned to a specific period, because temporal control was poor for some excavations. Based on direct dating and associated artifacts, the burial population was divided into two groups: Early (before 3000 B.P.) and Late (after 3000 B.P.). The intent of the temporal divide was to discern possible changes in diet and behaviors occurring over time for the San Nicolas Island people, as well as differences between the San Nicolas Island people and the early inhabitants of the northern Channel Islands and mainland-coast populations. It was postulated that the San Nicolas Island people were dependent upon marine resources and therefore would have lower rates of dental-pathological conditions than the terrestrial-food-dependent Channel Islanders or mainlanders. That did not prove to be the case (Kerr et al. 2002).

No outstanding differences were recognized in dental-pathology frequencies between the two San Nicolas Island groups, although a higher level of antemortem tooth loss was noted in the Early period individuals. Also of note was a slight increase in the number of enamel hypoplastic defects observed in the Late period individuals. The prevalence of carious lesions in each group was similar. Relatively small sample sizes were potentially responsible for the lack of significant differences in dental conditions (Kerr et al. 2002). In comparing the aggregate San Nicolas Island sample to the Channel Island and mainland populations, dental-carious-lesion frequencies were slightly lower for the former. However, other dental-pathology rates, including severe dental wear, were comparable between the San Nicolas Island and Channel Island/mainland groups.

Three burial collections from Santa Rosa Island, also a California Channel Island, demonstrated a dietary shift through time, by means of carious-lesion frequencies (Walker and Erlandson 1986). The Canada Verde burial area (SRI-41) bridged the Early and Middle periods, with occupation dates from 2050 B.C. to A.D. 1650. Two burial areas from different periods were located at the Skull Gulch burial area (SRI-2), identified as Middle period Burial Area A (A.D. 130–1050) and Late period Burial Area B (A.D. 1100–1500). Seventy-nine individuals were recovered from Canada Verde: 14 burials from Skull Gulch Burial Area A and 65 burials from Skull Gulch Burial Area B. Nearly 80 percent of the individuals from Canada Verde had carious lesions, and only 47 percent of the combined Skull Gulch (Burial Areas A and B) dentitions had carious lesions. Females from Canada Verde had more carious lesions than males from the same site; no differences in the distribution of carious lesions by sex were observed for the Skull Gulch populations. The overall reduction in the amount of dental carious lesions and dental attrition for the later Skull Gulch population suggested a transition from a dietary emphasis on tubers and roots, the diet of the earlier Canada Verde people, to a marine-based subsistence. Interpretation of the observed differences in carious-lesion frequencies between males and females from Canada Verde suggested division of labor (i.e., females were gathering roots and tubers and thus had direct access to those cariogenic foods).

Walker et al. (1996) analyzed Chumash burials from the Humaliwo site (LAN-264) in southern California. In addition to burials from the Middle period (A.D. 900–1150), burials from the Historical or Mission period were also recovered. Three burial-area locations were considered in the project, but only the two with unambiguous chronologies were discussed in the report. Unlike a number of other Santa Barbara Channel sites where commingling is an issue and temporal sequences are difficult to establish, the two burial areas from the Humaliwo site represented distinct periods of occupation that were relatively isolated within the site. That allowed for comparative analyses between the people that lived in the area before Spanish contact and those living in the area after Spanish contact. Changes in the diet, health status, activity patterns, and influx of disease between the two populations were of particular interest. The sample size for the Middle period was 16 females and 36 males, and 36 males and 34 females were identified for the Historical period. Four age cohorts (subadult, young adult, middle adult, and old adult) were created for each period for the dental analysis, and teeth were assigned to one age group for the analysis. Any differences between males and females were examined within and between temporal periods. Walker et al. (1996) expected the Middle period individuals, who practiced hunting-and-gathering subsistence, to have lower frequencies of dental pathology than the individuals from the Historical period, who were more reliant upon agricultural produce after the establishment of the mission and were therefore more exposed to infectious disease. Both conditions generally resulted in increased dental-pathology manifestation. Remarkably, dental health proved to be better in the individuals from the Historical period. The unexpected greater frequency for carious lesions and dental attrition in the Middle period was considered the result of a harsher, more abrasive diet, and one with more carbohydrates, than the Historical period diet. Differences in dental pathology for males and females were observed for the Middle period but not the Historical period.

The proximity of San Nicolas Island, Santa Rosa Island, and the Humaliwo sites to Playa Vista and the possibilities of both contemporaneity and ethnic relationships among all these populations make them worthy as comparative groups for the population of LAN-62.

Dental Carious Lesions, PCE, Abscesses, and Antemortem Loss

The best-known dental-pathological condition is carious lesions, most commonly referred to as "cavities." Dental carious lesions are not simply areas on teeth where the enamel, dentine, or cementum has been destroyed. Instead, they constitute a progressive oral disease that may spread to adjacent teeth and radically affect the overall dental and physical health of the individual (Mandel 1976; Tanzer 1995).

Briefly, the enamel of the crown or the cementum of the root may become compromised from the retention of plaque-forming bacterial agents from certain foods or the chemical composition of the saliva from the host that lead to initial dental-caries formation. A microscopic area of discoloration is the first indication of a carious lesion. The affected area typically increases in size and becomes a lesion with the demineralization and breakdown of the surface area. Ultimately, if not treated by removing the necrotic area, a carious lesion will continue through the dentine and enter the pulp chamber. The result is most often an abscessing of the associated alveolus, or tooth socket, and the eventual loss of the tooth. Carious teeth may jeopardize the overall physical health of an individual in several ways: (1) mastication becomes so difficult that nutritional intake is decreased, (2) untreated and active carious teeth can be the source of systemic or chronic infection, and (3) carious maxillary teeth can lead to infection in the sinuses and brain, resulting in death. The carious-lesion, PCE, and abscess frequencies for the LAN-62 adult population are presented in Tables 48–51. Note that in this table, percentages represent ratios of the numbers of diseased teeth to the numbers of healthy teeth.

Any macroscopic opening into the central core, or pulp chamber, of a tooth is identified as PCE, which typically develops within a carious lesion on the occlusal surface and the interproximal areas of the crown or at the cementoenamel junction of a single tooth. In addition to carious lesions, severe attrition can create PCE when the enamel and dentine structure of the tooth are lost or compromised. Tables 49 and 50 present the relative frequency of PCE in the LAN-62 burial population as it relates to carious lesions and noncarious dentition. Although severe abscessing may cause PCE, the majority of abscesses observed at LAN-62 were related to noncarious PCE from extreme wear/attrition.

Antemortem tooth loss, or the exfoliation of a tooth before death, though most frequently caused by dental caries, can also result from extreme wear. The complete resorption

Table 48. Carious Lesions and Observed Tooth Counts for the LAN-62 Burials

Sex	Observed Females	Observed Males	Combined Observed Known-Sex Individuals	Expected Females	Expected Males	Observed Indeterminate-Sex Individuals	Total
No. of healthy teeth	1,606	1,223	2,829	1,612.5	1,216.5	440	3,269
No. of carious teeth	84	52	136	77.5	58.5	9	145
Total	1,690	1,275	2,965			449	3,414
Percentage[a]	5	4	5			2	4

Note: Males vs. females: $\chi^2 = 1.02$; two-tailed $p = .31$.

[a] Each percentage was calculated as the number of observed carious teeth/the number of observed healthy teeth.

Table 49. Numbers of Carious Teeth with PCE in the LAN-62 Burial Population

Sex	Carious Teeth	PCE Teeth	Percentage[a]
Females	84	51	61
Males	52	34	65
Indeterminate	9	6	67
Total	145	91	

[a] Percentages were calculated by dividing the number of teeth with PCE by the number of carious teeth for females, males, and indeterminate-sex individuals, respectively.

Table 50. Numbers of Noncarious Teeth with PCE in the LAN-62 Burial Population, by Sex

Sex	PCE Teeth
Females	13
Males	79
Total	107

Table 51. Percentages of Abscesses for LAN-62 Adults, by Sex

Sex	Abscesses (n)	Total Individuals (n)	Affected Individuals	
			n	%
Females	31	38	16	42
Males	64	34	23	68
Indeterminate	5	5	2	40

Table 52. Antemortem Loss of Teeth for LAN-62 Adults, by Sex

Sex	Antemortem Loss (n)	Total Individuals (n)	Affected Individuals	
			n	%
Females	45	51	21	41
Males	46	32	19	59
Indeterminate	1	9	1	11

or remodeling of a tooth socket can occur in a matter of months and is indicative of antemortem loss. The general lack of preserved alveolar bone for some of the individuals recovered from LAN-62 did not prevent the collection of data on antemortem tooth loss and retention for 92 individuals (Table 52).

Overall, developing an understanding of the probable causes of observed PCE (i.e., abscessing and antemortem loss) in a population is important for assessing carious-lesion prevalence. Each of these aspects of dental health are interrelated, but PCE, abscessing, and antemortem loss are more logically explained by heavy wear than by carious-lesion formation, alone, and that was the case with the LAN-62 individuals. This conclusion is further validated in the Dietary Reconstruction and Dental Wear and Cultural Observations sections, below.

Dietary Reconstruction

The primary determinants for carious-lesion formation are the types of food consumed and the degree of dental hygiene. Carbohydrates, proteins, and fats are major dietary nutrients affecting carious-lesion prevalence. Understanding the interplay of these nutrients and dental hygiene can provide insight into how diet affects the development of carious lesions.

Carbohydrates, present in high levels within plants, are essential dietary nutrients and a prime source of energy for humans (Miller 1966a). In addition to providing energy, these compounds also act to transform other nutrients for use by the body. Carious-lesion formation has been definitively associated with the consumption of processed carbohydrates, like sucrose (or sugars), the most potent cariogenic substance. Moreover, highly processed, starchy, pasty carbohydrates are

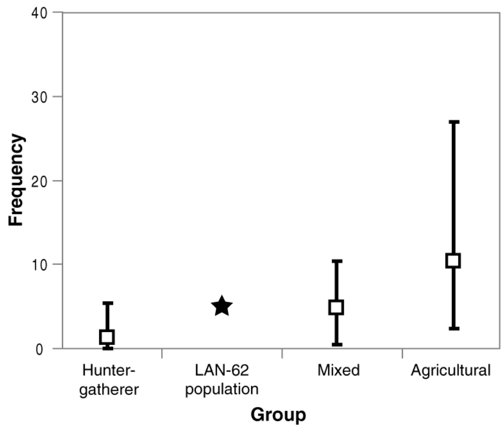

Figure 107. Graph of the comparison of Turner's carious-lesion frequencies in the LAN-62 burial population with respect to hunter-gatherer, mixed, and agriculturalist subsistence patterns.

Table 53. Carious-Lesion Rates for Adults (Aged at Least 15 Years) at LAN-62

Carious-Lesion Rate	Percentage
Observed caries frequency	4.30
Corrected caries frequency	5.30
Individual caries rate	43.60

Note: Mean number of caries per individual = 0.95.

exceedingly cariogenic, because their sticky consistency adheres readily to the teeth, where they are transformed into fermentable sugars (Harris 1966).

Proteins constitute another fundamental dietary nutrient present in most foods, and meat and fish are commonly recognized sources of protein. A number of studies have suggested that diets high in protein may promote dental-caries-free dentition, because proteins have little to no cariogenic properties (Alvarez et al. 1990; English and McClure 1966; Sweeney 1966).

Fat is also an important nutrient, although the significance of it to the formation of dental caries is uncertain. Some researchers suggest that a minor increase in carious-lesion frequencies results from the addition of hydrogenated fat to a cariogenic diet, because it secures the sugars within the pits and fissures of the teeth (Loe 1993; Nelson et al. 1990; Wood et al. 2003). However, Miller (1966b) hypothesized that fats create a protective barrier on the surface of a tooth that prevents sugars from fermenting and, therefore, hinders the development of carious lesions. Although fats may not be well understood in relation to dental caries, a high-fat diet has been associated with periodontal disease, another oral pathology (Loe 1993; Nelson et al. 1990; Wood et al. 2003).

Understanding the frequency of carious lesions can contribute to our understanding of a population's subsistence (Larsen et. al 1991; Leigh 1925; Schmucker 1985; Sobolik 1994; Turner 1979; Walker and Erlandson 1986). Turner (1979) reviewed dental-caries data for 80 global archaeological and living populations and established ranges for observed carious-lesion frequencies of hunter-and-gatherer, mixed, and agricultural food economies. The range of carious-lesion prevalence increased according to an economy's dependence on processed, high-carbohydrate foods. The ranges, from lowest to highest, were hunting and gathering, 0.0–5.3 percent; mixed subsistence, 0.44–10.3 percent; and agricultural, 2.3–26.9 percent. Turner also calculated a mean observed dental-caries frequency for each economy by pooling the carious and observed teeth in each category. The mean rates for each subsistence strategy were hunting and gathering, 1.3 percent; mixed subsistence, 4.8 percent; and agricultural, 10.4 percent. Figure 107 presents the LAN-62 dental-caries mean frequency compared to Turner's data, using these means and ranges. The PVAHP sample fell precisely in the middle of the mixed economic strategy.

At a glance, these ranges may appear broad, but when one considers the variety of food items and cultigens relied upon throughout the world, these ranges are actually rather comprehensive and can be applied to local or regional contexts for comparative purposes. For example, observed dental-caries frequencies for Late Archaic or Early Agricultural period (1200 B.C.–A.D. 50) populations from southern Arizona have ranged from approximately 3 to 12 percent (McClelland 2005; Minturn and Lincoln-Babb 1995). Observed carious-lesion frequencies for later prehistoric (A.D. 800–1450) populations from central Arizona, dependent upon maize, have ranged from approximately 11 to 18 percent (Lincoln-Babb 2001, 2006). As demonstrated below, the rates for the LAN-62 dental sample were considerably lower than the majority of dental-caries frequencies observed in Arizona archaeological populations prior to European contact.

Four different methods of calculating carious-lesion frequencies for the LAN-62 burials are presented in Table 53. One adult male (burial Feature 248) was excluded from the dental-caries analysis because of a poor state of preservation.

The *observed caries frequency* is equal to the number of observed carious teeth divided by the total number of observed teeth in a population and is considered a basic index of carious-lesion formation and carbohydrate/protein consumption in a population. The *corrected caries frequency* accounts for antemortem tooth loss and PCE (Erdal and Duyar 1999; Hillson 2001; Lukacs 1995, 1996)—an important consideration, because the prevalence of carious lesions within a population is affected by those two factors (Brothwell 1963; Kerr et al. 1990; Leigh 1925; Schmucker 1985). If there is an abundance of antemortem tooth loss and PCE from carious lesions, the corrected dental-caries frequency can be more than double the observed dental-caries frequency. That is especially true for agricultural populations, who experience greater tooth loss and PCE from carious lesions. Lukacs's (1995) formula for corrected

Table 54. Carious-Lesion Frequencies and Counts of Sample Sizes at LAN-62, by Sex

Sex	Teeth Observed (n)	Carious Teeth (n)	Observed Caries Frequency (%)	Individuals in Sample (n)	Individuals with Carious Lesions (n)	Individual Caries Frequency (%)	Mean Carious Lesions per Person
Female	1,690	84	4.97	74	37	50.00	1.14
Male	1,275	52	4.08	62	29	55.77	0.84
Indeterminate	449	9	2.00	28	6	21.40	0.32

Table 55. Numbers of Adults with Calculus Deposits in the LAN-62 Burial Population, by Sex

Sex	Calculus Deposits			
	None	Light	Moderate	Heavy
Female	20	38	9	3
Male	23	28	10	1
Indeterminate	17	9	1	—
Total	60	75	20	4

caries frequency is used in this study. The *individual caries rate* (i.e., the number of individuals with one or more carious teeth divided by the total number of individuals) may also provide information on carious-lesion prevalence within a population and can be useful in sex comparisons. Finally, the *mean number of caries per individual* (the total number of carious teeth divided by the total number of individuals) provides a simple index that is useful for comparing subsistence strategies.

Again, only erupted permanent teeth from individuals 15 years of age or older were considered when generating the LAN-62 dental-caries frequencies. Two subadults, one from each burial concentration, had carious deciduous teeth. Generally, the lack of carious lesions among juveniles in a population is indicative of limited carbohydrate intake.

Frequencies were generated for the females and males in the burial population. Counts of observed teeth, carious teeth, and individuals observed and affected are presented in Table 54. Half the females (37 of 74 total females) in this data set exhibited dental carious lesions, whereas a slightly greater frequency (55.77 percent) was observed for the males (29 of 62 total males). The differences in the numbers of females and males with dental caries was not statistically significant (χ^2 = 0.003).

The female population produced an observed dental-caries frequency of approximately 5 percent (84 of 1,690 observed teeth). Similarly, the males produced a dental-caries frequency of approximately 4.1 percent (52 of 1,275 observed teeth). Once again, those differences were not statistically significant (χ^2 = 1.02; p = .31). Females in archaeological and modern populations tend to have somewhat-higher dental-caries frequencies (Walker 1988). In archaeological contexts, females were presumably gathering or preparing foods and hence were closer to the food resources more frequently than males. Potential greater access to foods with higher carbohydrate content (plant products) would have resulted in more instances of tasting, sampling, or snacking.

The observed dental-caries frequency for LAN-62 fell into the high end of Turner's hunter-gatherer range and at the midpoint for a mixed economy (see Figure 107). Observed dental-caries frequencies for the burials corresponded closely to Turner's mean observed dental-caries frequency for mixed-subsistence economies, suggesting a diet dependent upon protein-rich foods (marine resources), some indigenous plant products, and limited cultigens.

In addition to the presence of carious lesions, inferences can be drawn about the processing of food into flours and pasty textures as a regular, but perhaps not extensive, part of the diet, using the presence of calculus on the adult dentition (Table 55). The presence of calculus (i.e., plaque) typically presents as a few teeth with thin, linear deposits near the cementoenamel junctions of the crowns. Periodontal disease, or infection of the bone surrounding the teeth from excessive calculus formation, was noted in 19 percent (31 of 164 observed dentitions) of the individuals from LAN-62.

Direct evidence of the foods processed with grinding materials was noted during the dental analysis. Three adult females (burial Features 410, 505, and 631) had small, rounded sandstone pebbles lodged between two molars. Bone remodeling of the alveolar crest that nearly encapsulated the pebbles indicated that these small inclusions had become lodged during life. An adult male (burial Feature 346) also had a very small pebble within a carious lesion. During the analysis, one of the pebbles dislodged, permitting a measurement of the inclusion, and the pebble measured approximately 2.25 mm in diameter.

Pebbles of that size in the food, as well as the constant grit or sand within processed foods, would certainly contribute to considerable dental wear and to some of the chipping of enamel noted in the LAN-62 population. Over 50 percent of the adults evinced at least one tooth with chipped enamel. Enamel broken away from a tooth's crown has been related to the use of teeth to break bones. Based on that assumption, Turner and Cadien (1969) suggested a high frequency for this type of trauma in hunting-and-gathering societies and predominantly meat-eating groups. The use of teeth as tools has also been suggested as a possible explanation for enamel chipping in some populations, particularly those lacking the necessary materials for expedient lithic production. That explanation is not likely for the PVAHP population. The overall prevalence of enamel chipping was not severe and is considered incidental rather than the result of regular biting on brittle materials like lithic flakes. The type and degree of enamel chipping observed in the skeletal population at LAN-62 appeared more consistent with chewing on small bones or shellfish, or perhaps biting down on a nut hull or an inclusion in processed foods.

In a preliminary examination of the nutritive values of some of the plant taxa identified at LAN-62 (see Chapter 14, Volume 3, this series), it appeared that many of the indigenous plants consumed were low in carbohydrates. Instead, protein values were high for a number of marshland plants and grasses. Perhaps that partly explains why carious-lesion frequencies are generally so low for many California indigenous groups, particularly those located near the ocean or marshland water sources. Although plant consumption was taking place, many of the food items, including acorns, roots, and tubers, were lower in carbohydrates than many of the indigenous plants utilized by hunting-and-gathering and mixed-subsistence groups from other locations in the Southwest.

Acorns are a recognized food source for the indigenous people of California (McCawley 1996). As a native food item, acorns are relatively high in carbohydrates, fats, and proteins. They have approximately half the carbohydrate value of maize and are virtually free from sugar, which suggests that they are less cariogenic. Acorns can be ground into flour for preparing cakes and other everyday food items, and because they may be stored for lengthy periods of time, they were most likely a seasonal food staple for the people of the Ballona Wetlands. Evidence of oak was noted during the paleoethnobotany analysis for the site (see Chapter 14, Volume 3, this series). Domesticated barley, also recovered from LAN-62, has a moderately high level of carbohydrate content. Corn was recovered in very low frequencies. Mission-introduced foods may have played important roles in the diet of the Ballona population during times when indigenous resources were low; however, the low to moderate dental-caries frequencies suggest a diet more dependent on indigenous seeds, grasses, and protein-rich marine resources.

The numerous grasses and fibrous plants excavated at LAN-62 likely played a role in these extreme attrition rates. Although processed foods were consumed, the angles and forms of dental wear for the anterior teeth suggest that fibrous materials from stalks or reeds were clenched in the anterior dentition for consumption. That would certainly have been the case for the tender parts of bulrushes. Oblique-angled wear on the anterior teeth and the first molars was observed for a number of males and females at LAN-62, similar to the wear patterns observed in prehistoric Mexican and southwestern groups who rely on the fibrous cactus for food and manufacturing (Anderson 1965; Minturn and Lincoln-Babb 1995). Evidence of such mixed plant use (i.e., food and manufacturing) was present for the people of LAN-62, as well. Some of the observed wear was related to consumption, but task wear was definitely involved. This is more fully explained in the section on Dental Wear and Cultural Observations.

Comparison of Carious-Lesion Frequencies at LAN-62 and Other Sites

To place dental health at LAN-62 in a greater regional context, data regarding dental caries from LAN-62 were compared to observations from the Historical and Middle period populations at the Humaliwo site (LAN-264) and populations from Santa Rosa Island recovered from Canada Verde and Skull Gulch. These populations were chosen because of sample size, relevance to the PVAHP data set, and accessibility of the data.

The frequencies of carious lesions at LAN-62 were slightly higher than the frequencies recorded for the combined sexes during both phases at the Humaliwo site (1.3 percent for the Historical period and 1.6 percent for the Middle period). The observed dental-caries frequency for the San Nicolas Island sample was 2.43 percent (Kerr et al. 2002). Frequencies for the two groupings of the San Nicolas Island people (before 3000 B.P. and after 3000 B.P.) were not significantly different, at 1.9 percent and 1.8 percent, respectively. The lower dental-caries frequencies at the Humaliwo and San Nicolas Island sites suggested that substantially fewer carbohydrates were consumed at those sites than at LAN-62.

The observed dental-caries frequencies for the Early period at Canada Verde (2050 B.C.–A.D. 1650) on Santa Rosa Island was 13.3 percent. The two later populations from the Skull Gulch burial areas on Santa Rosa Island had relatively lower dental-caries frequencies. Skull Gulch Burial Area A (A.D. 130–1050) produced an observed dental-caries frequency of 10.3 percent, and Skull Gulch Burial Area B (A.D. 1100–1500) had a substantially lower frequency of 6.3 percent.

The observed dental-caries frequency for LAN-62 was closer to that of Skull Gulch Burial Area B. The overall LAN-62 frequency of carious lesions, with approximately 44 percent of the adults with carious teeth, more closely resembled that of the combined Skull Gulch burial populations. That moderate frequency of carious lesions at both sites suggests that carbohydrates were consumed but that foods high in proteins made up a substantial portion of the diet. A mixed diet of marine resources and terrestrial plants seems very likely for the people of LAN-62. Their diet appears to have been one rich in proteins. Perhaps if acorns were a reliable food source, the fat content of the nut produced a somewhat-protective film against the cariogenic effects of the carbohydrates, as suggested by Miller (1966b). Based on the data available for this analysis and the frequency of carious lesions noted in the sample, there was no indication that the people of the Ballona Wetlands were dependent upon cultigens from an agricultural context to supplant a need for carbohydrates.

Enamel Hypoplastic Defects and Health Status

Enamel hypoplastic defects are macroscopic scars on teeth that occur during dental development. These growth-arrest defects appear as pits, grooves, or discolorations on the labial, buccal, or, at times, lingual surfaces of the tooth crown. Enamel hypoplastic defects are typically present on the paired teeth of the same dental arch (e.g., maxillary canines and maxillary lateral incisors) and generally in the same locations. These defects are caused by disruptions in the enamel-formation process of a tooth and may reflect a single episode or a chronic condition of metabolic disturbance or environmental stress during childhood (Ensor and Irish 1995; Goodman and Armelagos 1985; Rose et al. 1985). Nutritional deficiencies can seriously affect an individual's metabolism and are therefore fundamental to the formation of enamel hypoplastic defects (Goodman and Rose 1991; Goodman et al. 1987). Children are particularly susceptible to nutritional instability during the weaning period, when they shift from breast milk to foods consumed by the rest of the population. Moreover, childhood illnesses obviously impact nutritional uptake and consequently are associated with the formation of enamel defects. Trauma to an area of a developing tooth can also result in an enamel hypoplastic defect. Trauma-related defects are infrequently observed and can be identified on a single affected tooth within the dentition. Only one individual in the LAN-62 sample had a trauma-related enamel defect.

Mortality has been associated with the degree and severity of enamel hypoplastic defects (Duray 1996), because individuals that suffer from such a serious disruption to their health at an early age may have a somewhat shorter life span. For this reason, the health status of a population may be inferred from the prevalence of enamel hypoplastic defects.

Although deciduous teeth can present enamel defects, they are more frequently observed on the permanent teeth. The deciduous teeth from LAN-62 were inspected for this pathological condition, and no juveniles in the sample presented enamel hypoplastic defects.

The frequencies for the LAN-62 population are presented in Table 56. Because enamel hypoplastic defects are a developmental pathological condition, subadults with sufficiently developed permanent teeth were included in some calculations.

The frequency of enamel defects for adults from the burial area demonstrated that among females, there was a 22 percent occurrence of teeth with enamel hypoplastic defects. In comparison, approximately 29 percent of the male cohort had teeth with enamel defects. These figures suggest a slightly more compromised health status for males than females during the developmental years of childhood.

Approximately 23 percent of the total LAN-62 population had at least one tooth with enamel hypoplastic defect, including adults of indeterminate sex and subadults. Only four children had enamel defects. If the subadults are excluded, approximately 25 percent of the adults in the sample population presented some form of enamel hypoplastic defect. However, only 3.6 percent of the total observed teeth were affected. One individual of unknown sex had 20 teeth with enamel defects, a number that may have elevated the observed enamel-hypoplastic-defect frequency for the overall population.

To estimate the approximate age for the onset of a metabolic disturbance, the distance from the cementoenamel junction of the affected tooth to the middle of the defect can be measured and compared to a chart developed by Rose et al. (1985). Only 18 percent of the affected individuals had disturbances that fell within the weaning years (approximately 2–3.5 years). Some children were potentially breastfed past the age of 2 years, but it would have been an uncommon practice (McCawley 1996). Surprisingly, over half (54 percent) of the affected individuals suffered an episode of severe metabolic stress after the age of 4 years. Approximately 25 percent of

Table 56. Frequencies of Enamel-Hypoplastic-Defects in the LAN-62 Burial Population, by Sex

Sex	Teeth with Enamel Hypoplastic Defects		Total Teeth (n)	Individuals with Enamel Hypoplastic Defects		Total Individuals (n)
	%	n		%	n	
Female	3.1	49	1,566	22.0	15	68
Male	3.2	37	1,150	28.6	16	56
Indeterminate	8.0	35	439	25.9	7	27
Combined adults and subadults	3.6	130	3,580	23.0	42	183

the individuals experienced that period of environmental stress between the ages of 3.5 and 4.5 years. Four individuals (10 percent) were chronically ill during childhood. Curiously, many children past the age of weaning suffered from metabolic disturbances serious enough to leave enamel defects. Although postweaning stress (the period shortly after the weaning transition) may be more influential in the development of enamel defects than the actual period of weaning, at ages greater than 4 years, children have likely passed that adjustment period. Perhaps those individuals experienced severe bouts of illness, such as the kind brought about by an epidemic within the population, and developed enamel hypoplastic defects at seemingly later times in childhood. The majority of the individuals within this group were between 25 and 35 years of age at the time of death.

Based on the analysis of dental pathology, most of the LAN-62 population experienced relatively healthy childhoods. Middle and Historical period burials from the Humaliwo site evinced enamel-hypoplastic-defect frequencies of 36 and 38 percent, respectively (Walker et al. 1996). The frequencies for enamel hypoplastic defects among the San Nicolas Island population, at 35 percent for the early sites and 38 percent for later sites, were nearly the same as those for Humaliwo (Kerr et al. 2002). The higher frequency of enamel hypoplastic defects for individuals from Humaliwo and San Nicolas Island suggest more environmental stress than was experienced by the people of the Ballona Wetlands, as well as a comparative general decrease in health.

Overall, the frequencies for enamel defects among the California people are not indicative of major stress. Consider populations like colonial people of the eastern United States and the prehistoric agricultural Anasazi, who have exhibited much higher frequencies of enamel defects (between 80 and 100 percent) (Malville 1997; Wood 1996).

Dental Anomalies

The term *dental anomalies* covers a broad range of dental alterations, including position within the dental arch (ectopic), morphological variants (peg or cone shape), and number (supernumerary). A number of individuals from the LAN-62 dental sample presented at least one of these atypical aspects of dentition. Other observed unusual features included extra roots. Extreme rotation of teeth within the arches was also noted.

Ectopic eruption usually occurs in the maxillary arch. The most commonly affected teeth are the maxillary canine and the maxillary first premolar. The cause for this displacement has been attributed to developmental problems such as cleft palate, retained deciduous teeth, displacement of the tooth germ from trauma, and splitting of the tooth bud. A genetic component also has been associated with these phenomena (Chen et al. 2002; Ely et al. 2006). Burial Features 137 and 440 each had an ectopic eruption. The right maxillary canine of burial Feature 137, an adult female, erupted in the right palate. A heavily worn deciduous maxillary incisor or canine was present, and that retained deciduous tooth is the most likely explanation for the ectopic eruption (Figure 108).

The primary individual in burial Feature 440, an adult male, had a more complicated and unusual form of ectopic eruption. The maxillary left second premolar had partially erupted within the sinus cavity. The morphology and size of the tooth were unremarkable and appeared normal. The ectopic tooth was oriented diagonally, such that its root was in contact with the root of the left first premolar (Figure 109).

Burial Feature 223, an adult female, presented a talon-shaped, supernumerary maxillary tooth. Three other individuals (burial Feature 76, male; burial Feature 204, female; and burial Feature 278, indeterminate) had lateral incisors with a variant morphology known as peg-shaped incisors. These attributes are typically recorded within the ASU Dental Anthropology System, but the lack of comparative data for these morphological variants makes it more worthwhile to discuss their presence here.

Another trait that is collected using the ASU system and was observed for several LAN-62 individuals was a parastyle, an accessory buccal cusp of the maxillary molars. Feature 370, an adult male, had the most extreme expression of this trait, a large cusp with a free apex (Figure 110).

Two other individuals in the LAN-62 sample had teeth with aberrant morphologies. Burial Feature 376 (sex indeterminate) presented a fused mandibular left second and third molar. The mesial-to-distal width of the tooth was approximately 15.4 mm. At least seven cusps were observed. Separating grooves for the crown of each tooth were observed on the buccal and lingual aspects at the point of fusion. Unfortunately, the roots had been broken postmortem, so it was impossible to determine whether a common, shared root was at the junction of fusion. At least three roots were present before breakage (Figure 111).

Additional Individual 2 in burial Feature 250 had a very unusual maxillary right second premolar. The tooth had two large accessory cusps, one on the buccal aspect of the tooth and one on the mesial aspect. The cusps had a rounded, peg-like morphology, arising from the cingulum at angles that would have precluded occlusion with the mandibular premolars (Figure 112).

Root number could not be consistently evaluated, because the teeth remained in situ within alveolar bone or because of postmortem root damage. Nonetheless, root counts for the first and second molars are usually of greatest interest in population studies, along with maxillary and mandibular first premolars and mandibular canines. Maxillary molars generally have three roots, and mandibular molars typically have two.

A few general observations regarding root number were made for the LAN-62 sample and are presented below. At least six females had extra roots for molars. Burial Features 11, 145, 505, and 109 each had three-rooted mandibular third molars.

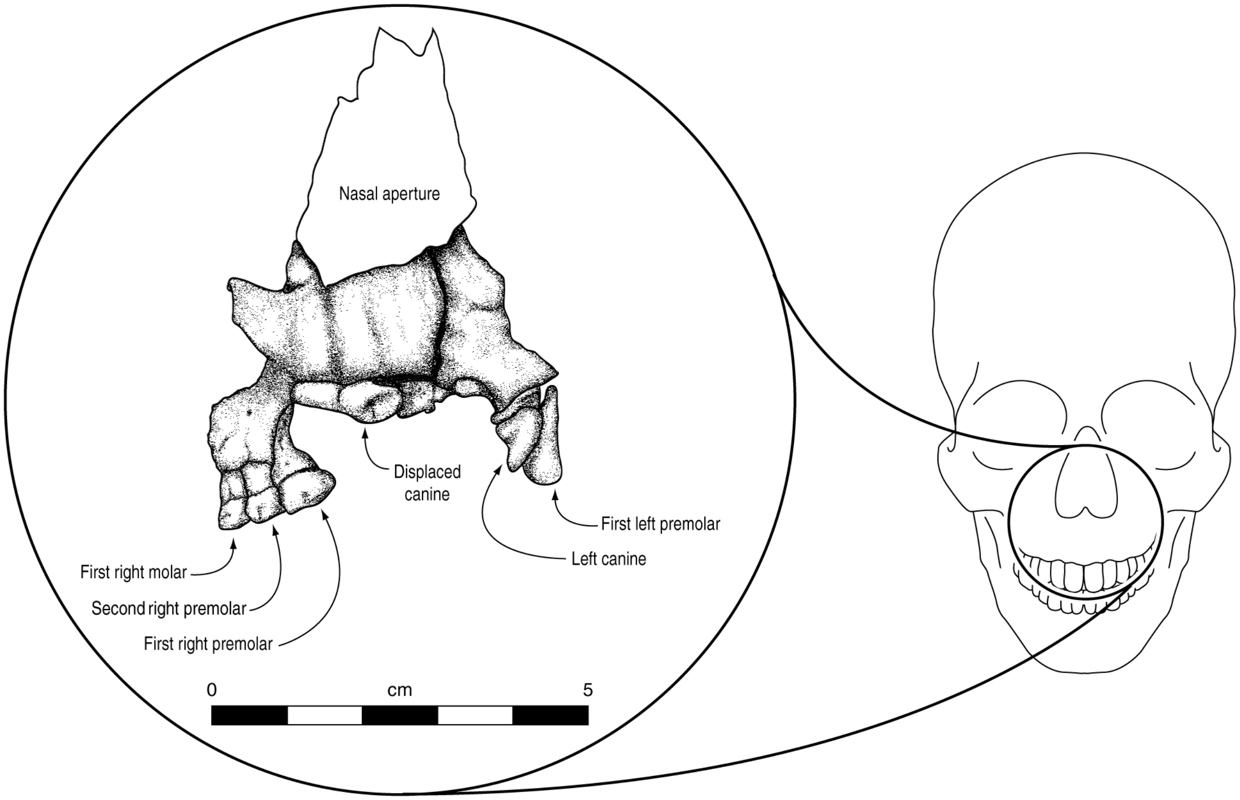

Figure 108. Illustration of the ectopic right maxillary canine from Feature 137 at LAN-62.

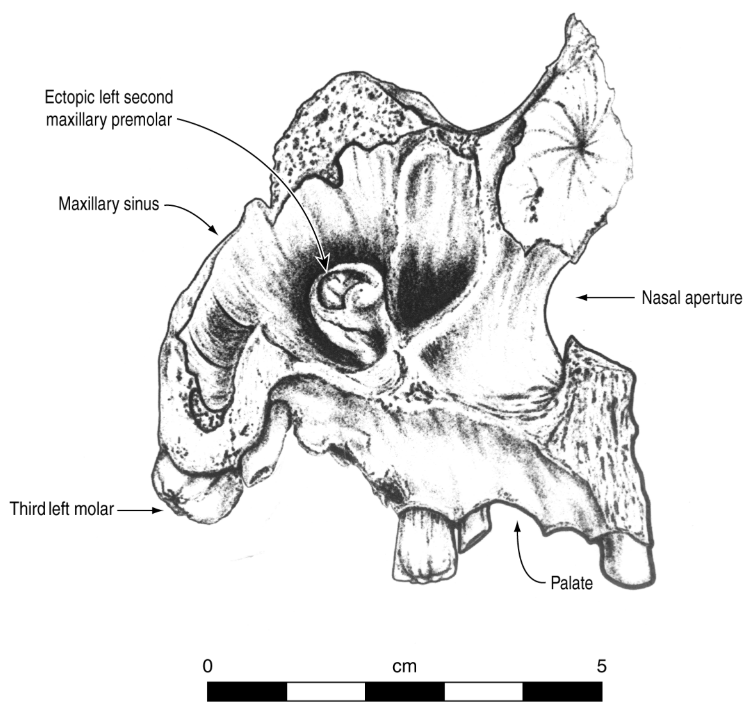

Figure 109. Illustration of the ectopic left second maxillary premolar from Feature 440 at LAN-62.

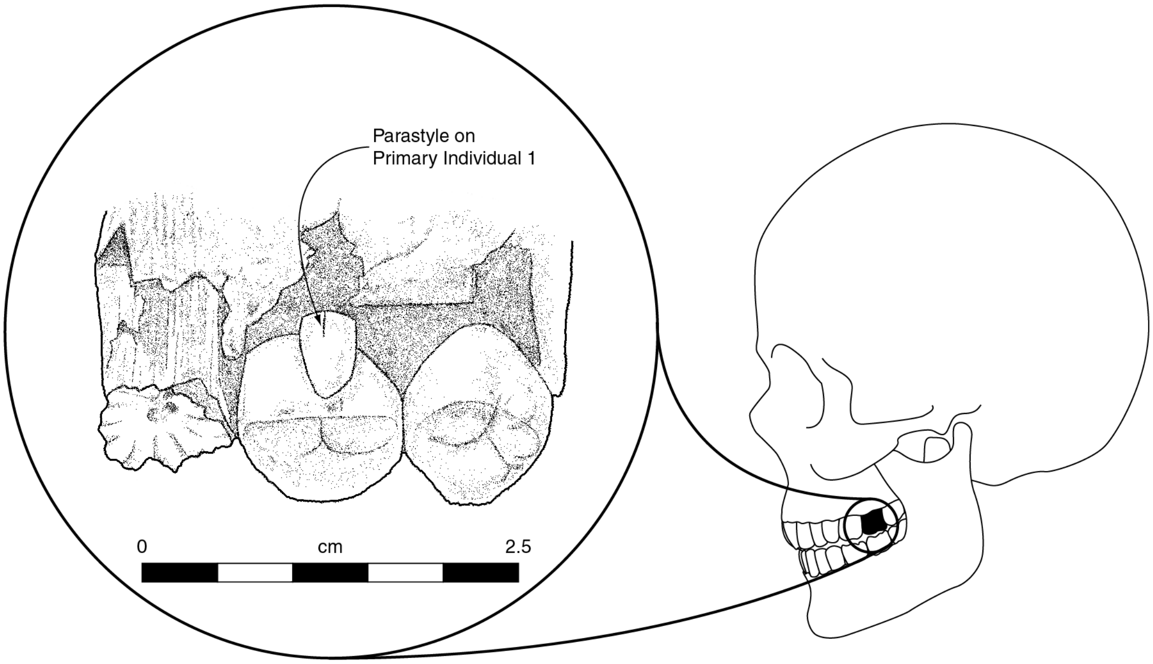

Figure 110. Illustration of the parastyle for Primary Individual 1 from Feature 370 at LAN-62.

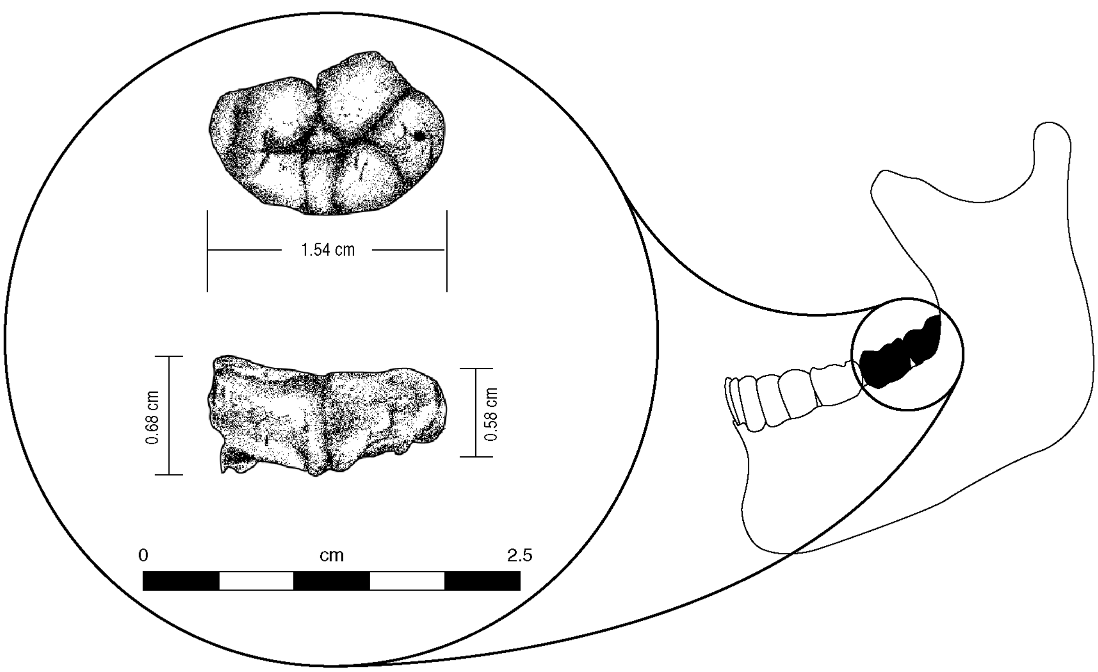

Figure 111. Illustration of the fused left-mandible second and third molars from Feature 376 at LAN-62.

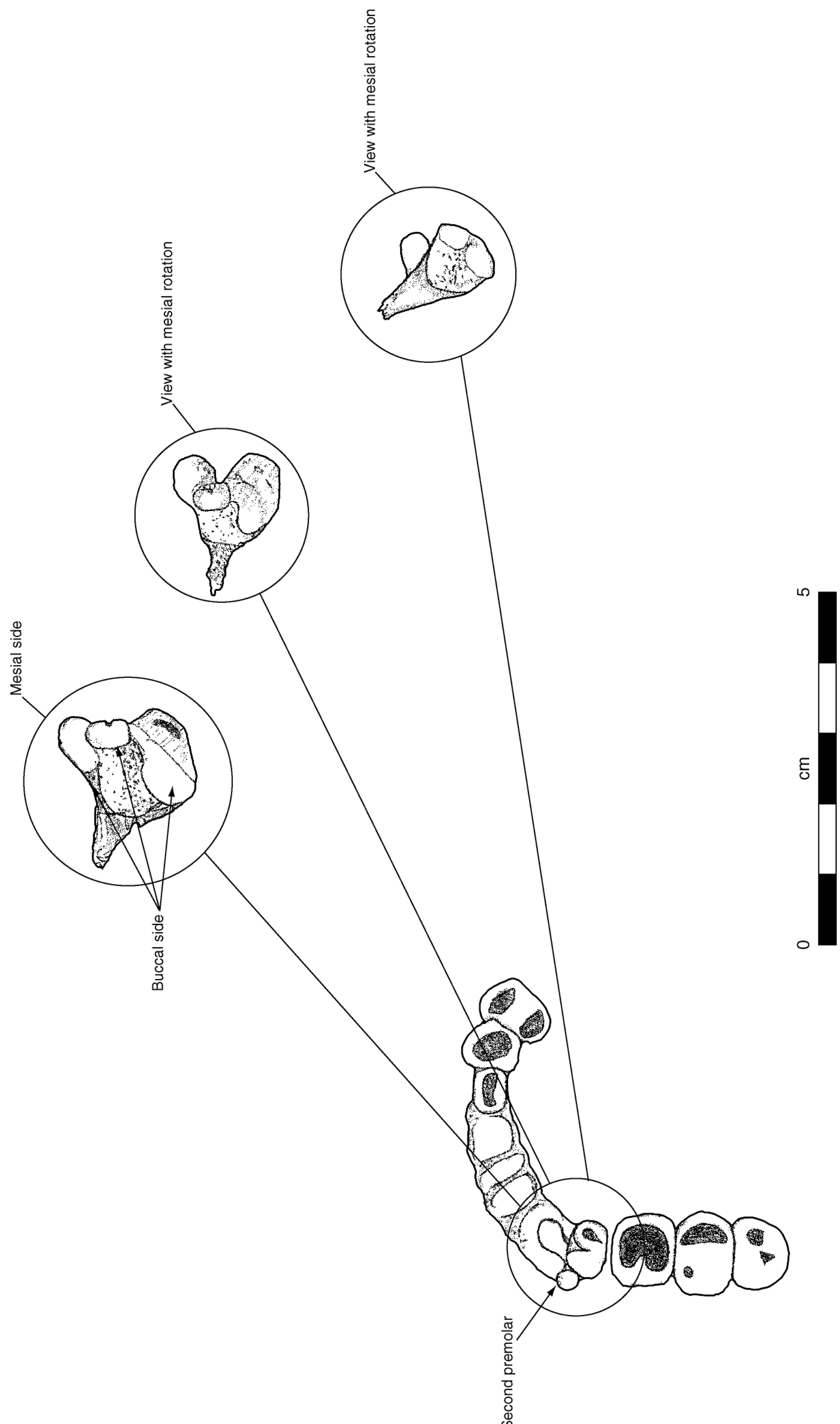

Figure 112. Illustration of the unusual crown morphology from Feature 250 at LAN-62.

Burial Feature 11 also had a four-rooted maxillary third molar (Figure 113). Burial Features 69 and 269 had three-rooted first molars. Three-rooted first molars have been recorded at higher frequencies among Native Americans, particularly among the indigenous groups from the American Arctic (Scott and Turner 1997). One male with extra roots was noted: burial Feature 214 had bilateral, two-rooted mandibular canines. Canines from both arches are generally single rooted. Europeans generally present the highest frequencies of two-rooted mandibular canines; Native Americans rarely have this trait, although it is not unheard of among indigenous North American groups (Scott and Turner 1997).

Dental Wear and Cultural Observations

The majority of population studies for indigenous California groups have discussed at length degrees of attrition and rates of dental wear (Kerr et al. 2002; Molnar 1971; Walker 1978; Walker and Erlandson 1986; Walker et al. 1996). The standard observations on extreme crown reduction and loss of enamel in those studies appears true for the individuals recovered from LAN-62, as well. The degree of abscessing and the most prevalent cause for its occurrence—PCE from harsh attrition—were also consistently noted in the LAN-62 population.

The typical appearance of dental wear for many of the LAN-62 adults is depicted in Figure 114, an illustration of the intact maxilla and mandible in occlusion noted in burial Feature 197.

Although the favored methods for evaluating dental wear in previous reports are those of Smith (1984) and Scott (1979), Molnar's (1971) method was selected for this analysis, because that method addresses direction and form of wear. With that information, more-specific data on occupational-task wear can be assessed for the population as a whole and more specifically for males and females.

Frequencies for each category and level of wear were generated for each tooth from the left side of the dentition. Selection of one side in skeletal and dental analysis is a standard procedure (Buikstra and Ubelaker 1994). The left side is generally preferred (including in the Scott [1979] and Smith [1984] methods). Overall, the degree of dental wear was extreme and progressive; in other words, older individuals exhibited more extreme attrition and angled and rounded forms of wear than did the younger individuals.

Appendix H, this volume, presents a frequency-distribution table for direction of wear, form of wear, and degree of wear recorded according to the Molnar (1971) system. The reader is directed to Molnar (1971) for a discussion on each type of wear and the specific methods advocated therein. The majority of both males and females exhibited the horizontal (Type 6) directional wear and the flat (Type 2) form of wear on the anterior and posterior dentition. That is consistent with Molnar's (1971) results for the California groups in that study. The frequency of unique directional and form wear were also not inconsistent with his findings, with one exception: LAN-62 males exhibited more rounded wear for the anterior dentition than did the females. That contradicts the reported trend of Molnar and other analysts, who noted that females, not males, exhibited more rounded extreme wear of the mandibular incisors. The LAN-62 males exhibited this form of attrition two to three times more than females. Additionally, males also exhibited a rounded wear on the mandibular canines than their female counterparts. The oblique wear on the maxillary central incisors noted for males from

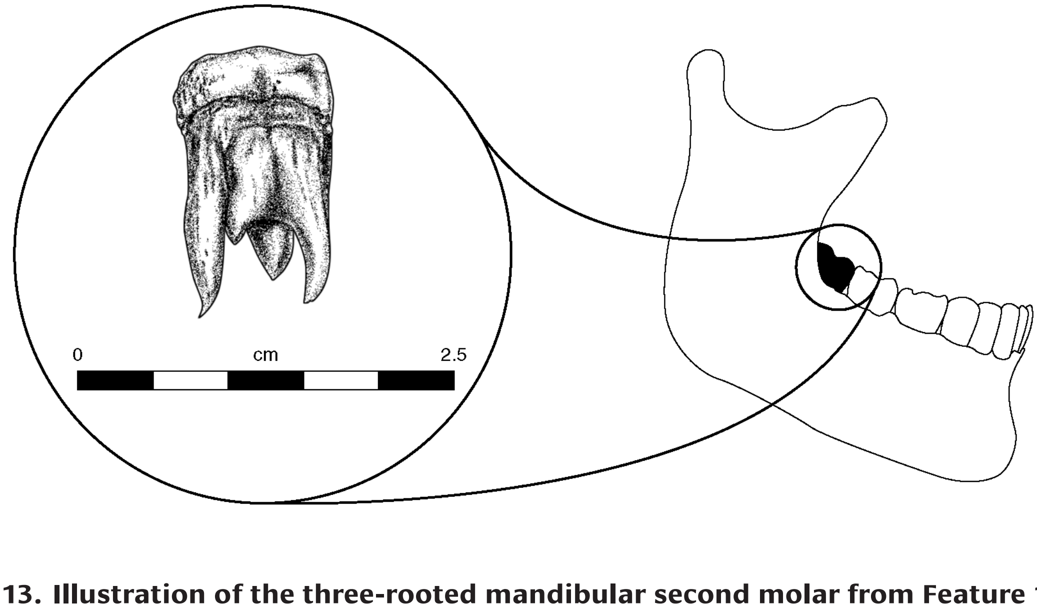

Figure 113. Illustration of the three-rooted mandibular second molar from Feature 11 at LAN-62.

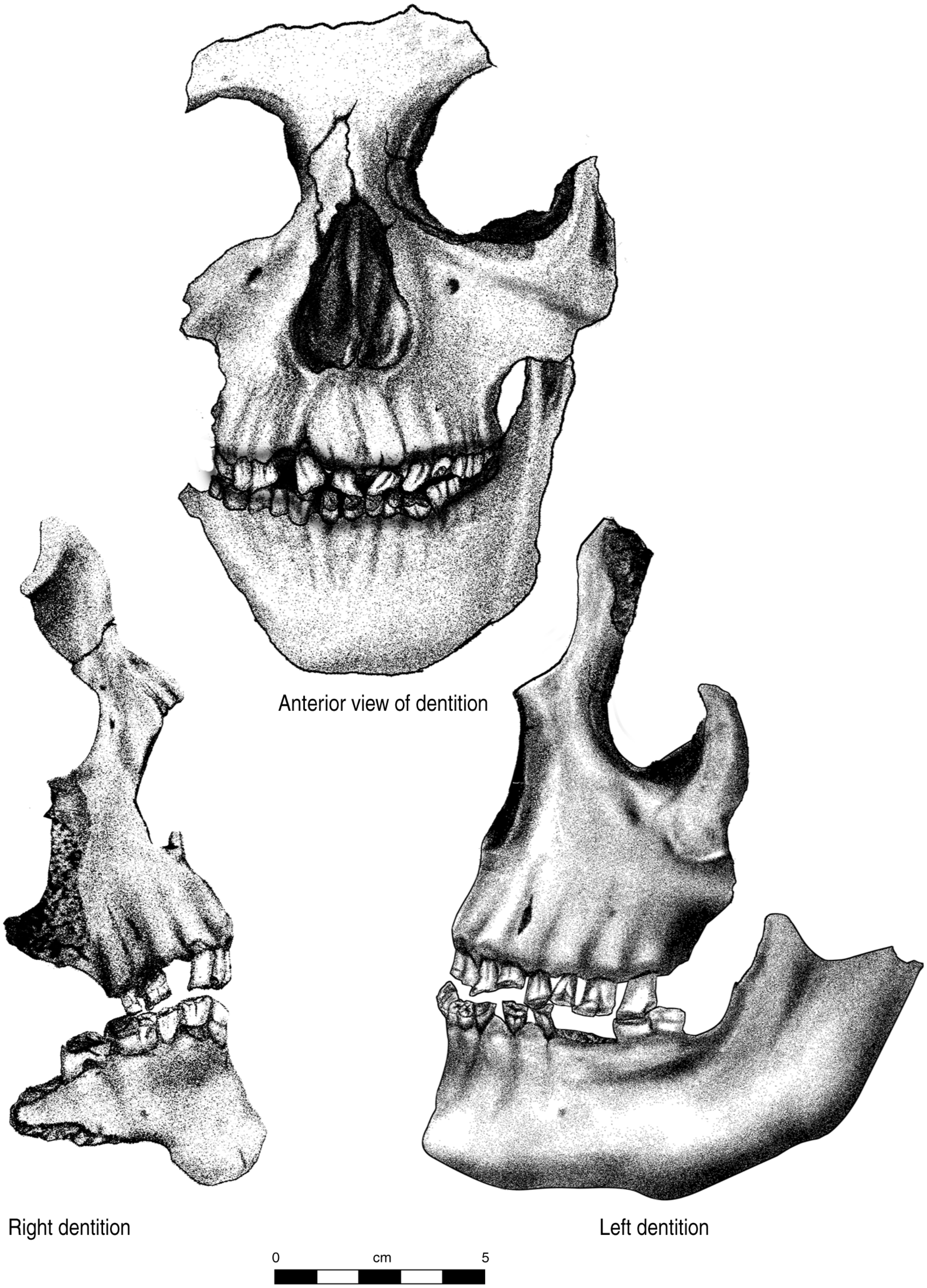

Figure 114. Illustration of typical dental attrition from Feature 197 at LAN-62.

LAN-62 is also unusual because females had more oblique wear on the maxillary lateral incisors. Furthermore, males and females exhibited oblique wear on the mandibular canines, but in opposite directions. Stripping fibrous plants through the teeth for consumption and manufacturing may create a rounded and oblique wear pattern.

Thus, the differences between forms of dental wear among males and females most likely reflect sex-specific tasks. The rounded mandibular anterior wear seen among males suggests use wear and may indicate the manufacture of cordage. Larsen (1985) posited that milkweed, which was useful in cordage production, was grasped by both hands and passed through the teeth, to crush and soften the tough fibers (Larsen 1985). In contrast, the oblique-angled wear found among the female cohort is more consistent with clenching and splitting of fibrous materials, as would be the case during basket making. Ethnographic sources have documented such task work and the transverse grooves in the teeth that result from repeated activity (Wheat 1967). The oblique angles and transverse grooves associated with that behavior were observed on the primary individual from burial Feature 631, an adult female. At least four females exhibited this type of wear (Figure 115).

Overall, there was a slight difference between males and females in the frequencies of unique wear forms. Although the differences in wear patterns observed between males and females were not statistically different, occupational tasks were very likely specific to one sex or the other. Such division of labor should be mirrored in the dental record when the teeth are impacted by a sex-specific task.

Several taphonomic factors can mimic intentional, cultural modification. Manganese staining was observed on the teeth of many individuals at LAN-62, suggesting a water-saturated, depositional environment. Burial Feature 260 had asphaltum adhering to the central maxillary incisors. Neither of these dental anomalies appeared to have resulted from intentional burial practices. Rather, they more likely resulted from post-depositional processes.

Dental-Trait Analyses

Dental morphological traits are features of teeth and include ridges, crenulations, pits, and cusps that are visible on the crowns. The roots also have macroscopic characteristics that have been shown to vary among individuals and between groups. The phenotypic expressions of teeth are believed to be genetically determined, quasicontinuous variables (Scott 1973; Scott and Turner 1997) that are useful in biological-distance studies. Consequently, dental-trait data for populations can be used in affinity studies. In this type of analysis, dental-trait frequencies for a population are compared to those of other populations. Those data are then used to assess biological

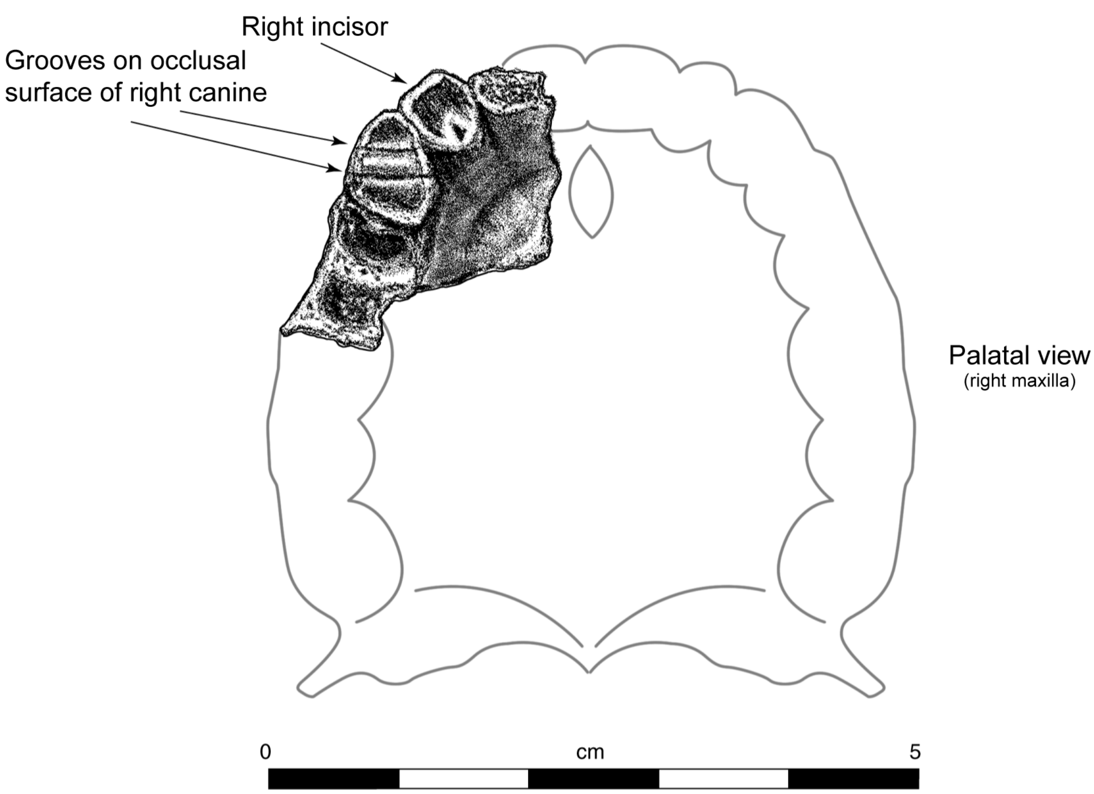

Figure 115. Illustration of the unusual wear on the right maxillary canine from Feature 631 at LAN-62.

relationships between groups. This method of analysis has produced meaningful results regarding differentiation and groupings of populations at both the regional and local levels (Greenberg et al. 1986; Scott 1973; Scott and Dahlberg 1982; Scott and Turner 1997; Turner 1969, 1986, 1998).

Trait frequencies based on the degree of expression (i.e., ordinal character states) may better characterize population variability than studies using simple presence/absence dichotomy, because the latter may fail to capture the extent of variation within and between groups. To categorize trait grades, detailed observational standards are necessary. In this study, the ASU Dental Anthropology System was used (Turner et al. 1991). That system makes use of plaster reference plaques that represent the various character states for a dental trait, from minimal to maximal grades of expression in the permanent dentition. Each plaque is used in conjunction with written descriptions of the character state. To date, it is the only classification system developed for the permanent teeth that systematically codes the dentition in aggregate. The brief descriptions of the traits used in this study that are presented in Appendix F (this volume) were adapted from Scott and Turner (1997) and Turner et al. (1991).

Representative plaques for several traits in the ASU system are not currently available: winging (UI1), interruption groove (UI1, UI2), premolar accessory cusps (UP1, UP2), and groove pattern and cusp number for LM1, LM2, and LM3. As a result, it was necessary to use written descriptions exclusively when assessing these traits (Turner et al. 1991). Root characteristics were generally not evaluated for the LAN-62 individuals, because of general poor preservation and because systematic assessment of root traits for in situ teeth requires extraction, which was not possible, because of restrictions on any destructive analysis.

Crown characteristics were assessed through visual comparison to casts, when available, using a bright light and a 10× hand lens. Observations for right and left sides were recorded using the standardized ASU dental form. The individual count method was used to derive a single score. This procedure uses the highest grade of expression of the individual for a specific trait as representative, thereby maximizing sample size and minimizing potential problems with trait asymmetry and missing antimeres (Scott 1980; Scott and Dahlberg 1982; Turner and Scott 1977; Turner et al. 1991). Because dental morphological traits are believed to be the result of genetically based, quasicontinuous threshold characters (cf. Falconer 1965), it is reasonable to assume that the expression of a trait on the left or right indicates trait presence for the individual.

Fifty-nine dental traits were scored and recorded for individuals with permanent teeth from LAN-62. Moderately to severely worn teeth were not considered for trait assessment. Because of relatively small sample sizes, it was necessary to pool data from males and females. Because the purpose of the biological-distance study was to compare the LAN-62 population to other groups, pooling the sample was not unwarranted and did not directly affect the overall analysis. Frequencies for the LAN-62 inhumations are presented in Appendix P, this volume.

Dental-trait frequencies in the LAN-62 sample were compared to published frequencies for living and prehistoric southwestern groups. A hierarchical cluster analysis using Ward's minimum-variance-clustering algorithm and squared Euclidean-distance measures was used to empirically assess the relationships between LAN-62 dental-trait frequencies and those of the sample populations. SPSS 10.0 for Windows was used to generate dendrograms, to graphically represent the hypothetical biological distances between the LAN-62 data set and the comparative groups.

Trait frequencies are not currently available for other archaeological samples from California groups. However, frequencies for living populations derived from publications by Dr. G. Richard Scott and his coworkers are available (Scott and Dahlberg 1982; Scott et al. 1983). Moreover, living-population frequencies for two traits, the triform variant and the Uto-Aztecan premolar, were derived from two additional sources (Bailey-Schmidt 1995; Morris et al. 1978). Turner (1998) provided much of the data for southwestern prehistoric populations. The reader is referred to the bibliographic references for information on the populations, sample sizes, and trait-grade frequencies used in the multivariate analyses.

Interregional Cluster-Analysis Results

Only a subset of the 59 traits recorded in the LAN-62 population is available for each of the comparative samples. As a result, frequency data for 13 of the most commonly recorded dental traits were used in the cluster analysis. The traits and populations used in the analysis are listed in the dendrogram presented in Figure 116. The LAN-62 sample was compared to samples from Hopi, Navaho, Papago, Zuni, Yaqui, Mimbres, northern Mexico, Hohokam, Basketmaker, Eastern Anasazi, Western Anasazi, Sinagua, Grasshopper, and Salado populations, using 13 traits. Even though these data only included approximately 25 percent of the traits recorded for the LAN-62 burials, the selected traits were sufficient to address some of the various aspects of affinity important for an understanding of the Ballona Wetlands people.

The two-cluster-solution hierarchical cluster analysis demonstrated that all of the prehistoric populations in the sample were in one group, and the modern populations are in the second group. That is not surprising, because roughly 300–500 years separate the two groups. Dental traits are considered to be polygenic characteristics more resistant to random drift, and temporal variation in dental traits is expected to result from gene flow (i.e., admixture and migration) over time (Turner 1998).

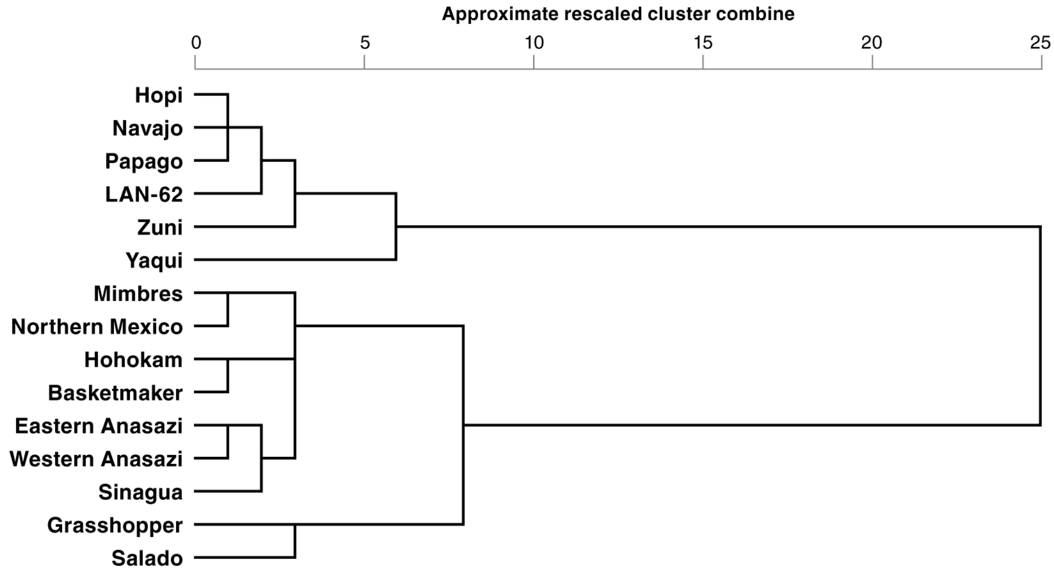

Figure 116. Dendrogram of prehistoric and modern populations, from the analysis using 13 dental traits.

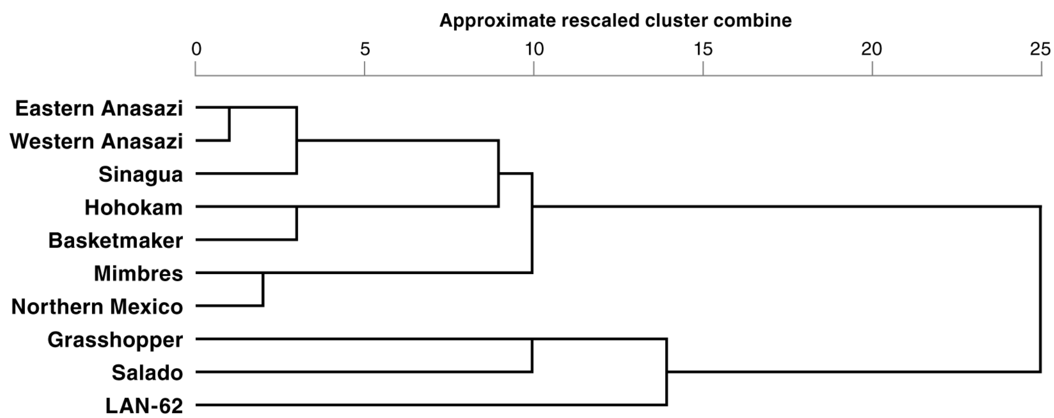

Figure 117. Dendrogram of prehistoric populations, from the analysis using 13 dental traits.

As will be discussed further in the following section, groupings within the modern populations were consistent with the known geographical locations and the inferred cultural relationships among the groups. Associations within the prehistoric populations were also generally consistent with other lines of evidence, including geographical proximity, temporal associations, and material-cultural traits. For example, samples from northern Arizona (including the Eastern Anasazi, Western Anasazi, and Sinagua) appeared to be closely related. These results were consistent with previous analyses of genetic relationships among southwestern populations (Lincoln-Babb 2001; Turner 1998), which support the results of the current analysis.

Figure 117 is a dendrogram showing the results of a cluster analysis performed using the same variables but excluding the modern populations. At the two-cluster-solution level, the PVAHP sample is in a group that includes two Classic period (roughly A.D. 1150–1450) southwestern populations. The seven populations in the second group largely included samples that date before A.D. 1150. Without additional data, it is difficult to assess whether these apparent patterns are the result of synchronic or diachronic variation in dental-trait data. The most effective and reliable method for determining affinity among prehistoric and modern populations would be DNA analysis, but destructive analysis was not permitted.

Modern Native American Cluster Analysis

The affinity of the LAN-62 sample with modern Native American populations was one of the central research issues guiding this analysis. As previously stated, however, dental-trait data for other Californian groups are currently unavailable. That limits the potential inferences that can be made on the genetic affinity of the LAN-62 population. The results of this analysis can be used in future research, and these data are an important contribution to understanding of both prehistoric and Historical period relationships.

Associations for the modern Native American populations used in this analysis exhibited geographical and historical commonalities and were consistent with the results of previous studies (Scott 1973; Scott and Dahlberg 1982). Figure 118 presents the results of a two-cluster-solution level. The only population from Mexico included in the study (i.e., the Yaqui) was separated from the five groups from the United States (i.e., the Hopi, Navaho, Papago, and Zuni and the LAN-62 samples). At the three-cluster-solution level, the Zuni were in one cluster, and the Hopi, Navaho, Papago, and LAN-62 populations were in a second. The separation of the Zuni level is unsurprising, given their linguistic distinctiveness from other southwestern Native American groups (Lincoln-Babb 2001).

The close association between the Hopi and the Navajo is unexpected, given the linguistic differences between the two groups. However, that relationship has been previously noted and appeared to be related to geographical proximity and resultant admixture between the groups (Lincoln-Babb 2001). Although these data suggest that proximity and resultant admixture over time affect associations in dental-trait frequencies, the LAN-62 population more closely clustered with the Hopi/Navaho/Papago samples. In fact, the latter cluster fell closer to the LAN-62 sample than to the geographically and temporally closer Zuni.

In summary, the currently available data suggest that the people of the Ballona Wetlands may have been most closely related to Uto-Aztecan groups of the American Southwest. That is possibility consistent with a large influx of Uto-Aztecan groups from the desert to the coast that occurred around 3,000 years ago (see Vargas et al. 2005). That possibility was suggested by Kroeber (1976:913), who wrote in 1925 that southern Native Californian "cultures present numerous relations to the great Southwestern province, and it is not open to doubt that many of their constituent elements can be traced back to an origin among the Pueblos or the ancestors or cultural kinsmen of the Pueblos."

Discussion

Relationships identified within the populations considered here were by and large consistent with other lines of evidence, including geographical proximity, temporal associations, and material cultural. That pattern supports the analytical utility of this study. Results of the cluster analysis indicated that crown traits of the teeth from individuals recovered from LAN-62 appeared to be most similar to several modern Native American groups from the Southwest, particularly those speaking one of the Uto-Aztecan languages. That is unsurprising, given the 300–500-year gap in the data between the prehistoric and modern samples. The suggestion about regional relationships should, however, be considered tentative, because data for other California groups are currently not available.

Conclusion

The LAN-62 burial ground had a concentration of burials in the central area of the site, and that was the population examined in this study. Fewer than 100 individuals were recovered in the periphery of the site area.

Research on the prehistoric diet for southern California island and mainland indigenous groups has demonstrated that, over time, subsistence changed from a terrestrial hunting-and-gathering economy to marine exploitation (Lambert

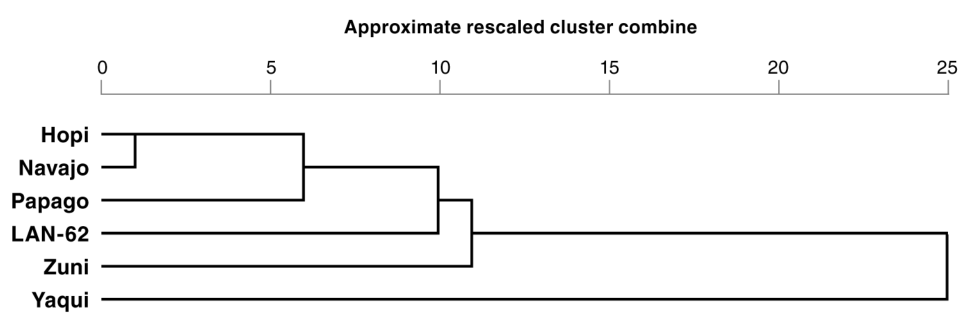

Figure 118. Dendrogram of modern Native American populations, from the analysis using 13 dental traits.

and Walker 1991; Walker and DeNiro 1986; Walker and Erlandson 1986; Walker et al. 1996). That shift in subsistence economies was determined partly by the analysis of dental remains from prehistoric California burial populations; however, such a shift was not supported by the analysis of the faunal remains from the PVAHP.

The Early period hunting-and-gathering diet included acorns, tubers, and roots—food products abundant in carbohydrates. Grit introduced during food processing and preparation accelerated the rate of enamel loss and crown reduction. The individuals recovered from LAN-62 had low to moderate dental-caries frequencies compared to some of the early indigenous California populations with diets focused on terrestrial foods. On the other hand, the dental-caries frequencies noted in the LAN-62 sample were slightly higher than those of later groups who relied on marine resources. Based on these results, a diet abundant in proteins from the ocean and, to a lesser degree, terrestrial sources is suggested for the people of the Ballona Wetlands. Carbohydrates were likely consumed on a regular basis, but the degree of wear suggests that they were likely derived from fibrous plant materials that obliterated tooth surfaces before carious lesions could substantially impact the teeth.

Food types and the amounts consumed may have varied between males and females for other southern California indigenous populations (Lambert and Walker 1991; Walker 1980; Walker and Erlandson 1986). Based on dental patterns, such differences could not be discerned in the LAN-62 population. Dental-caries frequencies were not significantly different between males and females.

Social organization and differential mortuary treatment according to status have not been ascertained for the people associated with LAN-62. Therefore, dietary differences between individuals based on these factors could not be addressed.

Enamel hypoplasia were observed in approximately 25 percent of the LAN-62 population. That is low, compared to many populations from prehistoric and historical-period times, indicating that overall health related to nutrition was not an issue. There may have been serious illnesses or epidemics that affected the group at specific times. The presence of enamel defects on several individuals indicated a certain level of survivorship.

The teeth of the adult individuals from LAN-62 exhibited degrees and types of dental wear similar to what has been observed in other indigenous California populations (Molnar 1971; Walker 1978). General levels of dental wear ranged from very extreme and uneven (substantial exposure of dentine and varying directions of wear on the occlusal surfaces) to a more moderate, even wear (less reduction of crown height and dentine exposure with flat occlusal surfaces). These differences were generally age-related; older individuals exhibited more extreme attrition than younger individuals did. Unintentional dental modification due to task-related activity was observed for a number of individuals in the sample. That task-related wear was equally distributed between males and females, but the tasks may have been sex-specific.

Nearly half the population with alveolar bone evinced abscesses. Most of the localized losses of alveolar bone were the result of infection from PCE due to severe attrition. The LAN-62 rate for chipped teeth was considered moderate but certainly higher than what has been observed in agricultural populations. Inclusions from food processing contributed to enamel chipping, as well. Interesting observations that attest to inclusions in foods included the presence of small pebbles imbedded in the alveolar bones of three adult females.

Dental anomalies were present among the LAN-62 population. A number of individuals had teeth with atypical morphologies or that were malpositioned. Explanations for abnormal dental conditions include inheritance or an association with a physiological syndrome.

Dental morphological traits were recorded for at least 83 of the LAN-62 inhumations with minimally worn permanent teeth, using the ASU Dental Anthropology System (Turner et al. 1991). Observations suggested that LAN-62 interments had the most extreme expressions recorded for some traits, including shoveling of the maxillary incisors, upper-molar parastyle, and lower-molar root numbers. Such high grades of expression for these traits exceeded those typically observed in southwestern indigenous populations from Arizona or Northern Mexico. Nevertheless, in comparing the LAN-62 population to several other Native American populations from the greater Southwest, a degree of relatedness to groups from the Uto-Aztecan linguistic family, in particular, was established. However, no comparative data for other indigenous groups from California, like the Chumash, are available. The dental-morphology data now available for an indigenous southern California population (LAN-62) should assist future researchers in the collection and comparison of California groups. With such data, the origins and migrations of the indigenous peoples of California may be explored.

Overall, the dental sample from LAN-62 is considered representative of the entire burial population. It is hoped that the new information presented in this study about the people of LAN-62 from the Ballona Wetlands will lead to a greater understanding of this important indigenous culture of southern California.

Paleopathology and Trauma

Patrick B. Stanton

Introduction

This chapter details the paleopathological and traumatic conditions observed in the human-skeletal remains recovered from PVAHP sites. The first section of this chapter briefly discusses the theoretical underpinnings of paleopathological research. Discussion of the analysis of the human remains associated with LAN-62 follows that discussion. Because of the sample size, the entire burial population was combined and analyzed, regardless of associated time period. Because of the large volume of information recorded for LAN-62, that section constitutes most of this chapter. The second section details the paleopathological or traumatic conditions observed on the human remains from the other sites excavated by SRI personnel during the PVAHP: LAN-211, LAN-2768, LAN-54, and LAN-193. The final section of this chapter summarizes the causes of death detailed in the pre-1850 California mission records, in an attempt to provide a backdrop against which the paleopathological data gathered from the human-skeletal remains recovered during the PVAHP might be compared.

Background: Paleopathology

Paleopathology is the study of "the evolution and progress of disease through long periods of time and examines how humans adapted to changes in their environment" (Roberts and Manchester 1997:1). Furthermore, traumatic conditions, such as fractures, are also studied by the paleopathologist, because they afford the researcher an opportunity to glimpse past human behavior. To study these conditions, the paleopathologist must analyze the biological remains of a population, which mostly consist of skeletal material and, rarely, mummified tissue. By incorporating other forms of information, such as contemporary documents or ethnographic accounts, the researcher can gain a firm understanding of the health of the population. The paleopathologist, however, is at a severe disadvantage when compared to modern pathologists. Several assumptions must be made, and the researcher must contend with the host of difficulties inherent to the field.

To begin with, a burial population might not be representative of the contemporaneous living population. In fact, a burial population might consist of individuals who died naturally or as a result of disease, murder, or mishap. Furthermore, sampling bias and preservation can further hinder paleopathological research by reducing the completeness of a burial population. At LAN-62, the complete recovery of the observed burial area helped to reduce sampling error but did not eliminate it. Although a substantial number of individuals were recovered, the site has been impacted over the years by construction activity and previous professional and avocational archaeological pursuits. For instance, a review of the known literature revealed that burials and isolated human remains had been previously encountered at LAN-62 and other sites in the PVAHP area (Luhrs and Arris 1948; Peck 1947; Thiel 1953).

The nature of individual diseases further confounds paleopathological research. Analysis of mummified tissue is an extremely rare opportunity for the paleopathologist. As previously mentioned, most paleopathology data are derived from skeletal remains. Unfortunately, however, many diseases are not exhibited skeletally, and absence of evidence in no way represents evidence of absence. For instance, according to the Web site of the Centers for Disease Control and Prevention (CDC), heart disease and strokes are "the first and third leading causes for death for both men and women in the United States, accounting for nearly 40 percent of all annual deaths" (CDC 2009; National Center for Health Statistics 2006). Neither of those conditions, however, is likely to produce skeletal responses. The second leading cause of death in the United States, cancer, *can* produce skeletal lesions but only under certain circumstances, such as when the disease metastasizes to bone (National Center for Health Statistics 2006).

Although most diseases only affect the soft tissue, for some infectious diseases, virulence inhibits skeletal response. In these situations, infected individuals can often succumb to illness before the disease leaves any indication of presence in the skeleton. In rare situations, some illnesses with high virulence and mortality, such as small pox, can produce skeletal responses in young children, because the woven bone characteristic of the developing skeleton is produced much more rapidly and has a better chance of capturing some response to the illness (Lane Beck, personal communication 2006). Further, Gupta and Srivasta (1973, as cited in McClain [1997:543]) stated that, in regard to small pox, "arthritis and osteomyelitis developed late in the course of disease in about 1–2 percent of patients, more frequently occurred in children, and was often manifested as bilateral joint involvement, particularly of the elbows."

Hindering paleopathological analysis further, one finds that most diseases do not have uniquely diagnostic traits. Bone responds to disease in a limited number of ways, and for most diseases, the paleopathologist must rely heavily on the pattern of the responses rather than the actual type of response. For instance, multiple myeloma and metastatic carcinoma are both forms of cancer that can affect the bone and are very similar, except for the pattern of skeletal elements that are affected (Ortner 2003:377). Because of this tendency for nondiscrete traits among pathological conditions, the level of preservation can greatly impact the success of the analysis, especially because different skeletal elements have different levels of survivability. Additionally, one must be especially vigilant against pseudopathological conditions. Animal activity, excavation damage, and erosion of skeletal elements can often lead to misdiagnosis of a pathological condition by an inexperienced analyst.

Wood et al. (1992:344) discussed three additional concerns that paleopathologists (as well as paleodemographers) must address during the course of an analysis: demographic nonstationarity, selective mortality, and hidden heterogeneity in risks. These concepts were defined earlier, and for further information, the reader is directed to Chapter 6, this volume. Because of these concerns, Wood et al. (1992:345) maintained that it would be difficult, if not impossible, to separate individuals that died from an epidemic but did not develop skeletal lesions from those that never experienced that epidemic in the first place, or those that survived and never developed lesions. Additionally, individuals that developed skeletal lesions may have been survivors of the epidemic or, conversely, may have died as a result of it. Both types of individual would seem identical. So, in skeletal analysis, several distinct populations are unfortunately reduced to a binary system between stressed individuals (those with observable lesions) and unstressed individuals (those without observable lesions).

Although such problems seem to present insurmountable opposition against accurate paleopathological research, analysis can successfully navigate the treacherous morass of caveats and theory and provide meaningful statements regarding the health and life of past populations. For the remains recovered during the PVAHP, the majority of the pathological and traumatic conditions observed were recovered from LAN-62, obviously as a result of the significantly larger skeletal population at that site. As expected, regardless of the number of individuals with pathological conditions or evidence of trauma, there was a greater tendency for more-mundane conditions, such as vertebral osteophytosis, to appear in higher frequencies than rarer conditions, and evidence to suggest the mechanism of death for each individual was scant. Regardless, the following chapter details the information regarding the pathological and traumatic conditions observed on the skeletal remains from the PVAHP area and also provides some insight into the life of the people of the Ballona Wetlands. Appendix E, this volume, details all observations regarding paleopathology and trauma recorded at sites excavated during the PVAHP.

LAN-62

This section details the trauma and pathological conditions observed on the skeletal remains at LAN-62 and is divided into four subsections: trauma, metabolic conditions, inflammatory and infectious conditions, and joint disease. Because each of these general types may represent a multitude of pathological conditions, these subsections are further subdivided. Nonspecific conditions, such as osteophytosis, were not explored further, because of the multitude of factors affecting their presence and severity. Their presence, however, was noted in regard to other, more definable pathological conditions, such as osteoarthritis.

Trauma

This section details the three main forms of trauma observed on the skeletal remains from LAN-62: sharp force, fracturing, and blunt force. As its name implies, sharp-force trauma refers to any trauma incurred from sharp objects, such as blades, and may include cuts, scrapes, chops, or punctures. The second category, fracturing, is a form of trauma that can result from any activity that surpasses the limits of the stress tolerance of the bone, either through more-dynamic high-energy actions, gradually increasing stress until the breaking point is met, or intermittent stress from repetitive activity (Ortner 2003:120). Fractures can be difficult to analyze because they may occur as symptoms of other types of trauma or pathological conditions or even as isolated events. The third type of trauma, blunt-force trauma, is inflicted by blunt objects' striking or crushing the bone and is identified by certain kinds of fractures, such as depression fractures. Although these fractures are similar to ordinary fractures, maintaining a distinction between blunt-force trauma and general fractures is important because of the behavioral implications. Because fractures and blunt-force trauma are so inextricably connected, these types of trauma will be discussed in a single section.

As with pathological conditions, identification of trauma can be troublesome. Taphonomic processes can often mimic trauma. Gnaw marks from animals (especially rodents), etching from plant roots, and fracturing from sediment weight can all produce effects that appear similar to trauma. Similarly, to the untrained eye, grooves from blood vessels can also be misidentified. In addition, although trauma might be evidence of interpersonal violence, intent is difficult to infer.

Three types of trauma—antemortem, perimortem, and postmortem—are identified for each form. Antemortem trauma is trauma inflicted prior to death. Evidence of healing is the defining characteristic of antemortem trauma. Perimortem (occurring around the time of death) and postmortem (occurring after death) trauma, however, can often prove difficult to distinguish from one another, especially in regard to blunt-force trauma and fractures. One of the keys to distinguishing perimortem from postmortem trauma is the observation of plastic deformation. Older bone tends to be brittle and more likely to break under stress, whereas newer bone tends to be plastic and more likely to bend or deform before breaking, partly because of the higher collagen content in newer bone, which helps give it a certain level of elasticity.

Sharp-Force Trauma

Two types of sharp-force trauma were observed on the human-skeletal remains recovered from LAN-62: cuts/slices and punctures. Cuts/slices are defined for this analysis as sharp-force trauma incurred when the blade of a tool is moved across the bone. These constituted the most numerous type of sharp-force trauma, with approximately 75 relatively V-shaped cuts/slices observed on various axial, cranial, and appendicular skeletal elements associated with 16 individuals. Additionally, nearly 40 more cuts/slices were associated with 14 isolated human-skeletal remains. No cuts/slices were observed on the elements associated with the extremities (hands/feet), scapulae, pelvises, vertebrae, or sterna. Figures 119–121 illustrate some examples of cuts/slices observed on the skeletal remains recovered from LAN-62. No microscopic stone flakes/chips were observed embedded in the cut marks.

Punctures—which occur when a pointed instrument (e.g., a projectile point or the tip of a knife) impacts the bone, resulting in complete or partial penetration—on the other hand, were the least common of the two types of sharp-force trauma observed at LAN-62. Only four puncture wounds were observed. Three of these originated from projectile points embedded in the remains of the second primary inhumation associated with burial Feature 305, a 30–40-year-old male (see Chapter 5, this volume). A possible puncture was observed on the right radial tuberosity of the primary inhumation in burial Feature 23, a 20–30-year-old possible female. That individual also exhibited five cuts/slices.

Nearly half the individuals with cuts/slices or punctures exhibited sharp-force trauma on more than one skeletal element, and of those, less than one-third exhibited sharp-force trauma on three or more skeletal elements. Furthermore, sharp-force trauma was associated with children and young and middle adults of both sexes (Figure 122). In addition, nearly twice as many female individuals exhibited cut marks than males, and sharp-force trauma occurred on young-adult female remains more often than on middle-adult female remains, a trend that was reversed among adult-male individuals.

As interesting as that incongruity might seem, it was most likely a function of preservation and demographics. As previously discussed in Chapter 6, this volume, approximately 1.5 times more female than male individuals were associated with the non–Mission period burials, and 3 times more female than male burials were associated with the Mission period. So, the disparity in the frequencies between these two groups was more likely related to the greater abundance of one group in the archaeological record than a perceived favoritism of one group over the other in regard to cultural behavior or trauma.

At the element level, it is clear that, with the exception of the extremities and most of the vertebrae, most elements/element groups had at least one associated incident of sharp-force trauma, although the right side seemed to be favored over the left (Figure 123).

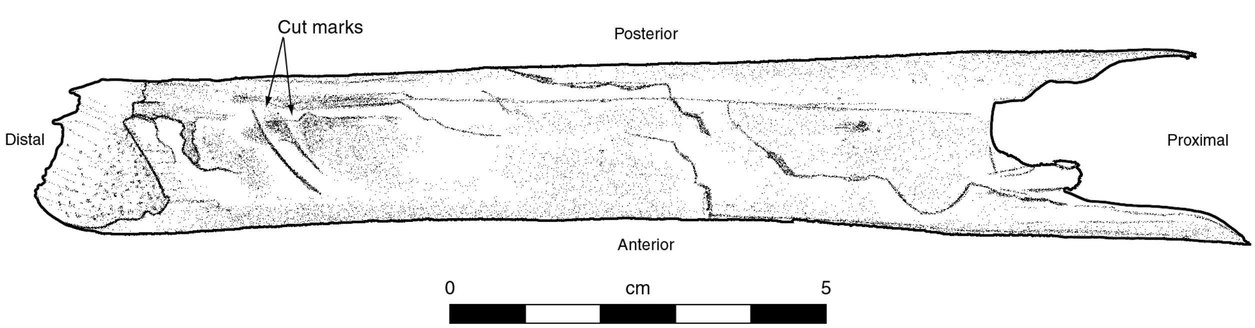

Figure 119. Illustration showing the two cut marks on the distal lateral end of a right humeral shaft recovered from burial Feature 282 at LAN-62; no demographic information is available.

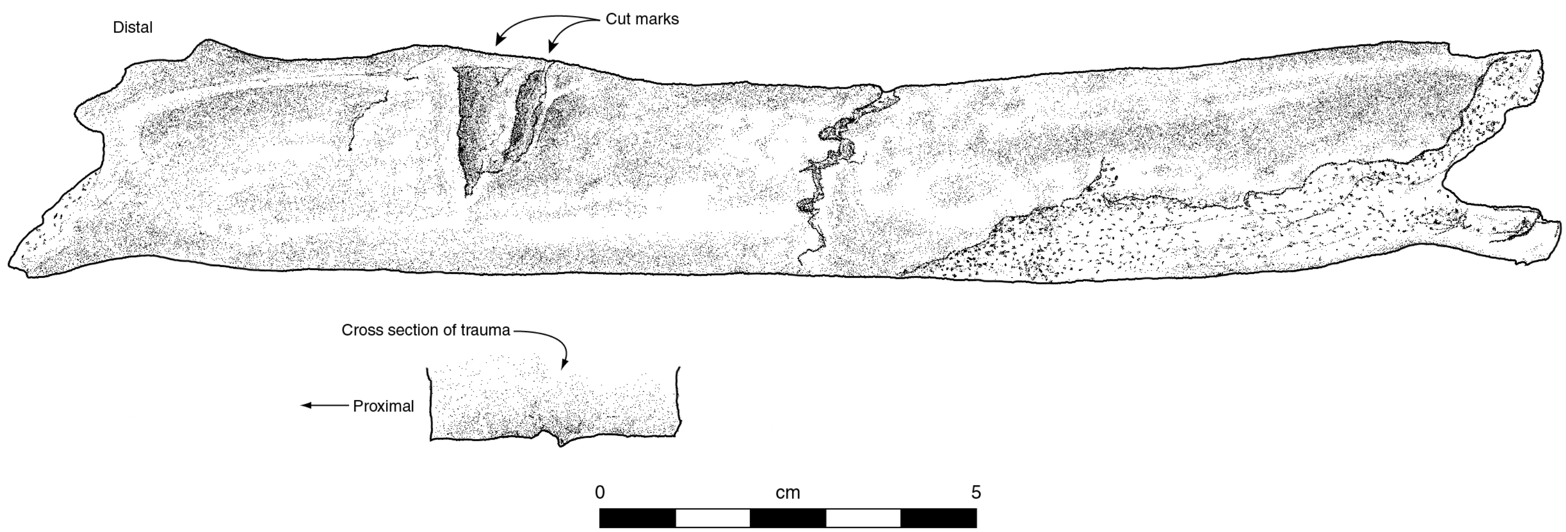

Figure 120. Illustration showing the cut marks on the distal end of the shaft of a possible left femur associated with the fourth additional individual (an adult of indeterminate sex) in burial Feature 204 at LAN-62.

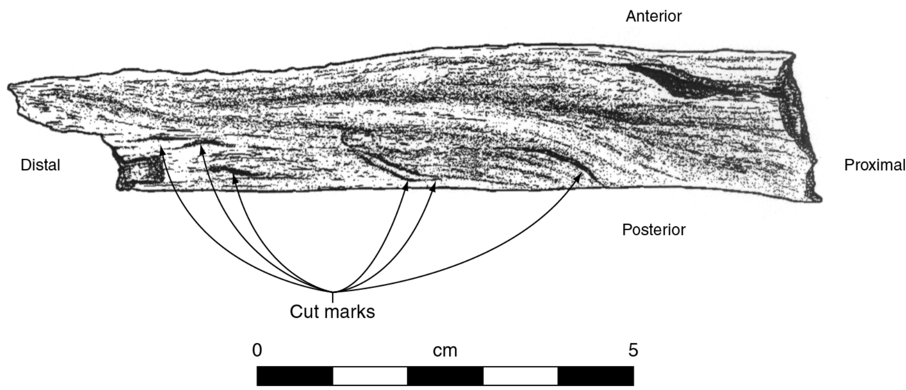

Figure 121. Illustration showing the six cut marks on the shaft of an unsided humerus recovered from burial Feature 149 at LAN-62; no demographic information is available.

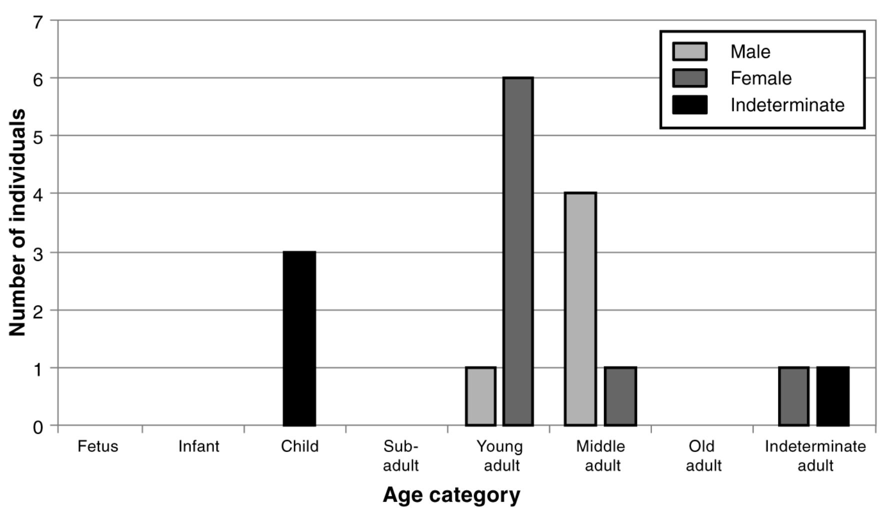

Figure 122. Graph of the demographic distribution of sharp-force trauma at LAN-62.

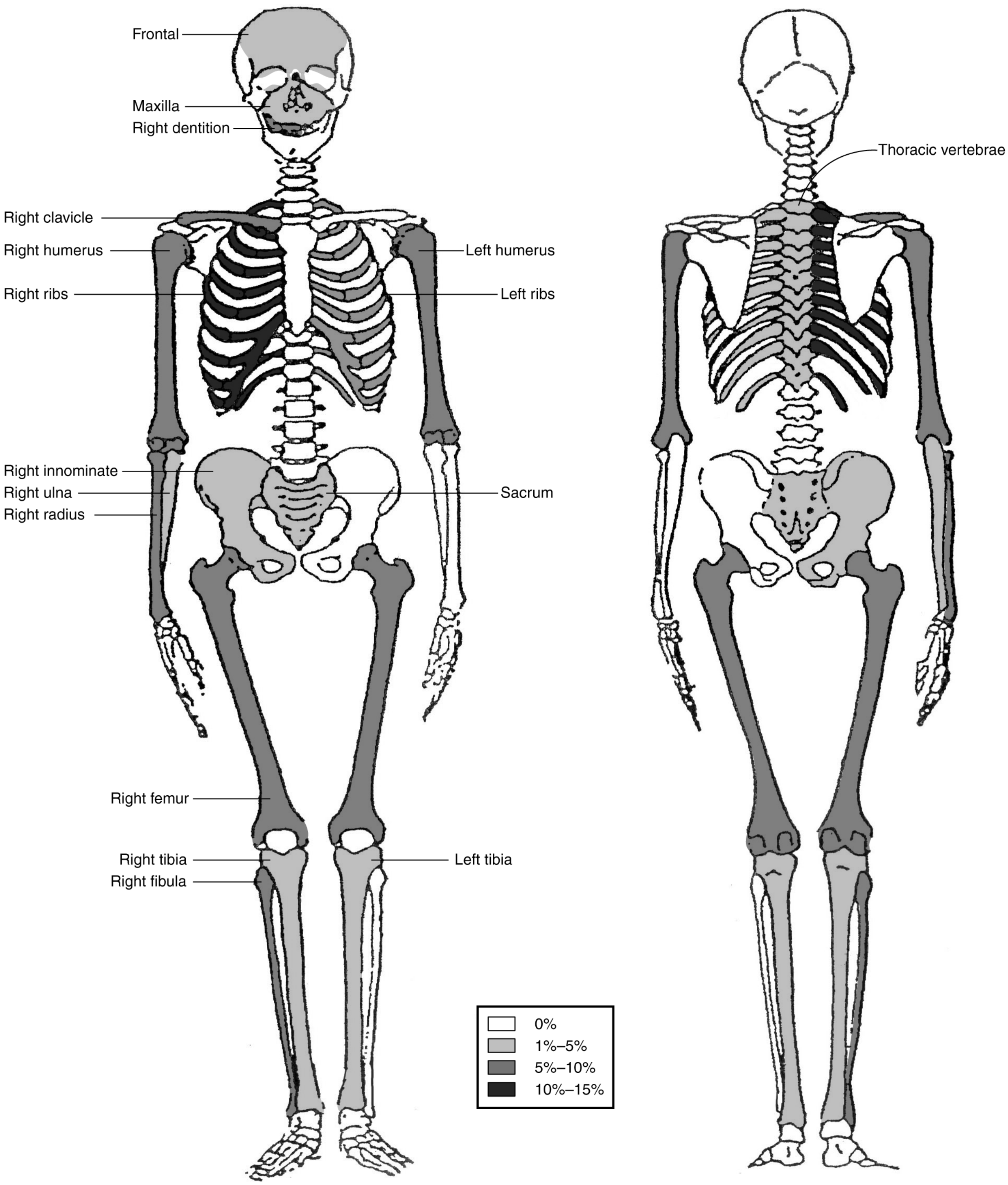

Figure 123. Illustration of the distribution of sharp-force trauma at LAN-62, by element type (*Note*: only sided elements were included).

For the skeletal population from LAN-62, at least two behaviors were observed regarding sharp-force trauma. Some cut marks on the skeletal remains appeared to suggest that the remains had been subjected to a mortuary custom involving defleshing or disarticulation. Additionally, clearly identifiable perimortem sharp-force trauma was observed for other individuals, indicating that several instances of sharp-force trauma were related to interpersonal violence. Unfortunately, clear examples of each were more the exception than the rule, because in many instances, the nature of the cut marks was too ambiguous to discern. Even so, the following sections detail each type of behavior and describe some of the better examples of each type.

Defleshing/Disarticulation

When each cut mark was plotted on a schematic of a human skeleton, the presentation throughout the skeleton revealed numerous patterns. With the exception of one cut/slice, the articular surfaces were unremarkable in regard to sharp-force trauma. There were, however, numerous concentrations of shallow, but distinct, cut marks in periarticular regions and sites of muscular/ligamentous attachment. These included cut marks associated with the lateral end of the clavicle, the radial tuberosity, the interosseous region of the forearm and lower leg, and the linea aspera. Cut marks in these locations are suggestive of disarticulation or defleshing. Olsen and Shipman (1994:380–381) wrote that defleshing marks are characterized by short, fine cuts or scrapes that frequently appear in clusters, indicating the necessity of applying repeated strokes in locations in order to thoroughly remove tissue. Comparisons between the composite schematic detailing the locations of the cut marks from LAN-62 with a schematic from Olsen and Shipman (1994:Figure 5) revealed similarities in the placement of the incisions.

Interestingly enough, however, unlike the individual detailed by Olsen and Shipman (1994:Figure 5), no single individual at LAN-62 exhibited bilateral cut marks for any single element type. One would expect that with complete disarticulation or defleshing of an individual, the skeletal remains would display cut marks throughout the body. In reality, very few intact burials at LAN-62 exhibited cut marks on more than one element. Even so, one can argue that some form of purposeful, perhaps selective, mortuary custom that exercised defleshing or disarticulation was used.

Although dismemberment and defleshing are well-documented mortuary customs in other cultures—e.g., the Arikara and Mandan of the Northern Great Plains and the Huron of the Great Lakes—such customs have not been commonly recorded for the Gabrielino/Tongva (Bodin 2002; Olsen and Shipman 1994). In fact, the only references to dismemberment, to the author's knowledge, were associated with a 25+-year-old male individual at the Mulholland site (LAN-246) (Galdikas-Brindamour 1970:Table 1) and three burials from the Medea Creek site (LAN-243) (King 1982:147–152). The presence of evidence of possible defleshing or dismemberment at LAN-62 might be related to the differential preservation of skeletal remains at the site.

In many burials at LAN-62, isolated remains with articulated joints were discovered. Most of those joints, such as the hip or elbow, are associated with dense concentrations of connective tissue. Because they were sometimes found isolated but intact, it is logical to infer that they were most likely moved while some tissue remained. Additionally, it was evident that preexisting burials had often been disturbed by subsequent burials. In some instances, disturbed remains were placed around and above the remains of the later interment. Perhaps for some situations in which remains still exhibited remnants of connective tissue, the gravedigger would cut through the remaining connective tissue to bend, or completely disarticulate, the joint, in order to inter a second burial.

Defleshing for Ritual Purposes

Some evidence of defleshing and disarticulation observed at LAN-62 might be associated with ritualistic activity instead of consolidation of previously interred remains. The cut marks on the skeletal remains of the primary inhumation from burial Feature 108 were consistent with such a hypothesis.

Burial Feature 108

Two ribs from this individual, a 30–45-year-old male, exhibited numerous cut marks (see Chapter 5, this volume). The left first rib exhibited 12 small cut marks ranging in size from 3.8 to 5.2 mm in length over a 6-mm area between the insertions for the anterior and middle scalene muscles, on the visceral surface. The left second rib exhibited 4 additional cut marks approximately 1 mm in length on the body of the rib. With the exception of 1 cut mark, they were also shallow. The deeper cut mark resulted in a slightly lifted edge because of the angle of the cut. The cut marks associated with the first rib, and possibly the second rib, were consistent with those of defleshing trauma and probably occurred during separation of the scalene and iliocostal muscles from the bone. Furthermore, the trauma that created the cut marks on the first rib might have also transected the subclavian artery and vein and the brachial plexus. Because there was no evidence of healing, these cut marks likely occurred around the time of death, when the bone was still fresh.

One might suggest that these cut marks are related to possible dismemberment activity. For this individual, the elements of the thorax and pelvis as well as both femora were found articulated, although the left femur consisted only of the head and neck. The cranium, on the other hand, was located at the right hip, facing up, and the left ulna, radius, fibula, and tibia were located across the back. Both the tibia and fibula and the ulna and radius were articulated with one another but not to any other contiguous elements. Furthermore, although the cranium was found disarticulated from the body, the cut marks on the first rib were not consistent with decapitation. Effective decapitation would occur on the cervical spine; these were far too low on the body. Unfortunately, the lack of cervical vertebrae for this individual precluded any assessment of possible decapitation. Alternately, one might hypothesize that the remains had been disturbed and reburied. Certainly, other examples of this behavior can be found associated with other burial features at LAN-62, and it is not outside the realm of possibility.

Juaneño ethnographic information might provide some insight into the cut marks observed on the skeletal remains from burial Feature 108. Boscana (Harrington 1934:45) wrote that in order for a *tomyaar*, or shaman, to ascend to *Tokuupar*, or the upper world, a special ritual commemorating Coyote's act of consuming the heart of Ouiot before his cremation was conducted. An individual known as the *taakwa* embodied the spirit of Coyote. During the ritual, "a little piece of meat from the shoulder near the neck of the deceased [was removed] and before all the people who were presented there, he ate it raw" (Harrington 1934:45). Similarly, Boscana (1933:62–63) (see also Davis 1921:109; Hull 2011:29) wrote that

> whenever a Captain, or one of the *puplem*, died, they sent for the Eno [Coyote, "thief and cannibal" (Boscana 1978:28)], who was thus called before he officiated in his duties, and afterwards [called] *tacue* signifying "an eater." Having arrived at the place where they had placed the dead body, he immediately cut off a large piece from the neck and the back, near the shoulder, and consumed the flesh in its raw state, in presence of the multitude assembled to witness the performance. This was always done in commemoration of the feat performed by the Coyote upon the body of the great captain, Ouiot.

The location of the cut marks on the first rib, though extremely deep, could have been made by a blade inserted into the thoracic inlet, possibly during the removal of this tissue. Although the location of the cut marks on the second rib did not correspond to the location described in the ethnographic account, they might represent a variation on this ritual or another activity altogether.

Evidence of Interpersonal Violence from Sharp-Force Trauma

As previously mentioned, intent is difficult to establish when examining sharp-force trauma in skeletal remains. Often, cut marks can be ambiguous, and their presence could be equally explained by an act of violence, mortuary custom, or even accidental trauma. Because of this, interpersonal violence can be difficult to argue in most circumstances. In some instances, however, the evidence of trauma can easily lend itself to such a diagnosis. The following burial features detail some of the best examples of interpersonal violence observed at LAN-62.

Burial Feature 305

One of the additional individuals found in burial Feature 305, a 30–40-year-old male, represented the best evidence of interpersonal violence at LAN-62 (see Chapter 5, this volume). Three Cottonwood Triangular projectile points were embedded in the poorly preserved skeletal elements for this individual. One projectile point was located on the left side of the anterior surface of the sacrum, lateral to the right first anterior sacral foramen (Figure 124). It was intact, and the tip was angled cranially, suggesting one of two trajectories: (1) the wounded individual was standing above his opponents or (2) the wounded individual was prone when an opponent shot him while standing near his feet. The second projectile point was embedded on the anterior surface of the right ilium, near the sacroiliac joint (Figure 125). The base of this point exhibited some breakage, possibly the result of impact, and like the first point, this projectile point also entered the body through the abdomen at a 45° angle. The final point was lightly embedded in the left inferior aspect of the body of a midthoracic vertebra. None of these wounds exhibited any signs of healing, indicating that the individual likely succumbed to these or other, unobservable wounds. Figure 126 shows the potential soft-tissue injury this individual might have suffered from the projectiles embedded in the pelvis.

Many possibilities exist as to the circumstances that resulted in the death of this individual. Certainly, because of the weapons used, this individual might have died in a conflict with Native Californian adversaries. However, an equally plausible explanation could be that this individual was executed. Boscana (Harrington 1934:33) wrote that should an individual be found guilty of a social or civic infraction, they were dispatched with arrows "and together with the arrows . . . he was borne to the presence of Chinigchinich." McCawley wrote that "the parents of the executed offender were later allowed to take possession of the body" (McCawley 1996:105). Whether the remains were buried in the traditional manner is unknown, however.

Although numerous projectile points were recovered from the burial area, only this individual exhibited any definitive evidence of arrow trauma. Research by Milner (2005) has suggested that many of the loose projectile points often found with burials may, in fact, be associated with soft-tissue damage. Medical records regarding arrow wounds from the Indian Wars in the United States demonstrated that only one in three arrows struck bone (Milner 2005:150). This is further confounded by problems with recognizing injuries, such as lack of preservation. Furthermore, stone arrowheads

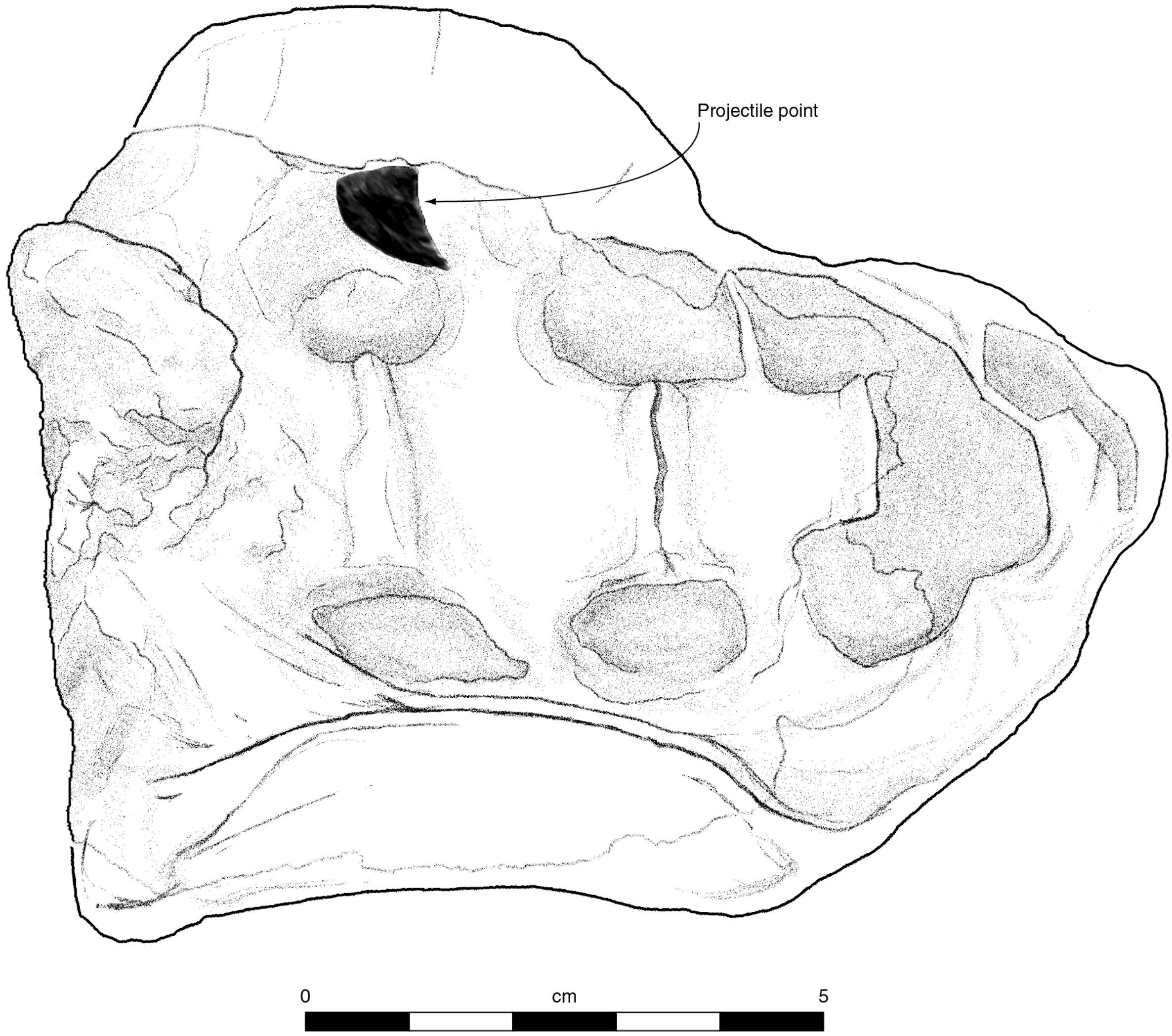

Figure 124. Illustration showing the projectile point embedded in the left side of the anterior surface of the sacrum associated with the primary inhumation (a 30–40-year-old male) in burial Feature 305 at LAN-62.

Figure 125. Illustration showing the projectile point embedded in the anterior surface of the right ilium near the sacroiliac joint associated with the primary inhumation (a 30–40-year-old male) in burial Feature 305 at LAN-62.

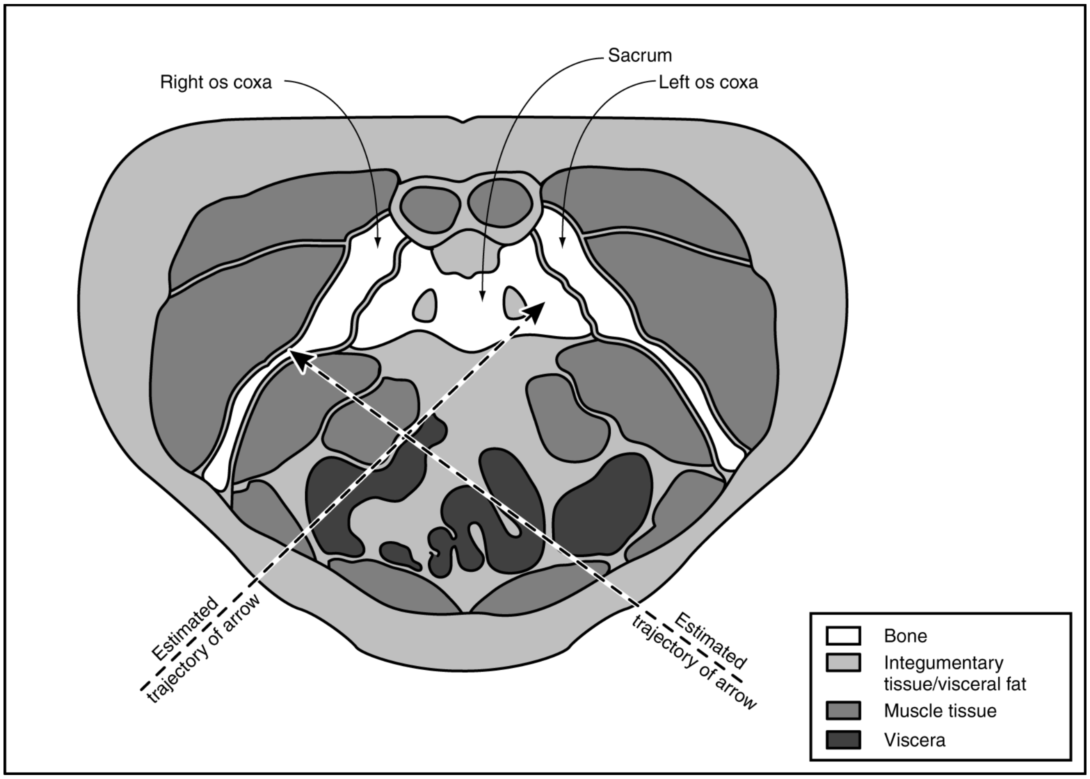

Figure 126. Illustration of a cross section of the anatomical region affected by projectile points embedded in the sacrum and the right innominate.

were more likely to shatter on impact or come free from the shaft during extraction, providing free-floating artifacts in the archaeological record (Milner 2005:148). These points could be identified as having been used, but unless detailed analysis is conducted, any association between the artifacts and nearby skeletal remains would be conjecture.

Burial Feature 267

A second example of potential interpersonal violence through sharp-force trauma at LAN-62 was exhibited in the skeletal remains of the primary inhumation from burial Feature 267, a 25–33-year-old female (see Chapter 5, this volume). A perimortem cut mark (Cut 1) was visible on the superior surface of the right tenth rib (Figure 127). On the inferior border of the same rib, along the vertebral neck and angle, were four additional perimortem cut marks (Cuts 2–5) (see Figure 127). Additionally, a sixth perimortem cut mark (Cut 6) was observed on the inferior margin of the right eleventh rib (Figure 128). Depending on the depth of the punctures beyond the ribs, these cuts might have resulted in damage to the liver and the surrounding structures. None of these cut marks exhibited any sign of healing, and the individual likely died as a result of this trauma or complications from it.

Cut 1 was small (4 mm in length) and angled 33° laterally. It was likely a nick from a blade as it passed through the intercostal space between the ninth and tenth ribs. A small chip of bone was struck off during the cut. Cuts 2–5 represented four successive sharp-force traumas, probably through a sawing motion, that entered the body at approximately 90°. Each cut mark was between 3 and 11 mm in length. The wounds were in a tight formation, suggesting that the individual was immobile. The angle of the cut marks began at 62°, angled laterally, and quickly approached 0° moving down the vertebral neck. The floors of the cut marks were smooth, and several exhibited a thin, curling spall, indicating that an extremely sharp blade was used to cut through fresh bone. Cut 6 was 9 mm in length and angled approximately 45° medially. The inferior margin of the right eleventh rib, associated with Cut 6, was pulled slightly outward, suggesting that the bone was dragged out with the blade.

Beneath the right femur was a large, lanceolate, dark-gray-chert spear/knife blade (Figure 129). The edge of the tool matched that of the sixth cut mark, and all the cut marks but one were consistent with the shape of a similar tool.

Although interpersonal violence seemed the most likely origin of these cut marks, could other origins be attributed? In short, probably not. The perimortem nature of these cut marks indicated that they had not been created postdepositionally or during excavation. Also, the lack of additional trauma, with the exception of the spondylolytic fourth and fifth vertebrae, or infection in the vicinity of the cut marks suggested that they were not linked to some prehistoric therapeutic activity. Finally,

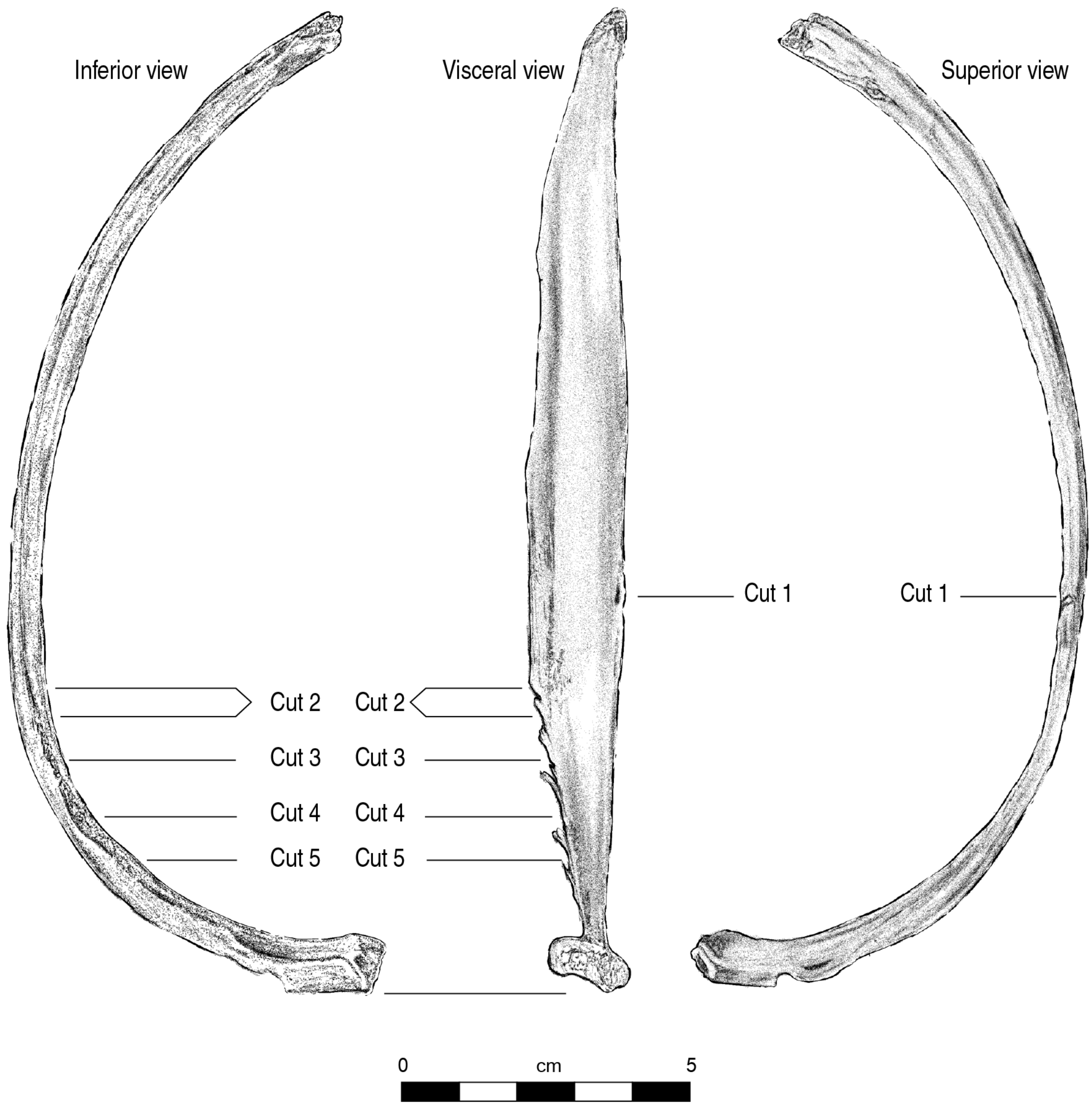

Figure 127. Illustration showing the five cut marks on the right tenth rib associated with the primary inhumation in burial Feature 267 at LAN-62.

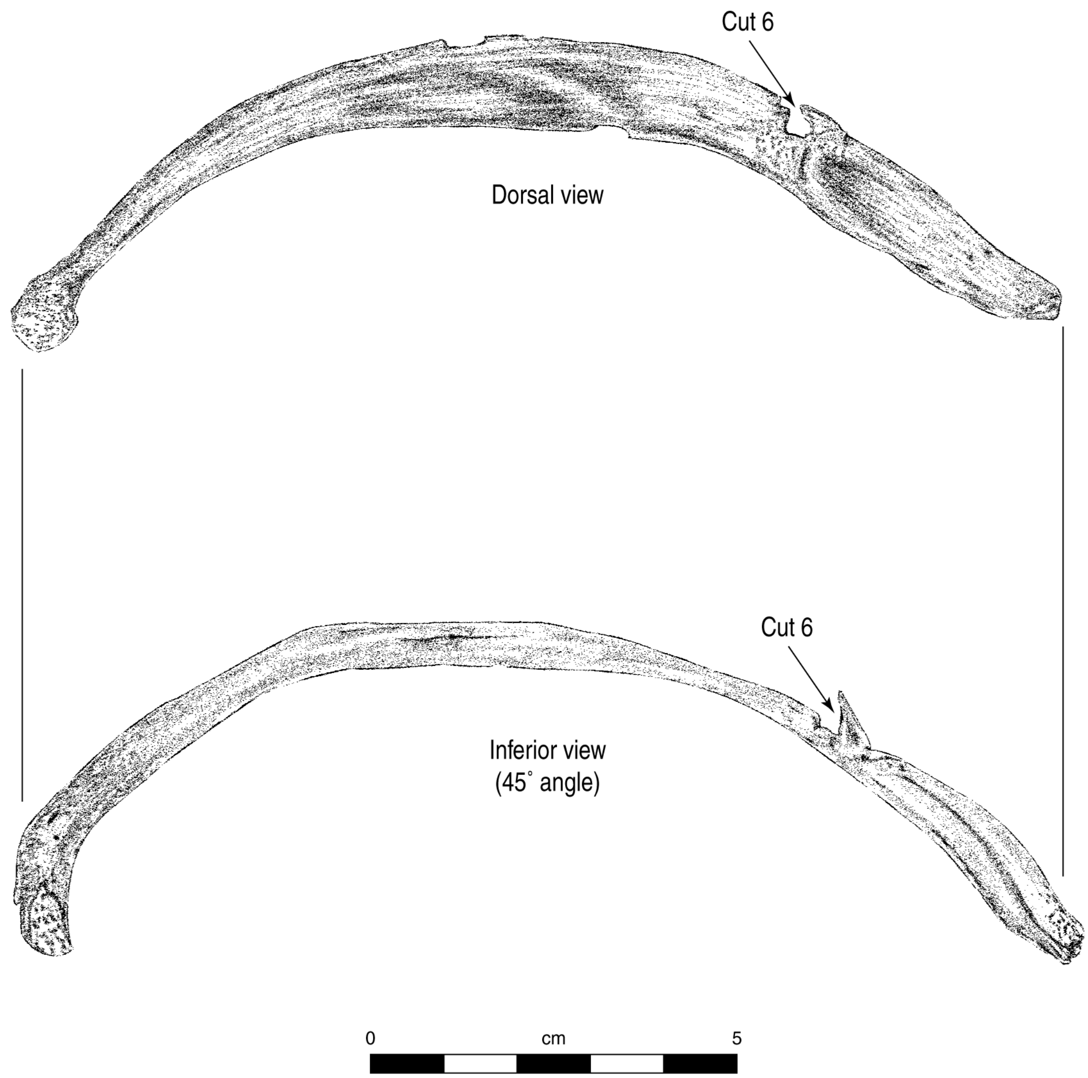

Figure 128. Illustration showing a cut mark on the inferior margin of the right eleventh rib associated with the primary inhumation in burial Feature 267 at LAN-62.

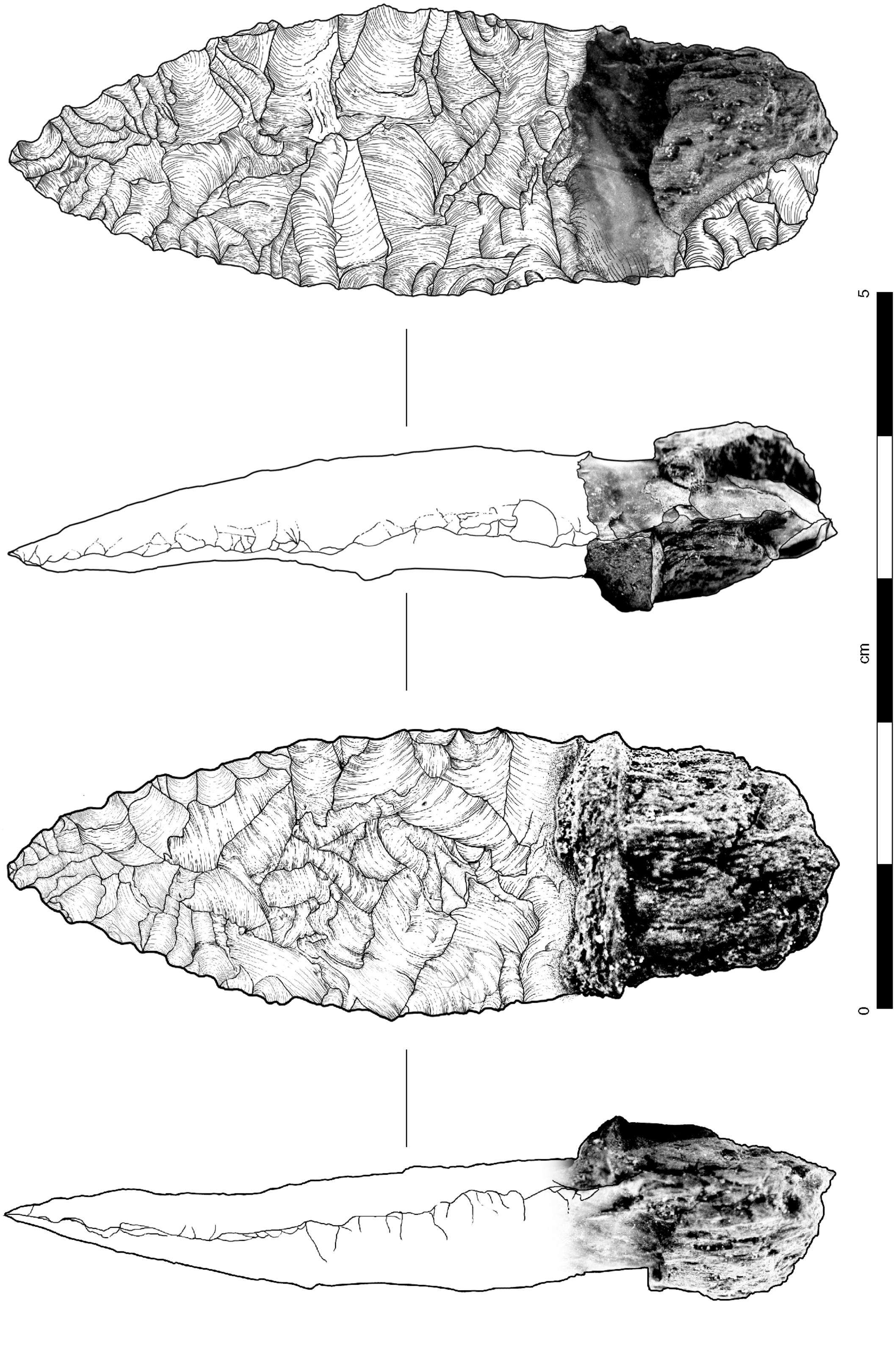

Figure 129. Illustration of the biface found beneath the right knee of the primary inhumation in burial Feature 267 at LAN-62.

as mentioned above and according to Boscana (1933:62–63, 77), although the mortuary customs associated with the interment of a shaman might require the consumption of some human tissue, that tissue was removed from the shoulder/neck region and not from the middle to lower back.

Burial Feature 112

The second additional individual from burial Feature 112, a 20–25-year-old possible female, exhibited another example of possible interpersonal violence. For this individual, a sharp, bladed object had been pushed through the right maxilla between the first premolar and the canine. The alveolar bone between the teeth had been sheared off, and the root of the right first premolar exhibited two distinct, interconnected cut marks that create a jagged cross section. The cut marks were V-shaped and were made at a roughly 45° angle. The cut marks on the tooth were extremely deep, exposing the pulp chamber.

The trauma associated with this individual had not healed, indicating that this individual died as a result of this injury, complications from the injury, or other subsequent injuries that might have occurred in addition to this wound. The bone, however, might be affected in a similar way in a postmortem context if the bone was still fresh. Yet this example of sharp-force trauma was not consistent with defleshing or dismemberment, in which one would expect a series of shallow, short cut marks.

Burial Feature 213

This burial feature was centrally located in the scattered burial concentration in the eastern portion of the site, approximately 1 m north of the historical-period trench (nonburial Feature 16). It consisted of a single primary inhumation and a second individual represented by an isolated cranium. The primary inhumation was a 30–40-year-old male interred semiflexed on the left side, oriented to the east, with the head facing south (see Chapter 5, this volume).

The second individual recovered from this burial feature, a 25–50-year-old possible male, was represented by a cranium located directly south and adjacent to the left elbow of the primary individual. During excavation, the possibility was raised that this cranium was a trophy skull that was buried with the primary individual. The proximity of the cranium to the primary individual suggested that both sets of remains were buried at the same time and in the same pit. Additionally, unlike many other burial features associated with LAN-62, this burial feature was relatively isolated from the commingling of remains common in the main burial area. Furthermore, the difference in the general appearance of the cranial shape for both the primary inhumation, whose cranium exhibited a relatively high vault with shorter cranial length, and this second individual, whose cranium exhibited a lower vault profile with a longer cranial length, further suggested that the second individual was from another group. Unfortunately, these differences could not be quantified, because damage in key locations of the cranium prevented craniometric analysis.

Trophy skulls are not outside of the realm of possibility. Cultures throughout the world often took trophies from the battlefield (Bonogofsky 2006). Andrushko et al. (2005) reported that in central California, forearms were often taken as warfare-related trophies by Native Californian groups. Furthermore, among the Gabrielino/Tongva, captured enemy combatants were either decapitated on the battlefield or taken as hostages, and scalps were taken for trophies or ransomed to the families of the deceased (McCawley 1996:107). Raab (1994:35) noted that Burial 24 at Calleguas Creek (VEN-110) included three additional crania in addition to the primary individual, suggesting that it was evidence of trophy-taking or kin worship. Because of the relatively discrete association between the primary individual and the isolated cranium, the cranium likely held some value for the primary individual in this burial feature, possibly as a trophy. Unfortunately, no cut marks were observed on the cranium associated with the second individual, and although the base of the cranium was missing, suggesting that the foramen magnum had been enlarged so that the skull could be placed on a post, preservation was such that the damage could not be interpreted as perimortem or postmortem.

Cranial Cut Marks: Scalping vs. Body Preparation

Several cut marks were observed on the elements of two crania. One of the crania, associated with the second additional individual in burial Feature 112, has already been discussed. The other cut marks were seven small, perimortem cut marks extending laterally along the posterior right aspect of the frontal bone associated with the primary inhumation in burial Feature 325, a 30–45-year-old female (Figure 130). The cut marks ranged in length between 5 and 10 mm, were shallow, and ran parallel to each other. There was no evidence of healing. The cut marks might have been related to scalping or some custom of body preparation.

Nadeau (1941) reported that there are many variations in the practice of scalping. In some instances, the entire scalp may be removed, along with the face, ears, and eyes and part of the neck. Stewart (1971:442) reported that the Mohave, when taking scalps as trophies, would remove them in such a manner. Sometimes, only the scalp from near the crown of the head was removed, whereas in other circumstances, multiple smaller patches of scalp were taken by different individuals as trophies. On some occasions, usually associated with torture, the scalp was partially removed but left attached to the neck.

Illustrations of scalped crania from four Great Plains sites have demonstrated that cut marks would have been evident

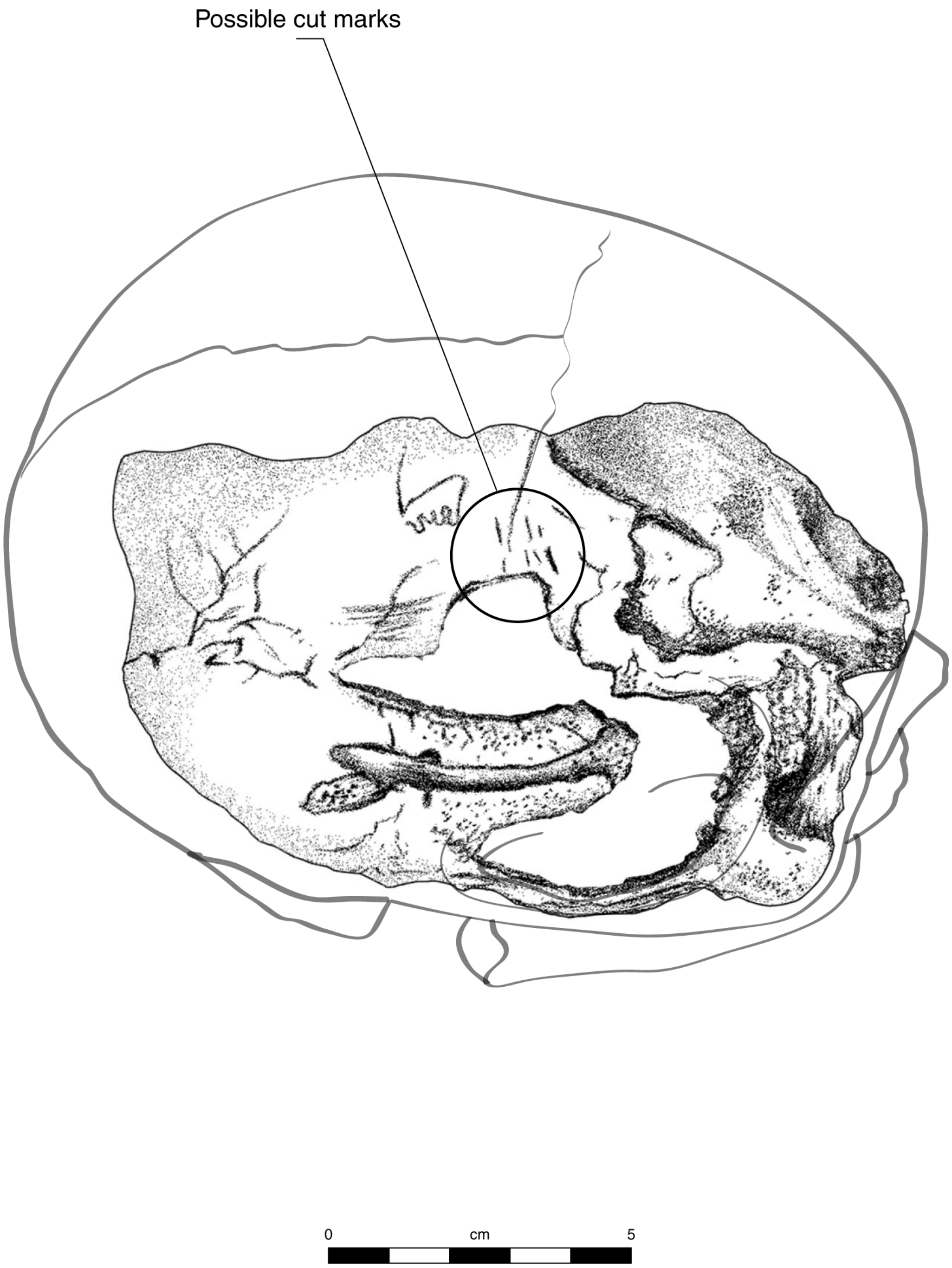

Figure 130. Illustration showing the seven cut marks on the posterior right aspect of the frontal bone associated with the primary inhumation (a 30–45-year-old female) in burial Feature 325 at LAN-62.

across the vault (Owsley 1994:Figure 1). That, of course, was not the case with the cut marks at LAN-62, but they might have been related to the very poor preservation attributed to these skeletal remains.

Johnson (2007:87) provided an explicit ethnohistoric example of an incidence of scalping among the coastal Chumash during the Mission period in 1775. Native Californians from Dos Pueblos *rancherıa* were encountered by Spanish on their way back to their village after a conflict with a neighboring village. The residents of the Dos Pueblos *ranchería* were carrying back one or more scalps of their victims.

Cut Marks of Unknown Origin: Burial Feature 218

The primary inhumation associated with burial Feature 218, an 18–25-year-old possible female, exhibited a series of cut marks of unknown origin (Figure 131). On the lateral aspect of the left humerus, at least 13 postmortem cut marks were observed in a region ranging from 63 to 125 mm from the proximal end, placing them over the deltoid tuberosity. The longest of the cuts measured 21 mm and was approximately 0.4 mm wide. Several overlapping cut marks produced a defect 20 mm long and 3 mm wide. Though postmortem, the cut marks were not incurred during excavation.

Twelve of the 13 cut marks shared the same orientation, between 120 and 130° from the vertical axis of the bone. One cut, however, was between 240° and 250° from the vertical axis and overlapped another cut at an angle of approximately 70°. This unique cut was likely placed after the other cut marks, because the path was uniform, and the lower cut mark was interrupted.

Because these cut marks appeared to have been made postmortem, there is a low probability that they were the result of defleshing, such as those observed on the skeletal remains associated with the primary inhumation in burial Feature 108, or as a result of a traumatic event. Such marks might have been created during some unidentified postdepositional behavior, such as the use of a digging implement near these remains.

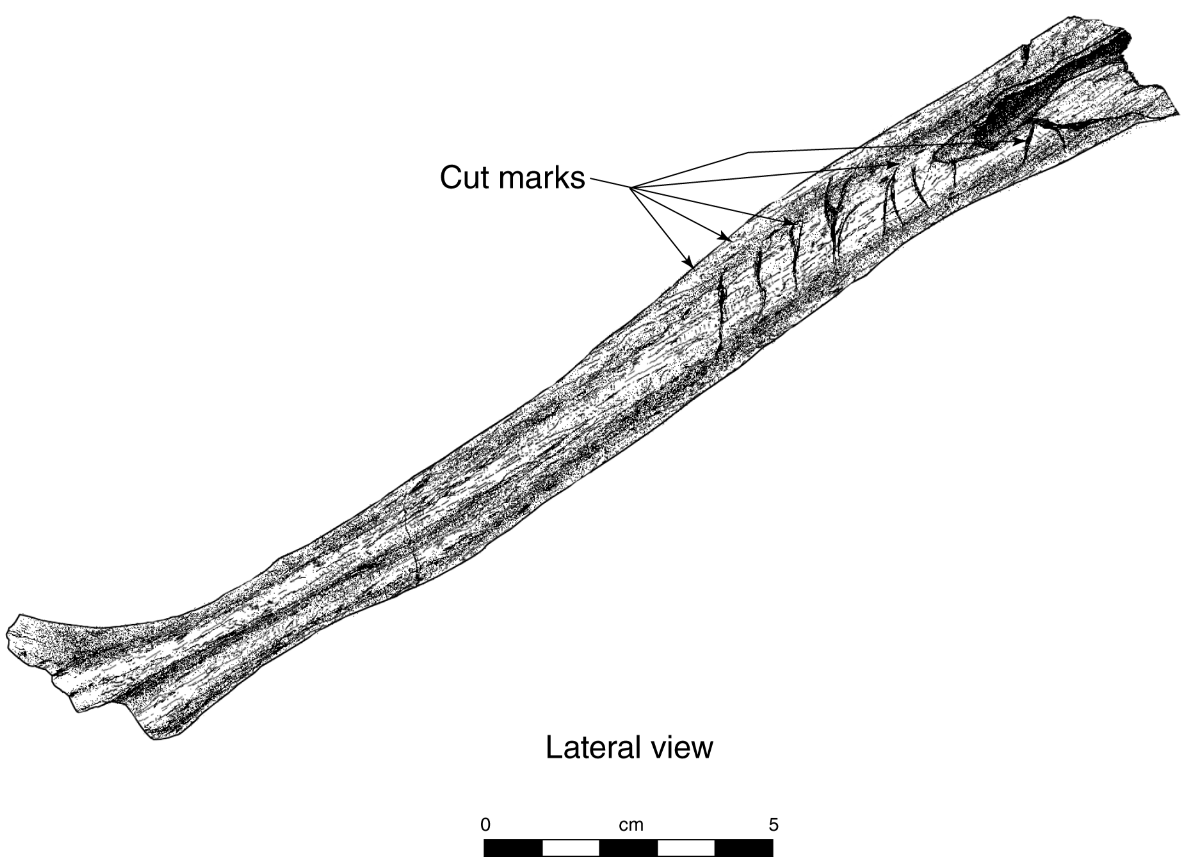

Figure 131. Illustration showing cut marks of unknown origin on the lateral aspect of a left humerus associated with the primary inhumation in burial Feature 218 at LAN-62.

Blunt-Force Trauma and Fractures

The following section details evidence of fractures and blunt-force trauma observed at LAN-62, with attention to interpersonal violence and activity-related fractures.

Fractures

Forty-two antemortem fractures not likely attributed to interpersonal violence, including 15 vertebral-compression fractures and 5 incidences of spondylolysis, were observed on the skeletal remains recovered from LAN-62 (Table 57). No individual exhibited perimortem blunt-force trauma, although one individual did die shortly after suffering cranial trauma, as indicated by the amount of healing (see the Evidence of Interpersonal Violence from Blunt-Force Trauma section, below).

In terms of distributions and patterns, males at LAN-62 exhibited slightly more antemortem fractures of the arm and leg bones than did females (see Table 57). On the other hand, a slightly greater number of hand-bone fractures was observed for the females (see Table 57). These differences were likely the result of sexual division of labor and differential hazards. Unfortunately, sex could not be estimated for many of the foot bones, which exhibited one of the higher frequencies of antemortem fractures. When trends at LAN-62 are compared to those observed at the Humaliwo site (LAN-264), one finds that the blunt-force trauma at LAN-62 was less than that observed in the Mission period population at LAN-264 but slightly more than the Middle period population from the same site (Walker et al. 1996:Table 15).

For the vertebrae and pelvis, overall, males and females exhibited roughly the same frequencies of antemortem fractures (see Table 57). However, unlike the other recorded fractures, the frequency of antemortem fractures in the axial skeleton was not as equally distributed among the individuals. In one rather dramatic example, all but one of the fractured vertebrae for the males were attributed to the primary inhumation in burial Feature 207, a 40–55-year-old male. Figure 132 shows an example of one of the fractured lumbar vertebra for this individual. Furthermore, one finds that at the individual level, four times as many females as males displayed antemortem fractures of the lumbar vertebrae (see Table 57). Such vertebral fractures might have been related to osteoporotic changes in the structure of the trabecular bone. For further information, see the Osteopenia/Osteoporosis section (below).

Spondylolysis

Of particular interest to the study of fractures in this population was the presence of lumbar spondylolysis, a vertebral stress fracture caused by movement of the affected vertebra

Table 57. Numbers of Antemortem Fractures for All Individuals in the LAN-62 Burial Population

Sex, by Skeletal Element	No. of Fractures	No. of Individuals
Arm		
Male	2	2
Female	—	—
Indeterminate	—	—
Subtotal	2	2
Hand		
Male	2	2
Female	4	3
Indeterminate	1	1
Subtotal	7	6
Leg		
Male	2	2
Female	1	1
Indeterminate	—	—
Subtotal	3	3
Foot		
Male	1	1
Female	—	—
Indeterminate	7	—[a]
Subtotal	8	1[a]
Cervical vertebrae		
Male	—	—
Female	—	—
Indeterminate	—	—
Subtotal	—	—
Thoracic vertebrae		
Male	4	2
Female	1	1
Indeterminate	—	—
Subtotal	5	3
Lumbar vertebrae		
Male	5	1
Female	7	4
Indeterminate	3	—[a]
Subtotal	15	5[a]
Pelvis		
Male	1	1
Female	1	1
Indeterminate	—	—
Subtotal	2	2
All bones		
Male	17	11
Female	14	10
Indeterminate	11	1[a]
Subtotal	42	22[a]

[a] Some elements could not be attributed to a specific individual.

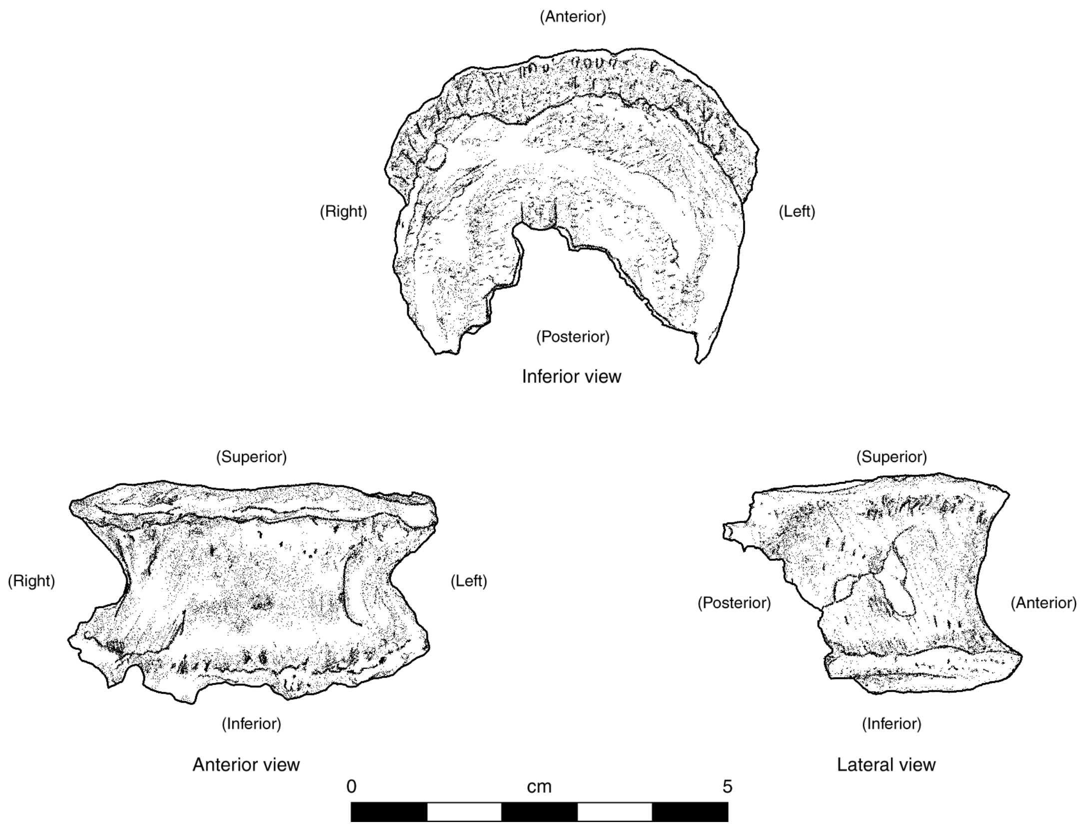

Figure 132. Illustration showing the compression fracture of the first lumbar vertebra associated with the primary inhumation (a 40–55-year-old male) in burial Feature 207 at LAN-62.

relative to the vertebra below it, during which the neural arch is separated from the remainder of the vertebra (Capasso et al. 1998:24; Merbs 1996:357). This condition may be further characterized as partial, bilateral, or unilateral and may occur in any vertebra, although it occurs more frequently in the lower lumbar (Merbs 1983:120). Furthermore, spondylolysis may occur at the interarticular area, the pedicle, or the lamina on the affected vertebra; failure in the interarticular area is the more common representation in the literature.

Although the etiology of this condition is somewhat debated, research by Merbs (1983:172–174) yielded evidence that this condition is precipitated by a variety of factors, including genetic predisposition and behavioral patterns that facilitate the development of the condition. Furthermore, Merbs's exhaustive survey of the clinical literature revealed a host of activities associated with this condition, including gymnastics, contortionism, dancing, diving, hockey, javelin throwing, rowing, canoeing, football, handball, weight lifting, and wrestling, in addition to traditional Native Californian activities (Merbs 1996:365).

At LAN-62, five lumbar vertebrae with spondylolysis were observed. To find the frequency of this condition in this population, the completeness scores for the lumbar vertebrae were used to weight the total number of adult lumbar vertebrae recovered from LAN-62. The number of complete bones was multiplied by a factor of 1, the number of partial bones was multiplied by a factor of 0.5, and the number of bone fragments was multiplied by a factor of 0.25. By incorporating completeness, a closer approximation of the actual amount of observable material, rather than an idealized amount, can be used to calculate the frequency. Such a method was used by Walker et al. (1996:Table 14) when examining the human remains recovered from the Humaliwo site (LAN-264) for pathological conditions, such as periostitis. This translated to a weighted frequency of nearly 2 percent for all adult lumbar vertebrae exhibiting spondylolysis in the skeletal population.

Unfortunately, demographic information for these vertebrae is limited. Only fourth and fifth lumbar vertebrae (one each), both attributed to the primary inhumation in burial Feature 267, provided such information. Because of that, no information regarding differences in patterns of expression for spondylolysis based on age or sex could be gathered.

Evidence of Interpersonal Violence from Blunt-Force Trauma

At LAN-62, evidence of interpersonal violence in the form of blunt-force trauma and fracturing of the cranium, forearm, and possibly the ribs was observed. Certainly, there are multiple factors that might result in such trauma. In prehistoric and early-historical-period southern California, however, the possible factors were rather limited. Although trauma from mundane sources or accidents (e.g., falling from a height) might have resulted in similar fractures, interpersonal violence appeared to be a major cause of the blunt-force trauma, especially on the cranium. Walker (1997:160) stated that targeting the head, and especially the face, during conflict is tactically advantageous, because these wounds can be rather debilitating, and the subsequent wounds and bruises are highly visible, asserting the aggressor's dominance over the victim.

Some postcranial fractures might also indicate evidence of interpersonal violence. Unfortunately, it is often difficult to separate accidental from intentional trauma, especially in long bones. Ortner (2003:143) wrote, "it is certainly plausible that many if not most fractures of the long bones, other than parry fractures, are the result of accidental causes." Following that assertion, only fractures believed to be "parry" fractures were included as evidence of interpersonal violence. These fractures (also known as night-stick fractures) are simple fractures of the ulna or radius usually resulting from direct trauma, such as one might receive while blocking a blow with a raised forearm (Perry et al. 1995:107–108). Figure 133 details a parry fracture on the left ulna associated with the primary inhumation from burial Feature 26, a 20–30-year-old female. Note the osteophytic growth on the posterior surface of the distal shaft of the left radius associated with the same individual. Such growth might have been related to the traumatic event that resulted in the fracture.

In addition to parry fractures, antemortem rib fractures were also included. A study of domestic abuse found that the thorax was the next-most-common location for injury in battered women, after the head and face (Muelleman et al. 1996:Table 2). Although cultural patterns of violence do not necessarily translate exactly across groups and throughout time, and modern analogs should be taken with a measured response, modern clinical data can provide information regarding areas of the body that are more susceptible to injury.

For the skeletal remains at LAN-62, there were 14 fractures that might be attributable to interpersonal violence on the remains of at least eight adult individuals (Table 58). Although the numbers were rather small, some patterns were apparent. Most of the trauma was divided between the ribs and the cranium. Very little trauma was located on the ulna, and none was observed on the radius. Unfortunately, for some elements, association with a specific individual was not possible.

Although slightly more males exhibited trauma on the cranium, females displayed a more diffuse pattern and an overall slightly greater frequency of trauma. Of the individuals with estimated sex, trauma to the face was exclusive to males, and postcranial trauma was exclusive to females. All but one fracture attributed to interpersonal violence were located on the anterior portion of the skeleton, and nearly three times as many fractures occurred on the left side (n = 8) than the right (n = 3). The exception to that rule was a single depression fracture found on the posterior vault of a female individual, the primary inhumation from burial Feature 4.

Two individuals exhibited multiple fractures. Both the mandible and the maxilla of the primary inhumation in burial Feature 346, a 31–42-year-old male, exhibited some antemortem trauma. The primary inhumation associated with burial Feature 234, a 17–25-year-old female, on the other hand, displayed two broken ribs. In addition to the individual in burial Feature 346, the primary inhumation associated with burial Feature 341 exhibited partially healed cranial trauma, indicating that the primary individuals in burial Features 341 and 346 died as the result of these injuries, complications from them, or other injuries that might have occurred in addition to these wounds.

Cranial-vault trauma consisted of three healed or partially healed circular or elliptical depression fractures. Dimensions of two of the fractures indicated a mean diameter of approximately 17 mm. Although the shape of these fractures was comparable to the fractures on skeletal remains recovered from the Channel Islands described by Walker (1989:316–317), the fractures observed at LAN-62 were nearly twice the size (Walker 1989:Table 2). As suggested by Walker (1989:319), the wounds might have been inflicted by a weapon similar to a Gabrielino/Tongva war club, which was sometimes lined with wooden studs (McCawley 1996:Figures 31 and 32).

Although the amount of trauma was small, the distribution of fractures has some social implications. First of all, the exclusivity of facial trauma and the absence of postcranial trauma in the males suggested that these wounds had been inflicted in a situation where the head was the focus for aggression, such as in close combat or a duel similar to the one described by Walker (1989:320). The anterior (and left) placement of these fractures, where the individual was likely struck in the face by a right-handed assailant, helps to support that hypothesis.

The pattern of trauma on the female skeleton was similar to the pattern submitted by Muelleman et al. (1996) regarding battered women. The lack of trauma on the face, however, is interesting. As mentioned before, the face is one of the primary locations in cases of assault. Unfortunately, because soft-tissue damage and bruising would not appear skeletally, any supporting evidence that did not result in a fracture would have been lost. A word of caution: the similarity between the pattern of trauma observed at LAN-62 and the pattern of injury from spousal abuse should not be misconstrued. As mentioned before, intent does not translate very well skeletally. Injury incurred from abuse and injury incurred during defense or evasion from the attacks of a homicidal assailant could look identical.

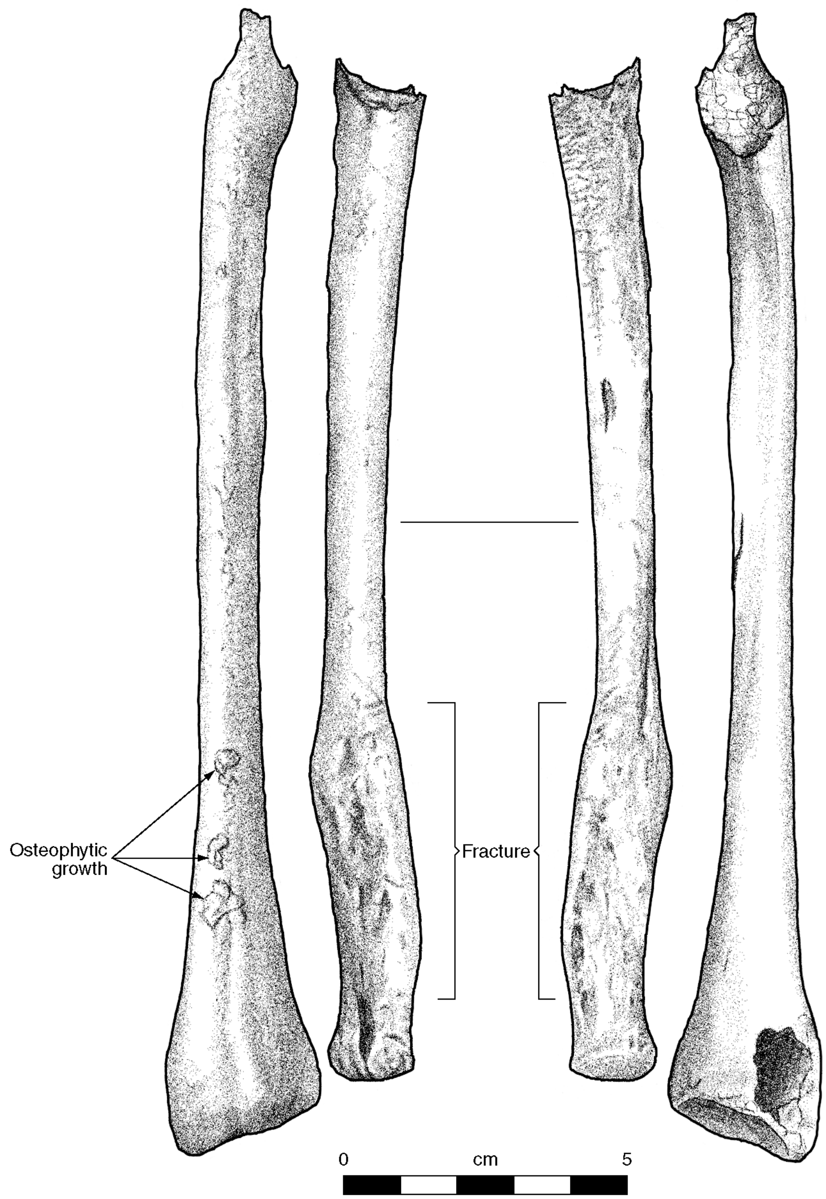

Figure 133. Illustration showing the "parry" fracture on the left ulna associated with the primary inhumation (a 20–30-year-old female) in burial Feature 26 at LAN-62; note the osteophytic growth on the posterior surface of the left radius, which might be related to the traumatic event that caused the fracture.

Table 58. Demographic Distributions of Blunt-Force Trauma Associated with Interpersonal Violence in the LAN-62 Burial Population

Sex, by Skeletal Element	No. of Fractures
Cranial vault	
Male	1
Female	2
Indeterminate	—
Subtotal	3
Facial region	
Male	3
Female	—
Indeterminate	—
Subtotal	3
Ulna	
Male	—
Female	1
Indeterminate	1
Subtotal	2
Radius	
Male	—
Female	—
Indeterminate	—
Subtotal	—
Ribs	
Male	—
Female	2
Indeterminate	4
Subtotal	6
All bones	
Male	4
Female	5
Indeterminate	5
Subtotal	14

Metabolic Conditions

This section details the various metabolic conditions observed among the skeletal remains recovered from LAN-62. In short, metabolic conditions are pathological conditions more commonly related to problems with nutrition, such as scurvy (vitamin C deficiency), rickets/osteomalacia (vitamin D deficiency), porotic hyperostosis/cribra orbitalia (iron-deficiency anemia), and osteopenia/osteoporosis (bone loss related to a variety of causes), as well as a suite of endocrine disturbances (Ortner 2003:383–433).

Porotic Hyperostosis/ Cribra Orbitalia

Porotic hyperostosis refers to an increased porosity on the skeletal elements of the cranium due to the thinning of the outer table of the cranial vault and the increase in the thickness of the diploë (the spongy bone inside cranial skeletal elements) (Roberts and Manchester 1997:167; Stuart-Macadam 1992:39). This condition commonly affects the elements of the cranial vault, although this porosity can occur on the orbital roof, and in such instances, it is known as cribra orbitalia. Traditionally, this condition is linked to the creation of more red blood cells by the body, to compensate for the reduction of iron in the blood during times of anemia. It may result from an iron-poor diet, such as maize-dominant and protein-poor diets; diarrheal infections; helminthic infestations; pregnancy; prolonged breastfeeding; injury; ceremonial bloodletting; and menstruation (Holland and O'Brien 1997:189; Walker 1986). Additionally, Ortner (2003:370, 372) maintained that the condition can occur as a result of other pathological conditions, including infection, cancer, and metabolic disease, such as scurvy or rickets/osteomalacia, and diagnosis should be treated with care.

There were 52 recorded observations for porotic hyperostosis at LAN-62, and an additional 2 individuals exhibited some degree of cribra orbitalia (Table 59). Most of these observations were attributed to specific individuals. Based on the information provided in Table 59, males exhibited more instances of porotic hyperostosis than females. No individual exhibited both cribra orbitalia and porotic hyperostosis.

Osteopenia/Osteoporosis

Osteopenia can be defined as the "occurrence of a disproportionate loss of bone mass" (Ortner 2003:410) and may be caused by such factors as osteoporosis, osteomalacia (adult rickets), rickets (vitamin D deficiency), hyperparathyroidism, cancer, malnutrition, and immobility/disuse (Richardson 2000). Osteoporosis, particularly senile and postmenopausal osteoporosis, is the most common form of osteopenia today (Ortner 2003:411; Richardson 2000). In general, women are more likely to be affected by osteoporosis than men, most likely because of a postmenopausal shift in hormones (Ortner 2003:411). Charlotte Roberts and Keith Manchester (1997:177) reported that in addition to age and sex, diet, lack of exercise, prolonged lactation, a high number of pregnancies, smoking, caffeine, and alcohol also play a role in the development of osteoporosis.

When an individual ages, bone formation lags behind bone destruction, and incrementally, bone loss occurs. If left untreated, this can lead to severely weakened bone and subsequent fracturing, particularly in areas of high trabecular bone content, such as the pelvis, the femoral neck, and the vertebrae. As expected, preservation plays a major role in the

Table 59. Distributions of Porotic Hyperostosis and Cribra Orbitalia in the LAN-62 Burial Population

Pathological Condition	Fetus (n)	Infant (n)	Child (n)	Subadult (n)	Male (n)					Female (n)					Indeterminate Sex (n)					Total (n)
					YA	MA	OA	AD	Ind	YA	MA	OA	AD	Ind	YA	MA	OA	AD	Ind	
Porotic hyperostosis	—	—	2	—	13	11	—	1	—	6	11	—	—	—	2	2	—	1	3	52
Cribra orbitalia	—	—	—	—	—	1	—	—	—	1	—	—	—	—	—	—	—	—	—	2
Total	—	—	2	—	13	12	—	1	—	7	11	—	—	—	2	2	—	1	3	54

Key: AD = indeterminate adult; Ind = indeterminate age; MA = middle adult; OA = old adult; YA = young adult.

identification of osteoporosis and calculation of its frequency in archaeological populations, mainly because osteoporotic bone is highly susceptible to diagenic activity because of increased fragility. Because of that, the prevalence of osteoporosis in archaeological populations, especially prehistoric, cannot truly be known. A multiregional study conducted by Chalmers and Ho (1970:673), however, found a correlation between increased physical activity and a decrease in incidences of osteoporosis. In that study, South African Bantu and Chinese populations had significantly lower numbers of incidences than populations from more developed countries, such as Great Britain and Sweden. That is most likely the result of heavy workloads for both men and women who, because of economic pressures, had to continue working until old age (Chalmers and Ho 1970:673). Because prehistoric populations most likely engaged in a similarly rugged lifestyle, one can postulate that the incidences of osteoporosis in those populations may have been similar.

Only a single individual from LAN-62 exhibited osteoporosis. The fragmentary nature of the right femur, tibia, and fibula of the primary inhumation (a 40+-year-old female) in burial Feature 61 permitted observation of shaft cross sections. These bones exhibited extremely thin (approximately 1 mm in thickness) cortical bone with macroporosity. A possible depression fracture on the outer surface of the ilium might also be associated with osteoporosis. The 15 vertebral-compression fractures noted above (see the Fractures section) were possibly associated with senescent osteoporosis. They were noted in the remains of six individuals (four females and two males). All but one of these individuals were middle adults; the exception was a young-adult female.

Although this condition was not observed for other individuals at LAN-62, that does not necessarily indicate a low prevalence of osteoporosis. The skeletal remains from the PVAHP were not X-rayed, and X-ray is a crucial step for analysis of osteoporosis. Equally problematic is the fact that poor preservation acts to reduce observations, and the internal structure of the intact, well-preserved bone cannot be readily observed. Because of these factors, commentary on the prevalence of this condition at LAN-62 is problematic. The age and sex of the primary inhumation from burial Feature 61, however, certainly do fall in line with modern medical observation that osteoporosis occurs more frequently in older women.

Inflammatory and Infectious Conditions

This section details pathological conditions primarily attributed to the skeletal response to infection by pathogenic organisms. Although many pathological conditions, such as syphilis, leprosy, and tuberculosis, fall into this category, inflammatory and infectious conditions observed at LAN-62 tended toward the more mundane, consisting of periostitis and osteomyelitis.

Periostitis

The periosteum is a fibrous sheath that covers the nonarticular surfaces of the skeleton and plays a variety of roles in the maintenance of healthy bone. Through a series of blood vessels and nerves, the periosteum provides the bone with blood supply and sensation. Furthermore, cells that create new bone (osteoblasts) reside in the periosteum, where they work to repair injured bone. The periosteum also acts as an anchor for muscles and tendons. Should this tissue become inflamed, however, the osteoblasts respond by depositing layers of new bone. This condition is referred to as periostitis.

Ortner (2003:208) referred to two types of periostitis: primary and secondary. Primary periostitis results from infection or trauma at a specific location, such as a localized ulcer. Secondary periostitis, on the other hand, occurs as a symptom of several disease syndromes, such as syphilis. Because periostitis is a common response to numerous pathological and traumatic conditions, diagnosis of a specific condition is often difficult. Furthermore, poor preservation and postdepositional processes, such as animal burrowing or burial treatment, can further confound attempts at diagnosis; both were common issues at LAN-62. Regardless of these difficulties, periostitis is one of the most common pathological conditions observed in archaeological contexts and can provide valuable insight into the relative health of past populations.

Periosteal lesions were fairly uncommon at LAN-62 and were observed on only 12 skeletal elements (Table 60; Figure 134). The same method used to calculate the frequency of spondylolysis in the skeletal population at LAN-62 was used to calculate the frequency of periosteal lesions and osteomyelitis. Ten individuals (1 infant, 1 child, and 8 adults) were represented by these skeletal elements (Figure 135). Over half the adults with evidence of periostitis were male (see Figure 135). Furthermore, twice as many periosteal lesions were observed on young adults as middle adults, and no periostitis was observed on old adults (see Figure 135). By and large, periosteal lesions only appeared on one skeletal element per individual. The primary inhumation from burial Feature 329 (a 24–28-year-old female), however, was the exception. This individual exhibited reactive areas on three elements: both humeri and the left fibula. Periosteal reactions on the humeri, which took the form of small areas of increased porosity, were observed on both medial epicondyles and the right lateral epicondyle of this individual. The medial epicondyle is the origin of the common flexor tendon, and the lateral epicondyle is the origin for the common extensor tendon. Clinically, periostitis in these regions is referred to as "golfer's elbow" (also known as medial epicondylitis) and "tennis elbow" (also known as lateral epicondylitis). Although these names imply sports-related origins, golfer's elbow and tennis elbow often result from a variety of situations, including inflammation of tissue in these regions from overuse,

Table 60. Frequencies of Periosteal Reactions and Osteomyelitis for All Individuals in the LAN-62 Burial Population

Element	Complete (n)	Partial (n)	Fragmented (n)	Elements (n)	Weighted Element Sum (g)	Periostitis			Osteomyelitis		
						Bones with Lesions (n)	Bones with Lesions (%)	Weighted Bones with Lesions (%)	Bones with Lesions (n)	Bones with Lesions (%)	Weighted Bones with Lesions (%)
Clavicle	91	115	98	304	173.00	1	0.33	0.58	—	—	—
Humerus	122	223	341	686	318.75	2	0.29	0.63	—	—	—
Ulna	103	170	216	489	242.00	—	—	—	—	—	—
Radius	108	149	231	488	240.25	2	0.41	0.83	1	0.20	0.42
Femur	170	326	454	950	446.50	1	0.11	0.22	—	—	—
Tibia	119	258	307	684	324.75	3	0.44	0.92	1	1.46	0.31
Fibula	97	170	236	503	241.00	3	0.60	1.24	—	—	—

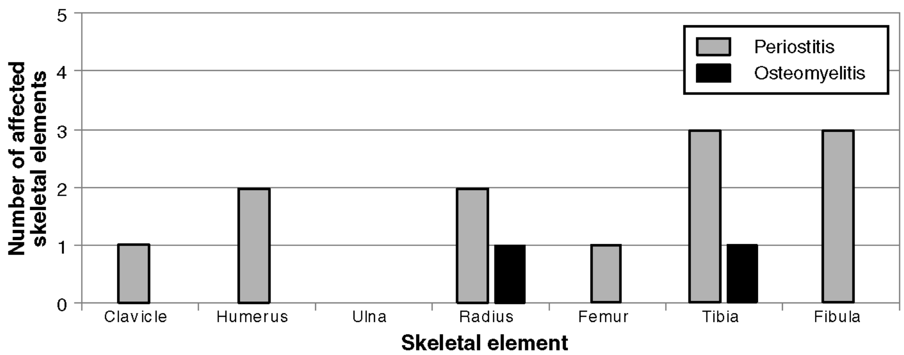

Figure 134. Graph of the distribution of periostitis and osteomyelitis for all individuals at LAN-62.

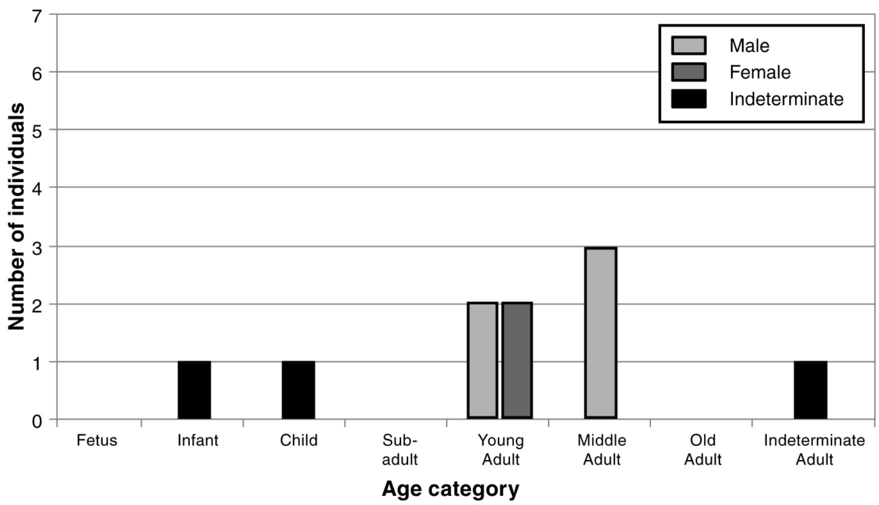

Figure 135. Graph of the demographic distribution of periostitis among individuals at LAN-62.

separation of the tendons from the periosteum, or infection (Garden 1961:101; Kurvers and Verhaar 1995:1374; Nirschl and Pettrone 1979:832). Certainly, many activities in which this population might have engaged that resulted in repetitive extension/flexion of the arms, such as mano use or throwing/hauling in nets, could have resulted in these conditions. One cannot discount the presence of periostitis on the left fibula, however. Though potentially unrelated, the involvement of the left fibula might indicate that these conditions originated from a more serious, systemic infection.

When the overall frequency of periosteal lesions at LAN-62 is compared to frequencies generated by Walker et al. (1996:Table 1) for Historical and Middle period Humaliwo collections, one finds striking differences. Far less periostitis was observed on the human remains recovered from LAN-62 than from either component at LAN-264 (Table 61). Of all skeletal elements exhibiting periostitis at LAN-62, the fibula exhibited the greatest frequency of periostitis, at 1.24 percent (see Table 60).

When considering the number of bones with lesions from each site, more instances of periosteal reactions for each bone type were observed at LAN-264 than at LAN-62. At LAN-264, anywhere from 1 to 12 affected bones were identified with a periosteal reaction (see Table 61). Conversely, at LAN-62, the number dropped to between 1 and 3 for each type of skeletal element in the study (see Table 60). When the numbers of long bones used in this analysis from LAN-62 and LAN-264 were compared, however, many more of each type of skeletal element were recovered from LAN-62 than from LAN-264. In fact, the weighted sum of the bone associated with the humerus, ulna, radius, femur, tibia, and fibula for LAN-62 was 1,813.25, as opposed to LAN-264, where the weighted sum of the bone associated with the same skeletal elements was only 359.5 (see Tables 60 and 61). Essentially, five times as many long bones were recovered from LAN-62 as from LAN-264. So, although there were, in fact, more instances of periosteal reactions observed at LAN-264, the dramatic difference in frequencies was at least partially related to sample size.

Barring differences in actual amounts, the remains associated with LAN-62 and the Middle period of LAN-264 shared a similar trend of some expression of periostitis in most limb bones, with the greatest expression in the legs (Figure 136; see Figure 134).

Table 61. Frequencies of Long Bones with Periosteal Reactions in the LAN-264 Burial Population

Temporal Component (Period), by Element	Complete (n)	Partial (n)	Fragmented (n)	Elements (n)	Weighted Element Sum (g)	Bones with Lesions (n)	Bones with Lesions (%)	Weighted Bones with Lesions (%)
Humerus								
Historical	1	26	17	44	18.25	—	—	—
Middle	34	33	3	70	51.25	2	2.86	3.90
Ulna								
Historical	1	15	11	27	11.25	—	—	—
Middle	26	30	—	56	41.00	2	3.57	4.88
Radius								
Historical	1	13	10	24	10.00	—	—	—
Middle	29	28	—	57	43.00	4	7.02	9.30
Femur								
Historical	6	44	18	68	32.50	1	1.47	3.08
Middle	41	21	5	67	52.75	12	17.91	22.75
Tibia								
Historical	2	8	21	31	11.25	6	19.35	53.33
Middle	31	29	2	62	46.00	10	16.13	21.74
Fibula								
Historical	—	8	4	12	5.00	—	—	—
Middle	20	34	1	55	37.25	8	14.55	21.48

Note: From Walker et al. (1996:Table 14).

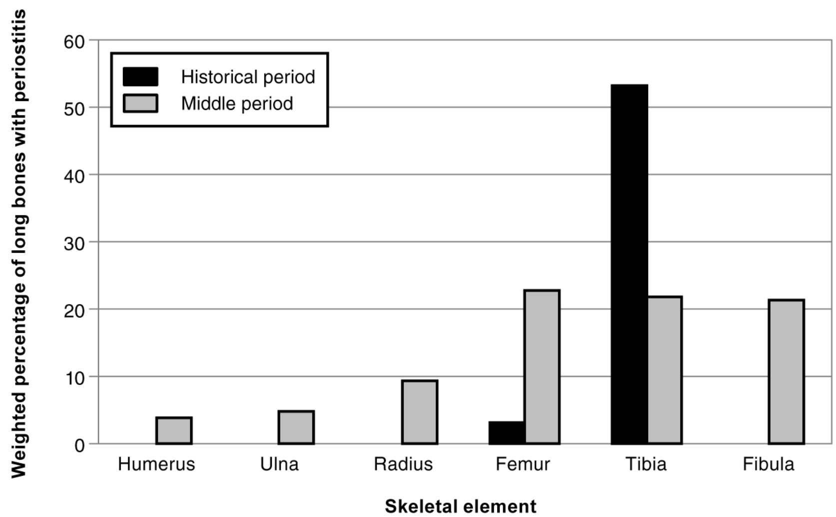

Figure 136. Graph of the percentages of long bones with periostitis at LAN-264, weighted for completeness (from Walker et al. 1996:18).

Osteomyelitis

Osteomyelitis is an infection of the medullary cavity of the bone. Though resulting from a variety of agents, osteomyelitis is mainly caused by bacteria, chiefly *Staphylococcus aureus* and *Streptococcus* sp. Infection occurs from direct inoculation, extension from adjacent soft tissue, or via the bloodstream from an infected location (Ortner 2003:181).

Ortner (2003:182–183) detailed how this pathological condition progresses. In the initial stages of osteomyelitis, the infection spreads through the bone and into the medullary cavity. As the infection grows, the pressure within the bone increases, and compression of blood vessels occurs, which can ultimately lead to necrosis in sections of the bone. As a response and in an attempt to repair the bone, the periosteum creates a bony sheath (involucrum) around the dead bone (sequestrum). Because this newly formed bone is very porous, pus and fragments of the sequestrum are pushed through, creating a drainage canal known as a cloaca. Ultimately, these drainage canals make their way through adjacent soft tissue to the surface of the skin, providing a means for the exudate to the leave the body. Like periostitis, osteomyelitis may be a primary condition or a symptom of a disease syndrome, such as typhoid fever or pyogenic arthritis (Ortner 2003:181, 188).

Osteomyelitis was very rare at LAN-62; there were only two osteomyelitic elements (one right tibia and one left radius) observed in the entire population (see Table 60; Figure 134). Each element was associated with a separate individual. One of the elements, the left radius, was associated with the primary inhumation in burial Feature 277 (a 30–35-year-old male) and was exhibited as a cloaca surrounded by a small involucrum approximately 40 mm from the proximal end, anterior to the radial tuberosity (see Chapter 5, this volume). The margins of the cloaca were sharp and exhibited some remodeling, suggesting that the lesion was active at the time of death. Because this individual was also diagnosed as having a possible case of reactive arthritis, or Reiter's syndrome (discussed below), this instance of osteomyelitis could be associated with that inflammatory condition.

The right tibia associated with the primary inhumation in burial Feature 606 (a 30–40-year-old male) exhibited an osteomyelitic infection on the posterior aspect of the distal end (Figure 137). Associated with this infection was a periosteal reaction on the medial surface of the distal right fibula, indicating that the infection had spread to the surrounding tissue.

Joint Disease

This section details the incidents of joint disease observed at LAN-62. The most common type of joint disease is osteoarthritis. More-aggressive joint diseases, however, were also observed among the individuals recovered from LAN-62. These consisted of wholesale destruction and joint fusion resulting from potential genetic predisposition, such as rheumatoid arthritis or ankylosing spondylitis.

Osteoarthritis

Synovial-joint surfaces are covered with a layer of hyaline cartilage that protects the bones constituting the joint by transmitting and distributing loads, absorbing shock, and maintaining articulation between bones of the joint with little friction (Roberts and Manchester 1997:101). Osteoarthritis occurs when continual and repetitive stress at synovial

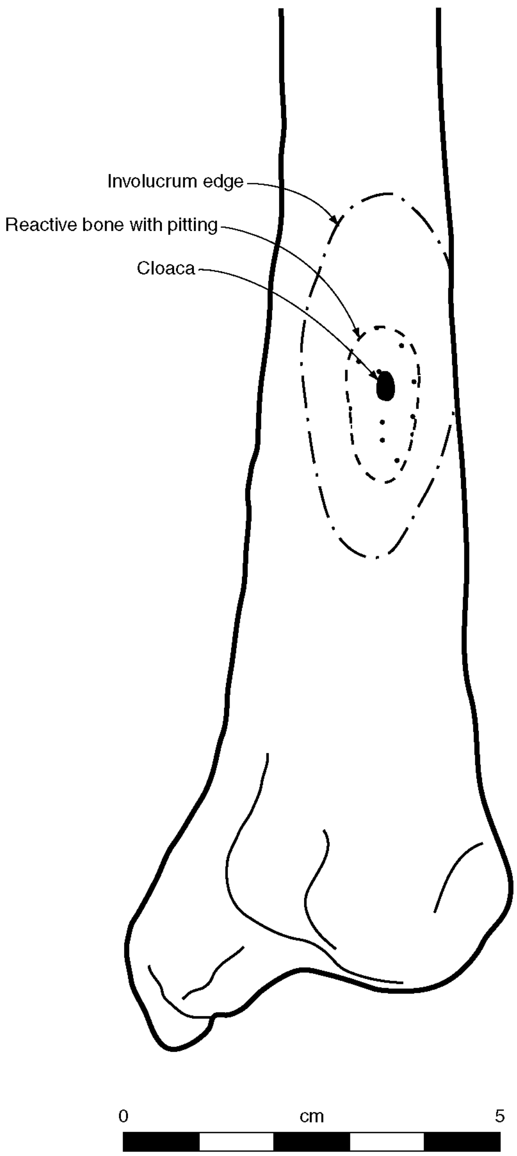

Figure 137. Illustration showing the osteomyelitis exhibited on the posterior surface of the distal end of the right tibia of the primary inhumation in burial Feature 606 at LAN-62.

joints results in pitting and tearing of the cartilage, narrowing of the joint space, and ultimately, exposure of the underlying bone. Furthermore, when the protective cartilaginous barrier is breached and the unprotected bones move past one another, the surfaces of these bones become denser (sclerotic) and highly polished, a condition known as eburnation. In response to degeneration of the joint, soft tissue along the margins and surfaces of the affected joint ossifies in an attempt at stabilization and to prevent joint failure.

According to Rogers and Waldron (1995:32), osteoarthritis is the most common joint disease described in archaeological and modern populations. Correct identification of this condition is facilitated by an easily observable and recognizable pathognomonic trait: eburnation. Secondary osteoarthritic traits observable in the human skeleton include osteophytic bone growth along the margins and surfaces of the joint, porosity on the joint surface, and deformation of the joint surface (Rogers and Waldron 1995:44).

Although osteoarthritis may be more common and far easier to diagnosis than other paleopathological conditions, the etiology of the condition might be difficult to determine because of the multifactorial nature of osteoarthritis. This condition might result from increasing age, trauma, infection, genetic predisposition, obesity, repetitive/habitual activity, and/or the environment (Roberts and Manchester 1997:106). Furthermore, the prevalence of the condition and specific forms of the condition varies based on sex and setting, such as urban vs. rural. Rogers and Waldron (1995:32) stated that although osteoarthritis is more prevalent in women than in men, bilateral osteoarthritis of the hips is more prevalent among younger men. Finally, this condition does not affect all synovial joints equally, and major sites include the hands, the facet joints of the vertebrae, the acromioclavicular joint, the first metatarsophalangeal joint, the hip, and the knee (Rogers and Waldron 1997:32). For the purposes of this study, however, observations were made at major joint locations, including the shoulder, elbow, wrist, hip, knee, and ankle. Systematic observations of other joint surfaces were not made, and information was recorded only anecdotally. Further information can be found in Appendix E, this volume. Table 62 and Figure 138 detail the prevalence of osteoarthritis at the major appendicular-joint locations among primary individuals of known sex at LAN-62.

For the purposes of this study, the left and right sides were combined. Furthermore, although joint compartments are composed of two or more elements, they were not reduced to the fundamental elements. Instead, observation of this condition on any of the bones that constituted a joint indicated a positive presence. Osteophytosis, a nonspecific condition associated with proliferative bone growth, is often a hallmark of osteoarthritis. For these individuals, indication of only osteophytosis was included as the positive presence of osteoarthritis, to allow for comparison with data from the Stillwater Marsh site, a multicomponent hunter-gatherer site in the Great Basin, as well as to information regarding agriculturists and preagriculturists on the Georgia coast (Larsen et al. 1995) (Figures 139 and 140; see Table 62).

Although males exhibited a much greater prevalence of osteoarthritis, that was probably the result of differential preservation. There are simply fewer observable joint surfaces for males, because the smaller male skeletal population was more sensitive to differential preservation than the larger female population. When observed at the individual level, the number of males and females affected were very similar. Overall, however, the total number of male individuals affected with osteoarthritis (n = 19) was just slightly greater than the total number of affected female individuals (n = 14). By far, the elbows and shoulders were the sites that exhibited the greatest number of affected joints in both sexes (see Figure 138; Table 62).

Table 62. Frequencies of Osteoarthritis in Major Appendicular Joints for Adult Individuals of Both Sexes in the LAN-62 Burial Population and Three Other Prehistoric Burial Populations

Sex, by Joint	Stillwater Marsh	Georgia		LAN-62
		Preagriculturists	Agriculturists	
Shoulder				
Male	61.5	10.5	1.7	15.38
Female	23.1	2.4	0.7	5.45
Elbow				
Male	61.5	13.7	6.1	19.44
Female	40.0	9.6	—	9.09
Wrist				
Male	41.7	2.6	0.9	8.00
Female	23.1	—	—	—
Hip				
Male	40.0	—	9.1	4.44
Female	6.3	4.3	—	1.09
Knee				
Male	33.3	18.6	12.6	5.41
Female	26.7	15.0	3.4	5.08
Ankle				
Male	45.5	4.1	9.2	9.52
Female	—	4.5	—	2.44

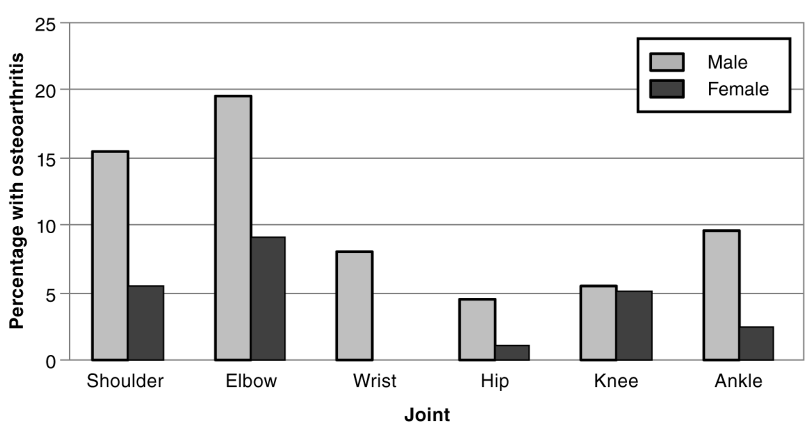

Figure 138. Graph of the frequency of osteoarthritis in major appendicular joints for adult individuals of both sexes in the LAN-62 burial population.

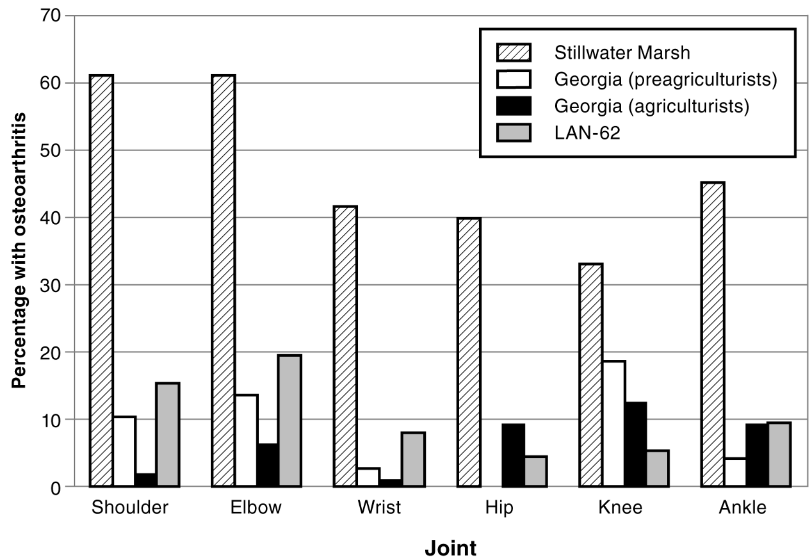

Figure 139. Graph comparing the osteoarthritis frequencies in males in the LAN-62 burial population and three other male burial populations.

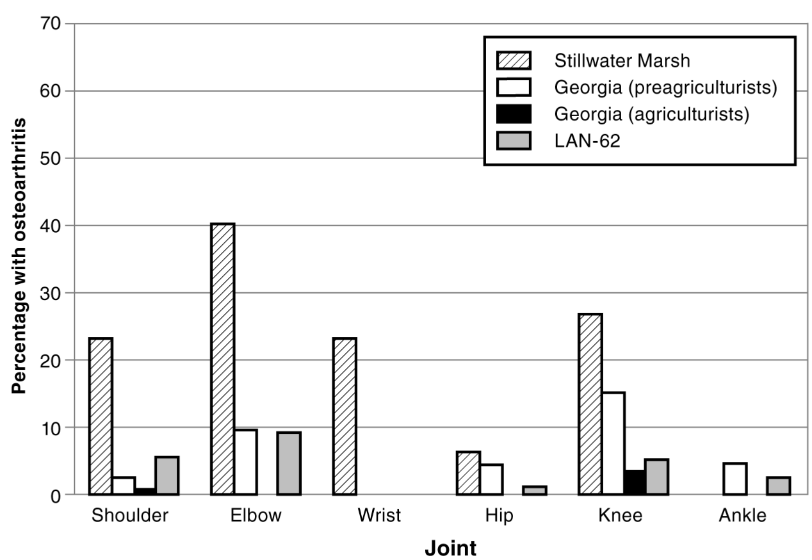

Figure 140. Graph comparing the osteoarthritis frequency in females in the LAN-62 burial population and three other female burial populations.

The male individuals at LAN-62 exhibited a greater amount of osteoarthritis of the shoulder, elbow, wrist, and ankle than both Georgia populations (see Figure 139; Table 62). Of all these populations, Stillwater Marsh exhibited the highest frequency of osteoarthritis for both males and females. Osteoarthritis of the hip and knee in the LAN-62 population was the lowest of all of the compared populations. The female individuals at LAN-62 followed a similar trend as the males, with a greater amount of osteoarthritis of the shoulder, elbow, and ankle than the Georgia populations (see Figure 140; Table 62). However, for the wrist, hip, and knee, the female population changed trends. Females exhibited no wrist osteoarthritis and displayed more osteoarthritis of the knee and hip than the Georgia agriculturists (see Figure 140; Table 62). Such trends might indicate that males were involved in more activity that used the upper body, such as hauling nets or hunting with bows, and females were engaged in activity that affected much more of the body, such as kneeling while processing food.

The skeletal data from the Humaliwo site (LAN-264) were not directly comparable to the data from LAN-62, because of emphasis in the data. At LAN-62, sex-related trends in the presence of osteoarthritis were explored, whereas at LAN-264, analysts looked at the severity of osteoarthritis.

Seronegative Spondyloarthropathies

Seronegative spondyloarthropathies are a collection of erosive polyarthropathies, including ankylosing spondylitis, psoriatic arthropathy, and Reiter's syndrome. These conditions share a suite of clinical traits, including inflammation of ligamentous insertions (entheses) and vertebral and sacroiliac joints, an association with the human leukocyte antigen (HLA)-B27, and ongoing infectious disorders, soft-tissue lesions and inflammations, and asymmetric arthritis (Rogers and Waldron 1995; Yu 2009). The term "seronegative" refers to the negative presence of the rheumatoid factor, an antibody that may bind to healthy tissue and result in damage. Skeletally, these conditions often exhibit ankylosis (fusion) of the vertebral and sacroiliac joints, fusion of the ribs to the vertebrae, abnormal bone growth at points of ligamentous attachment, and, in some conditions, periostitis and erosion of extremity joints (Rogers and Waldron 1995:68, 77).

The main seronegative spondyloarthropathy recorded at LAN-62 was ankylosing spondylitis. Rogers and Waldron (1995:68) summarized the skeletal characteristics observable for this pathological condition as follows:

- Disease of the synovium and entheses.
- Sacroiliac joints affected symmetrically.
- Sacroiliac joints often fused in the skeleton X-ray of sacroiliac joints may show erosions.
- Erosions may occur in large joints.
- Spinal fusion begins in lower lumbar region and progresses steadily upwards.
- No "skip" lesions.
- Kyphosis is often a feature.
- Ribs may be fused to vertebrae.

A "skip" lesion refers to a wound of inflammation that is patchy in appearance. Ortner maintains that the ankylosed joints in the ribs and pelvis will exhibit a breakdown in the articular cartilage and, ultimately, complete destruction of the joint (Ortner 2003:572). Intervertebral disks, however, are usually spared but have marked irregular appearances on the vertebral end plates (Ortner 2003:572). Osteoporosis often accompanies the fusion of the vertebral elements (Ortner 2003:572). This condition appears to have a strong genetic component and is 100 times more likely to affect males than females, and to affect males more severely, with significant symptoms occurring in approximately 0.5 percent of modern male populations with osteoporosis and 0.05 percent of modern female populations with osteoporosis (Rogers and Waldron 1995:65).

At LAN-62, the primary inhumation associated with burial Feature 74 (an adult male) represented a classic example of ankylosing spondylitis (Figure 141). Although most of the remains were missing postmortem, those that were present were very well preserved, which aided in observation and interpretation of this pathological condition. For this individual, all vertebrae that were present (the ninth through twelfth thoracic and the first through fifth lumbar) exhibited ankylosis. For the thoracic vertebral bodies, small syndesmophytes along the lateral aspects and superficial bone deposition on the anterior aspects were observed. The appearance of the condition in the lumbar vertebrae was similar to the expression in the thoracic, only to a greater degree. Where small syndesmophytes were observed for the thoracic vertebral bodies, the lumbar vertebrae displayed larger syndesmophytes. The expression of the condition on the anterior surface of the lumbar vertebral bodies was similar to the expression in the thoracic vertebrae. This extreme ossification of the vertebral bodies is often referred to as "bamboo spine" and is typical for this condition (Rogers and Waldron 1995:65, Figure 7.2).

The posterior sections of the vertebrae also exhibited ankylosis. For both the thoracic and lumbar vertebrae, the supraspinous and intraspinous ligaments had completely ossified. Also, for the lumbar vertebrae, large, thick deposits of bone were observed on the vertebral articular facets. Furthermore, most of the ribs had fused to the thoracic vertebrae; those that had not fused showed evidence that they were in the process of fusing prior to the death of the individual. Additionally, both sacroiliac joints had ankylosed, and the sacrum had ankylosed to the fifth lumbar vertebra. This individual exhibited extreme kyphosis (posterior curvature), and the thorax was tilted slightly to the left. The right innominate also appeared slightly angled, such that the ischium was closer to the midline. The misalignment of the thorax and pelvis would have given the individual an almost contrapposto stance, where the arms and shoulders were slightly twisted off-axis from the pelvis. The overall fusion of skeletal elements associated with this individual likely would have greatly affected mobility and flexibility.

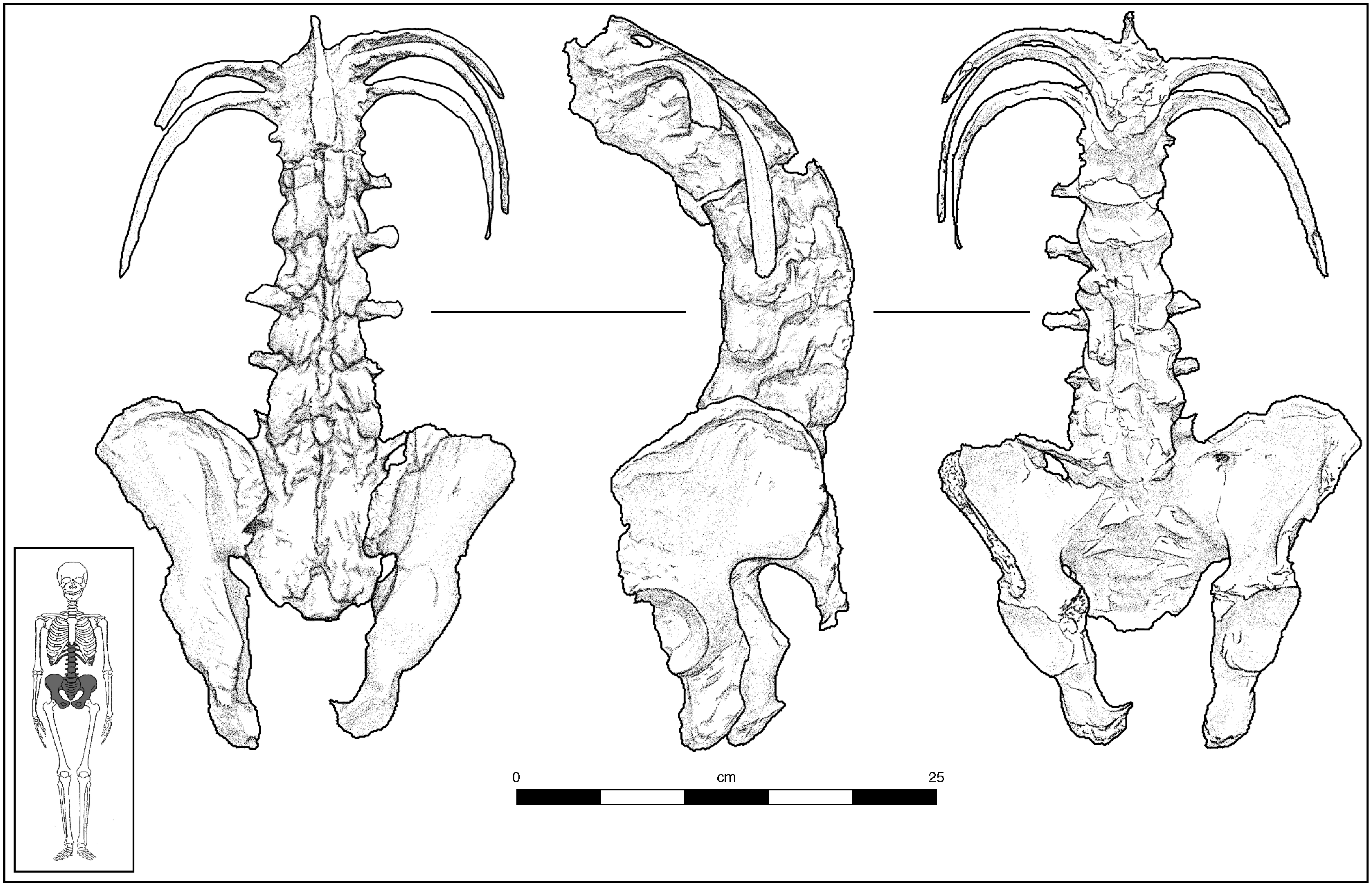

Figure 141. Illustration of ankylosing spondylitis as represented by the skeletal remains associated with the primary inhumation (an adult male) in burial Feature 74 at LAN-62.

In addition to these skeletal elements, an articulated right foot was also recovered. Some minor osteophytic lipping was observed along the margin of the proximal articular surface of a distal tarsal phalanx. Although other seronegative spondyloarthropathies, such as psoriatic arthropathy, are known to cause abnormal bone growth and erosive conditions in other parts of the skeleton, particularly the joints of the extremities, there is very little evidence to suggest that the osteophytosis of this individual was related to one of these pathological conditions.

The primary inhumation in burial Feature 277 (a 30–35-year-old male) exhibited a seronegative spondyloarthropathy suggestive of reactive arthritis, also known as Reiter's syndrome. This arthritic condition can be a complication resulting from infection by *Chlamydia trachomatis* and resulting in urethritis and conjunctivitis or from dysentery, which is caused by infection by microorganisms, including *Salmonella enteritidis, Salmonella typhimurium, Shigella* sp., *Campylobacter* sp., and *Yersinia* sp., the last three of which are less common than the *Salmonella* strains (Eapen 2003:242; Rogers and Waldron 1995:73–74). Reiter's syndrome has been identified by the Office of Rare Diseases Research of the National Institute of Health as a rare disease, meaning that fewer than 200,000 people are affected in the United States (Office of Rare Diseases Research 2009).

As noted previously, seronegative spondyloarthropathies, and hence reactive arthritis, have a strong association with HLA-B27. However, a smaller number of modern cases induced by Lyme disease, rheumatic fever, and *Neisseria gonorrhoeae* (strain of Gram-negative bacteria responsible for gonorrhea) develop in individuals without this genetic component, suggesting that HLA-B27 is not necessarily a prerequisite for the development of this condition (Kuipers et al. 1999:661). Kuipers et al. (1999:661, emphasis added) did, however, qualify this assertion by stating, "HLA-B27 has been identified as a genetic factor *predisposing* people with chlamydia induced or enterobacteria induced reactive arthritis to a more severe peripheral arthritis and involvement of the spine and sacroiliac joint." Rogers and Waldron (1995:74, 77) summarized the skeletal characteristics observable for Reiter's syndrome as follows:

- Lesions, peripheral and axial.
- Generally asymmetrical.
- Lower extremity affected more often than upper.
- Marginal and central erosions with proliferation of new bone.
- Sacroiliac joint involved.
- Lower spine tends to be affected, skip lesions present.
- Enthesopathy around the calcaneum.
- Periosteal new bone on shafts of long bones of hands and feet and on tibiae.
- More common in males than females, with onset between 15 and 35 years.

The primary inhumation in burial Feature 277 (see Chapter 5, this volume) exhibited the majority of these traits. Vertebral involvement varied significantly through the vertebral column (Figure 142). The first cervical vertebra was largely unremarkable, and the second cervical vertebra exhibited only minor osteophytic growth along the articular surfaces and odontoid process. The third and fourth vertebrae, however, were fused into a single element, and ankylosis had occurred at the superior and inferior articular surfaces, on the anterior portion of the centra, and along the posterior vertebral arches. The fifth, sixth, and seventh cervical vertebrae had also fused into a single unit and displayed a similar pattern as the third and fourth cervical vertebrae. The ankylosed bone in this region appeared reactive and progressive, indicating involvement until the time of death.

The thoracic vertebrae exhibited a similar pattern as the cervical vertebrae, yet with even more involvement of the posterior architecture than the cervical vertebrae. No observations could be made for the first and fourth thoracic vertebrae. The second and third thoracic vertebrae, however, were fused to one another at the articular surfaces. Progressively more ankylosis had occurred for the fifth and sixth thoracic vertebrae, with complete fusion along the centrum and the articular surfaces. The greatest degree of fusion had occurred in the seventh through ninth thoracic vertebrae, where elements had ankylosed into a single element. Fusion, however, was not consistent within that mass. In fact, although the articular surfaces for these three vertebrae had completely fused, only the eighth and seventh thoracic vertebrae displayed ankylosed centra. The tenth through twelfth thoracic vertebrae and the first lumbar vertebra were unfused and remained discrete elements.

For the second through fifth lumbar vertebrae, large, remodeled syndesmophytes partially fused the elements together. This ankylosis affected the right side more than the left side, left the articular surfaces largely unaffected, and ossified the supraspinous ligament between the fourth and fifth lumbar vertebrae. Both sacroiliac joints had completely ankylosed.

Fusion of seven ribs was also noted. For this individual, the left fifth rib, right sixth rib, left and right seventh ribs, left and right eighth ribs, and left ninth rib had all fused to their respective thoracic vertebrae. Furthermore, the right seventh and eighth ribs had also ankylosed to one another at the neck. Additionally, osteophytic growths extended from these two ribs in the direction of the sixth and ninth ribs, which likewise exhibited osteophytic growths extending toward the seventh and eighth ribs. The right sixth rib also displayed an osteophytic growth extending toward the right fifth rib. In time, during life, these growths would have likely ankylosed.

Appendicular involvement consisted of osteophytic lipping along the margins of nearly all joint surfaces, and greater degrees occurred in the lower limbs and extremities. That, however, might have been related to preservation, because there was comparatively less joint preservation for the upper limbs. Both calcanea exhibited enthesopathy associated with the insertion point of the Achilles' tendon. Although no periostitis was observed for the tibiae or long bones of the hands and feet, a small cloaca, suggesting localized osteomyelitis, was observed on the left radius (see the Osteomyelitis section, above).

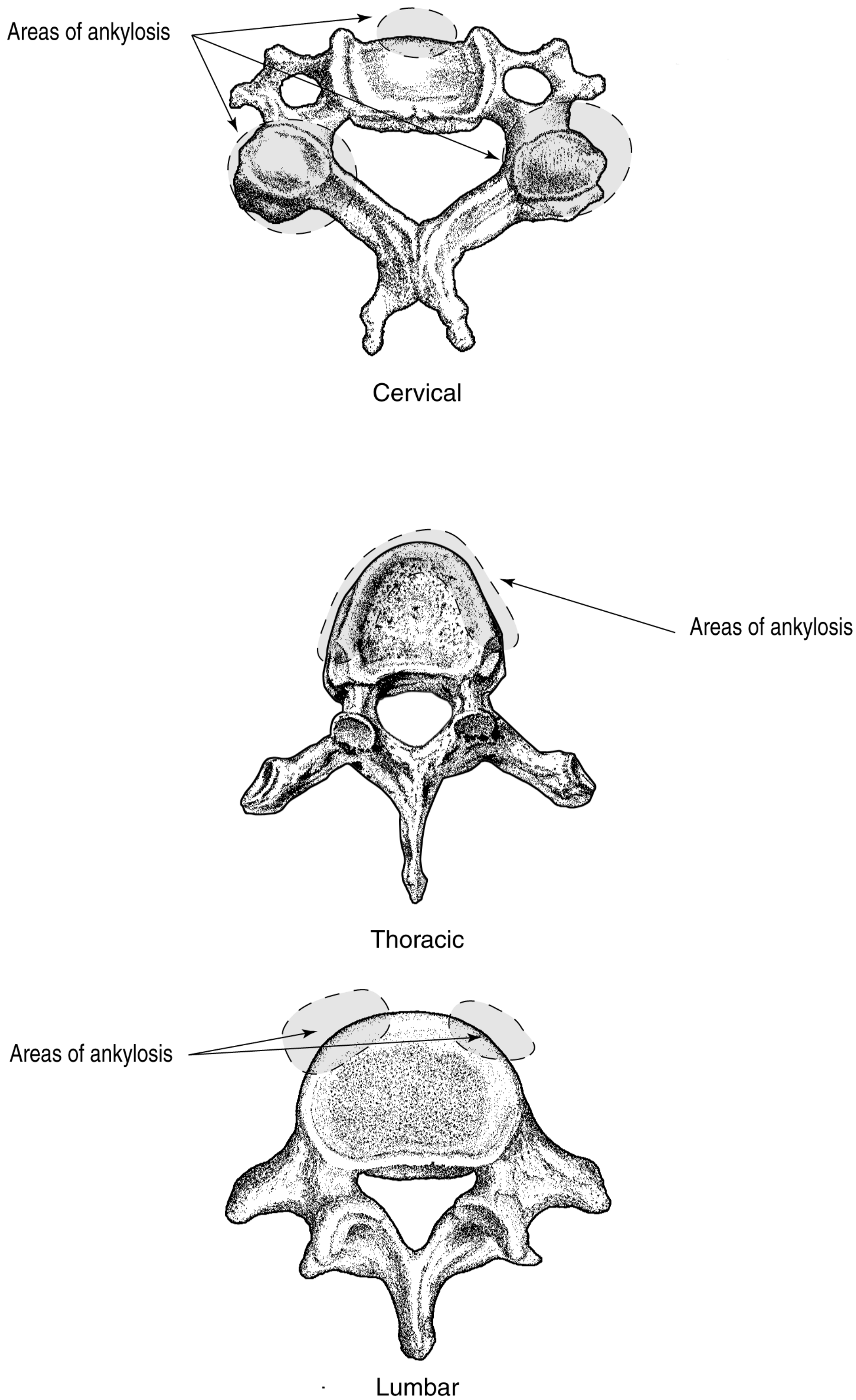

Figure 142. Illustration showing the locations of vertebral involvement in the ankylosis of the spine of the primary inhumation in burial Feature 277 at LAN-62.

The pattern of conditions observed for this individual was more consistent with Reiter's syndrome, or a variant of Reiter's syndrome, than other seronegative spondyloarthropathies. Ankylosing spondylitis, which exhibits a similar predilection for males, exhibits no skip lesions (Rogers and Waldron 1995:68). For this individual, the pattern of ankylosing was sporadic and inconsistent throughout the vertebral column. Another seronegative spondyloarthropathy, psoriatic arthritis, which is linked to the skin disorder psoriasis, exhibits similar traits to those of Reiter's syndrome, but it erodes the interphalangeal joints and, in some severe cases, mimics leprosy by causing complete erosion, creating what is termed the "pencil-in-cup" deformity (also known as arthritis mutilans), and ankylosis of these joints (Rogers and Waldron 1995:71). Only a small number of carpal phalanges could be recovered. However, for those observable, no erosion or osteophytic growths were noted.

Although this syndrome has links to sexually transmitted disease, one should avoid making that leap hastily. In a medical report, Tayal and Watson (1996:397) found that "urethritis also occurs in up to 90% of men with postdysenteric Reiter's syndrome and has been documented in sexually inactive adults with postdysenteric reactive arthritis." Regardless, the association of this condition with sexually transmitted disease and dysentery has interesting implications. During the Mission period, the Spanish clergy worked to convert and centralize the native populations at the missions where the unmarried native population was forced to sleep in crowded dormitories. Such conditions facilitated the spread of communicable disease, and it is well documented that both sexually transmitted disease and dysentery were pernicious problems that ran rampant, along with tuberculosis, in the early Spanish missions in California (Walker and Johnson 1992:132–133). Based on that information, it is easy to believe that the presence of Reiter's syndrome in an individual could occur from such an environment. Unfortunately, although shell and glass beads dating to the Mission period were found in the feature matrix associated with this individual, no direct associations could be made.

For some, one pathological condition, diffuse idiopathic skeletal hyperostosis (DISH), might be called to mind as a potential differential diagnosis. Like reactive arthritis, DISH is a disease affecting the ligaments and entheses and results in fusion of vertebrae to one another. DISH, however, is manifested in the vertebrae in a very specific manner, most notably in the thoracic spine, where ankylosis occurs along the right side, possibly because of the presence of the ascending aorta along the left side of the vertebral column (Rogers and Waldron 1995:49). Such vertebral fusion produces large osteophytes with a candle-wax appearance.

Sacroiliitis

As previously mentioned, inflammatory conditions associated with the pelvis, such as ankylosing spondylitis, reactive arthritis, and psoriatic arthritis, can sometimes result in the fusion of the sacroiliac joint, an arthritic condition known as sacroiliitis (Rogers and Waldron 1995:68, 77). Seronegative spondyloarthropathies, however, are not the only conditions associated with sacroiliitis. In fact, sacroiliitis is also associated with other pathological conditions, including DISH, a condition that results in abnormal bone growth and fusion of the vertebral elements; inflammatory bowel syndrome; and Crohn's disease (Peeters et al. 2004; Rogers and Waldron 1995:50). There have even been cited cases of sacroiliitis resulting from complications from childbirth (Floman et al. 1994). As with other inflammatory conditions, sacroiliitis appears to be connected with the presence of HLA-B27 (Peschken and Esdaile 1999).

Although also observed in individuals at LAN-62 with more advanced cases of ankylosing spondylitis and possible Reiter's syndrome, four individuals exhibited only fusion of the sacroiliac joint. Table 63 summarizes data from individuals exhibiting this pathological condition, as well as how this condition was expressed. Although the sample was very small, there seems to have been a predilection toward expression on the left side over the right and for individuals in the middle-adult age range over individuals from other adult age categories. Because of preservation issues, three of the four individuals could be confirmed as expressing the condition unilaterally. That pattern might suggest that the sacroiliac fusion associated with these individuals was not associated with ankylosing spondylitis, of which bilateral sacroiliac involvement is one of many symptoms (Rogers and Waldron 1995:68). An example of this condition observed on the human remains recovered from LAN-62 is shown in Figure 143.

Prevalence of HLA-B27 among Native American Populations

Surveys of the distribution of the HLA-B27 antigen have found that the prevalence among North American native populations is consistently high compared to other populations, and 9–18 percent of Native American populations who share the Uto-Aztecan language family with the Gabrielino/Tongva had HLA-B27 (Peschken and Esdaile 1999:Table 7; reprinted as Table 64 in this volume). Furthermore, a substantial number of Pima who exhibited sacroiliitis (50 percent of the females and between 50 and 73 percent of the males) also tested positive for HLA-B27 presence (Peschken and Esdaile 1999:381).

Table 63. Expression of Sacroiliac Fusion among Individuals in the LAN-62 Burial Population

Individual	Age (Years)	Sex	Side
F-188-P	35–40	female	right
F-204-P	16–20	possible female	left
F-526-P	35–45	male	left
F-500-P	30–45	male	left

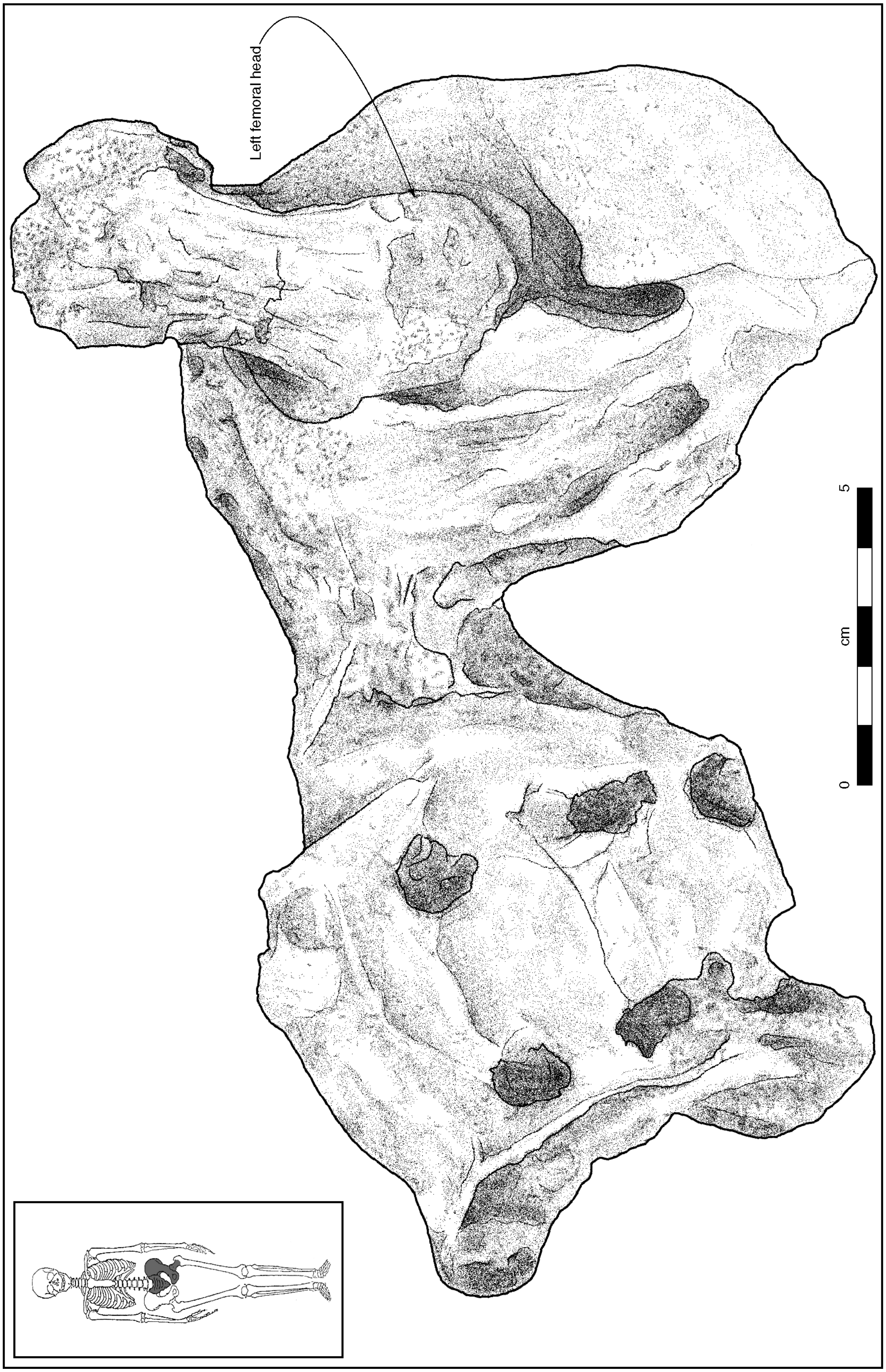

Figure 143. Illustration showing the sacroiliitis of the left sacroiliac joint associated with the primary inhumation (a 16–20-year-old possible female) in burial Feature 204 at LAN-62.

Table 64. Prevalence of the HLA-B27 Antigen in North American Native, European, North American White, and Mexican Mestizo Populations

Population	HLA-B27 Frequency (%)	
	General Population	Patients with Ankylosing Spondylitis/Reiter's Syndrome
Haida	50	100
Yupik	40	100
Inuit	37	87
Navajo	26–36	86–88
Dogrib	30	
Inupiat	25	
Bella Coola	25	100
Yakima	21	
Pima (Uto-Aztecan)	18	50–73
Tlingit	18	
Cree	14	
Zuni (Uto-Aztecan)	15	
Chippewa	11	
Hopi (Uto-Aztecan)	9	
Papago (Uto-Aztecan)	9	
Mexican Mestizos	3–5	69–80
Norway	16	90–95
Western Europeans	6–9	90–95
North American White	8	90–95

Note: Reprinted from Peschken and Esdaile (1999:Table 7).

Although Native American populations tend to have a higher prevalence of the HLA-B27 antigen, pathological responses have varied from population to population. For instance, "although the Haida and Pima appear to develop ankylosing spondylitis almost exclusively, the Navajo are more prone to Reiter's syndrome; and Alaskan Indians and all three Eskimo groups appear to develop both" (Peschken and Esdaile 1999:383). Furthermore, in their review of research regarding rheumatic diseases among Native American groups, Peschken and Esdaile (1999) also revealed that sacroiliitis is not uniformly expressed across groups.

Archaeoparasitological Analysis

Selected samples of burial fill associated with the abdominal regions of well-preserved burials were sent to Rhonda Bathurst, Department of Anthropology, UCSB, for archaeoparasitological analysis. The samples were placed in a 0.5 percent solution of trisodium phosphate for cleansing. Wet slides were prepared using the samples. No parasite eggs were observed in the samples, possibly because of preservation issues. After analysis, the soil samples were dried and returned for reinterment, and the slides were destroyed. The ultimate goal was to evaluate the relative health of this population in relation to the parasite load. Unfortunately, preservation was inadequate, and the results of the analysis were inconclusive. A detailed report concerning this analysis can be found in Appendix N, this volume.

Pathological Conditions at Other Sites in the PVAHP Area

Although the majority of the pathological conditions and trauma observed on the skeletal remains recovered from the PVAHP were from LAN-62, a few pathological conditions were observed on skeletal remains recovered from the other archaeological sites in the project area. This section details those pathological conditions in a case-by-case manner for each site.

LAN-54

Of the six individuals recovered from LAN-54, only two exhibited any skeletal pathological conditions. Both of these individuals were estimated to have been interred during the early Intermediate period, based on chronostratigraphic data that were much earlier than the bulk of burial features from LAN-62. For the primary inhumation in burial Feature 3 (a 35–39-year-old female), osteoarthritic changes included minor to moderate osteophyte growth on the right distal radius and ulna as well as the lunate. Furthermore, minor, plaque-like osteophyte growth was present on the dorsal articular surface of the lateral condyle of the left distal femur. This specific osteochondritic condition is typically a manifestation of a specific behavior pattern, which involves kneeling while using the arms to pound an object repetitively against a stable target (Capasso et al. 1998:127). The force of repetitive pounding with the arms is distributed to the hyperflexed knees, resulting in repetitive, concentrated pressure from the tibial condyles on the posterior surface of the femoral condyles, at the location of the observed facets or plaque (Capasso et al. 1998:111). The condition usually occurs bilaterally; however, the portion of the left femur that presumably had the same distinct marker was not preserved in this individual.

The primary inhumation in burial Feature 11 (a 21–25-year-old female) exhibited bilateral osteochondritis dissecans of the distal femora. Exhibited as active ovoid lesions on the lateral condyles of the distal femora, this condition results from fragmentation of cartilage and sometimes involves the underlying subchondral bone. Classic osteochondritis dissecans appears as a small, triangular sequestrum consisting of cartilage and necrotic bone on the articular surface of a bone (Ortner 2003:351–352). Furthermore, this condition occurs more frequently in adolescent and young-adult males and affects the knee in 90 percent of the cases (Ortner 2003:351–352). This same individual also exhibited an enthesophytic growth projecting laterally and inferiorly from the proximal right fibula. This enthesophyte was probably associated with the peroneus longus muscle, which works in conjunction with the peroneus brevis to abduct, evert, and plantar flex the foot (Gray 1949:488).

LAN-2768

At LAN-2768, pathological conditions were observed on the skeletal remains associated with the three inhumations. Based on chronostratigraphic information, this site was occupied during the early Intermediate period. The primary inhumation from burial Feature 108 (a 35–59-year-old possible female) was the only individual who exhibited porotic hyperostosis. For this individual, the condition was observed on the left parietal, near the lambdoidal suture.

Osteoarthritis was observed to some degree in all three inhumations. For the primary inhumations in burial Features 108 and 112 (a 45+-year-old possible male), osteoarthritis was restricted to the carpal phalanges. For the primary inhumation in burial Feature 109 (an adult of indeterminate sex), osteoarthritis was observed only on the tarsal phalanges.

Furthermore, for the primary inhumations in burial Features 108 and 112, some osteophytic lipping was observed. Of those two individuals, osteophytic lipping was more prevalent throughout the skeleton of the primary inhumation in burial Feature 108, where it was observed on both scapulae, the right knee, the third through fifth lumbar vertebrae, the sacrum, two left rib heads, one right rib head, and one distal carpal phalanx. Osteophytosis was only observed on several right carpal phalanges and on the coccyx (tailbone) of the primary inhumation in burial Feature 112. Some increased porosity was observed on the articular surfaces of several tarsals of the primary inhumation in burial Feature 109 and on the medial condyle of the right femur and the distal end of a proximal carpal phalanx of the primary inhumation in burial Feature 108. That porosity could have been related to the degeneration of joints observed in these locations on the two individuals.

LAN-193

No pathological conditions were observed on any of the skeletal remains recovered from LAN-193.

LAN-211

The primary inhumation in burial Feature 33 (a 20–30-year-old possible male) exhibited possible porotic hyperostosis near the vertex of the vault. As mentioned previously, this condition can be potentially linked to a variety of pathological conditions, the most commonly referenced of which is iron-deficiency anemia. This same individual also displayed a benign osteoma on the right parietal, in the proximity of the sagittal suture. The primary inhumation in burial Feature 49 (a 30+-year-old possible female) displayed possibly healed periostitis (marked by accretions of sclerotic bone) on the posterior-lateral shaft of the left fibula. Unfortunately, this condition is a fairly nonspecific response to infection and might indicate either localized or systemic infection.

Cause of Death: A Historical Perspective

This section details the causes of death plaguing individuals associated with the mission system in pre-1850 California. Such information provides a backdrop against which the paleopathological data from the human-skeletal remains recovered during the PVAHP might be examined. By working from a known contemporary data set, patterns or anomalies in the PVAHP skeletal data that may not be readily apparent can be elucidated.

Methods

The individuals described in the mission records were predominantly represented by southern Native Californians, with the inclusion of some individuals of European descent, such as Spanish soldiers, civilians, and clergy. Also, many of the soldiers and civilians were Indians or mestizos from Mexico. This information was provided by the ECPP, a public database developed by the Huntington Library based on pre-1850 mission records (http://www.huntington.org/Information/ECPPmain.htm). Although the database includes information from all 21 California missions as well as records from the Santa Bárbara Presidio and Los Angeles Plaza Church, only records from eight missions—La Purisima Concepción, Santa Bárbara, San Buenaventura, San Fernando, San Gabriel, San Juan Capistrano, and San Luis Obispo—and the Los Angeles Plaza Church were included in this analysis. Queries in the ECPP database resulted in nearly 850 death records with recorded causes of death. Those causes of death were divided into four main categories: disease, trauma, natural, and indeterminate. Those categories were then subdivided into more-descriptive subcategories or, in rare instances, specific diseases and traumatic events.

Recently, Hackel (2012) conducted a similar study in which mission cause-of-death records from the ECPP were explored to examine the external causes of death among Native Californians affected by colonization. In that study, Hackel demonstrated that in addition to epidemics precipitated by colonial expansion (i.e., virgin-soil epidemics), a myriad of diseases and trauma affected and worked to destabilize the native populations.

Results

This section details the results of the cause-of-death inquiry. As previously mentioned, causes of death were placed in one of four main categories, with further subdivision. Table 65 summarizes the cause-of-death information discussed below.

Indeterminate

Approximately 40 percent of the individuals with listed causes of death in the examined mission records did not have adequate descriptions to place them within any category (see Table 65). Such individuals were usually described as merely dying suddenly or unexpectedly. Although no information was available, such individuals might have died from some illnesses that were unknown or not readily apparent to the recorders (e.g., genetic anomalies); the causes of death could not be known because of extensive decomposition, as was the case for a small number of individuals; or the time was simply not invested to find the causes of death, for reasons unknown to the author. Hackel (2012:84) pointed out that individuals who were recorded as dying "suddenly" might "also mask a certain Indian ambivalence with Catholicism or life in the missions, for it is easy to imagine that an Indian who was not keen about a missionary or Catholicism might have not alerted the missionaries of his or her physical condition if he or she did not want to be anointed with Holy Oils, make a final confession, or receive Final Communion."

Natural Death

Less than 1 percent of the individuals in this sample were described as having died naturally from old age (see Table 65). Such an observation might indicate that there were relatively few older individuals associated with these populations. However, most elderly probably died a natural death, and it would be stating the obvious for a missionary to make an explicit comment that an aged individual died a natural death. The paleodemographic data from LAN-62 indicated a mean age of approximately 35 years for males and approximately 33 years for females in the non–Mission period burial population and approximately 29 years for males and approximately 28 years for females in the Mission period burial population (see Tables 26 and 28). Nearly 50 percent of the non–Mission period burial population and approximately 64 percent of the Mission period burial population at LAN-62, according to the generated life tables, were older than these mean ages (see Tables 25 and 27).

Disease

Almost 30 percent of the individuals in the mission records were explicitly stated to have died as the result of disease (see Table 65). Although slightly more than half the individuals suffered from unspecified illness, four diseases—cholera, rabies, smallpox, and stroke—were specifically identified as causes of death. Combined, these four illnesses accounted for almost 35 percent of the deaths associated with disease during the Mission period in this region of California, and smallpox was the most frequently reported illness, at nearly 25 percent (see Table 65). The small number of individuals who died from stroke or apoplexy as indicated in the mission records is rather interesting when one compares modern health statistics. As mentioned previously, the Centers for Disease Control and Prevention have reported that heart disease and stroke are "the first and third leading causes for death for both men and women in the United States, accounting for nearly 40% of all annual deaths" (CDC 2006; National Center for Health Statistics 2006). The reduced frequency of heart disease and stroke observed in this population was likely the result of inaccurate reporting due to limitations in medicine at that time. In fact, many individuals with indeterminate causes of death, especially those who were described as having died suddenly or unexpectedly, certainly could have succumbed to either of these two leading causes of death.

Table 65. Causes of Death Listed in the Death Records from Eight Missions and the Los Angeles Plaza Church

Cause of Death	Los Angeles Plaza Church (n)	Deaths per Mission (n)								Total (n)	Frequency (%)
		La Purisima Concepción	Santa Bárbara	San Buenaventura	San Fernando Rey	San Gabriel	San Juan Capistrano	San Luis Obispo	San Luis Rey		
Disease											
Cholera	—	—	1	—	—	—	—	16	—	17	7.1
Gastrointestinal	—	4	2	2	—	—	—	8	—	16	6.6
Infection	—	—	1	2	—	—	—	—	—	3	1.2
Nonspecific	—	13	52	10	4	28	1	24	—	132	54.8
Rabies	—	—	—	—	1	1	—	—	—	2	0.8
Respiratory	—	—	—	1	—	—	—	6	—	7	2.9
Smallpox	—	58	—	—	—	—	—	1	—	59	24.5
Stroke (apoplexy)	—	—	1	—	—	—	—	4	—	5	2.1
Subtotal, disease	—	75	57	15	5	29	1	59	—	241	28.4
Natural	—	—	2	1	1	—	—	3	—	7	0.8
Subtotal, natural	—	—	2	1	1	—	—	3	—	7	0.8
Trauma											
Accident, blunt force	—	1	3	1	1	—	1	2	—	9	3.5
Accident, nonspecific	—	5	7	10	—	6	—	11	—	39	15.3
Accident, sharp force	—	—	—	—	—	1	—	—	—	1	0.4
Animal related, bear	1	1	1	8	—	3	1	8	—	23	9.0
Animal related, bull/cattle	1	—	—	—	—	1	—	5	—	7	2.7
Animal related, horse	—	5	1	3	1	5	—	3	—	18	7.1
Animal related, mountain lion	—	—	1	—	—	—	—	—	—	1	0.4
Animal related, nonspecific	—	—	—	1	—	1	—	—	—	2	0.8
Animal related, snake	—	—	2	2	1	1	5	1	—	12	4.7
Animal related, spider	—	—	—	—	—	—	—	1	—	1	0.4
Birth	—	—	2	1	2	1	—	4	—	10	3.9
Drowning	—	8	7	10	1	—	2	6	—	34	13.3
Fire	—	3	2	4	—	—	—	—	—	9	3.5

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Cause of Death	Los Angeles Plaza Church (n)	Deaths per Mission (n)								Total (n)	Frequency (%)
		La Purisima Concepción	Santa Bárbara	San Buenaventura	San Fernando Rey	San Gabriel	San Juan Capistrano	San Luis Obispo	San Luis Rey		
Heat exhaustion	—	—	—	—	1	—	—	—	—	1	0.4
Homicide, blunt force	—	—	—	3	—	—	1	—	—	4	1.6
Homicide, nonspecific	9	15	10	14	6	2	2	4	—	62	24.3
Homicide, sharp force	—	—	—	—	2	1	—	—	—	3	1.2
Nonspecific	—	2	4	7	—	3	—	1	—	17	6.7
Nonspecific, blunt force	—	1	—	—	—	—	—	1	—	2	0.8
Subtotal, trauma	11	41	40	64	15	25	12	47	—	255	30.1
Indeterminate	3	50	14	87	57	68	50	16	—	345	40.7
Subtotal, indeterminate	3	50	14	87	57	68	50	16	—	345	40.7
Total	14	166	113	167	78	122	63	125	—	848	100.0

Disease of the gastrointestinal tract accounted for roughly 7 percent of the causes of death attributed to illness (see Table 65). Some of these individuals died from gastrointestinal upset, as evidenced by an instance of possible food poisoning. An unknown condition described as vomiting that is occasionally bloody and accompanying breathlessness, when listed with the diseases of the gastrointestinal tract, might be symptoms of any number of more-specific illnesses.

A small percentage of individuals (about 1 percent) was reported as having died from infections associated with lesions (see Table 65). Although that might indicate death from an untreated *Staphylococcus* sp. or *Streptococcus* sp. infection, one individual was described as having suffered from numerous sores for several years, suggestive of a chronic ulcerative condition, such as syphilis.

Respiratory illnesses constitute the final category of diseases affecting the individuals living in pre-1850 southern California. According to mission records, only about 3 percent of those who expired died from respiratory ailments (see Table 65). Although no specific disease was identified, the respiratory illnesses exhibited symptoms including increased chest congestion, breathlessness, and bleeding from the eyes, nose, and mouth.

Few of these illnesses and diseases appeared to be of the type to provoke a skeletal response. Certainly, the infections associated with lesions might have been related to such conditions as osteomyelitis or syphilis, gastrointestinal conditions might have been related to some forms of cancer, and respiratory illnesses might have been related to pneumonia, which might produce plaque-like osteophytic growths on the pleural surfaces of the ribs, but by and large, the illnesses reported in the death records were usually only associated with soft tissue, because of their virulence or brevity. Also, when the more-local missions, Missions San Gabriel and San Fernando Rey, were examined individually, comparatively few individuals were reported as dying of disease. For instance, smallpox and cholera, the most virulent of the diseases associated with these death records, appear to have been entirely associated with the more-northern missions in the sample, Missions Santa Bárbara, La Purisima Concepción, and San Luis Obispo (see Table 65). Most of the individuals at Missions San Gabriel and San Fernando Rey succumbed to unspecified illnesses, although both individuals who died from rabies were from those two missions (see Table 65). Note that the variability among the missions regarding statements about individuals who died from disease had little to do with a lack of disease and was more often the result of variability in recording proclivities among missionaries.

Furthermore, as indicated by Hackel (2012), these mission cause-of-death records exhibited a certain degree of bias. First of all, the violent, abrupt, and dramatic deaths were more apt to be recorded than deaths associated with more “normal” causes. Second, males were represented more frequently in the records, probably because their work tended to be more dangerous or took them away from home. Finally, causes of death for many infants and young children were not recorded. According to Hackel (2012:82), of the 25,000 Native Californian children who died before the age of 10 in the missions, only 338 had causes of death recorded, likely because infant mortality was such a common occurrence that the deaths were deemed normal.

Examination of the PVAHP individuals revealed that few exhibited lesions associated with infectious disease. In fact, only a handful of individuals displayed any periostitis or osteomyelitis (see Table 60). Such observations suggest that these individuals succumbed either to illnesses that rarely left skeletal indicators, such as virulent infectious disease, or to deadly noninfectious ailments, such as cardiovascular disease, and probably not those of a chronic nature. Though certainly not directly comparable, Mission period cause-of-death records and other ethnographic data demonstrated the diversity of illnesses that befell the native populations and further highlighted the dangers of the preindustrial, pre-antibiotic world in which these individuals lived.

Trauma

Another 30 percent of the individuals represented in the examined death records died as the result of having sustained some form of trauma—accident, homicide, or otherwise (see Table 65). Homicide and animal-related deaths were the most common forms of traumatic death recorded in the mission records, each occurring at a roughly 25 percent frequency (see Table 65). Accidents were slightly less common, at a nearly 20 percent frequency (see Table 65). With a frequency of approximately 13 percent, drowning was also a fairly common form of traumatic death. Nonspecific trauma, birth, fire, and heat exhaustion each occurred at a frequency of less than 5 percent (see Table 65).

As with disease, the types of trauma described in the mission records helped to provide data to which the PVAHP skeletal data might be compared. Intent is problematic to discern in a skeletal population. Although some types of trauma are more frequently associated with interpersonal violence or can be more readily explained as acts of violence as opposed to accidents, the expressions of these traumatic events on the skeletal remains are identical. Nearly equal numbers of people died in accidents as were killed through interpersonal violence. More often than not, burial entries for known cases of murder (otherwise documented by contemporary accounts) remained silent regarding causes of death in mission records (John Johnson, personal communication 2012). So, one must conclude that many cases of trauma likely went undocumented in those records.

A number of individuals at Mission San Gabriel died from accidents and interpersonal violence (approximately 8 percent) (see Table 65). Several individuals in the mission records had causes of death indicating that they had been shot. The nature of the shot, be it gunshot or arrow, was not indicated for all. One exception was an individual from Mission San Juan Capistrano who had been killed by an arrow.

Of particular note was the number of individuals who died as a result of animal activity. Generally speaking, bears and horses were the animals most frequently associated with causes of death in the mission records. Other animals were bulls, mountain lions, snakes, and spiders (see Table 65). For causes of death associated with these animals, skeletal responses to the trauma could have occurred; blunt-force trauma and bite marks would have been associated with the larger animals and predators, and potential osteonecrosis could have occurred with envenomation from spider and snake bites. Additionally, although the death records indicated causes of death, the revelation that animals were major sources of trauma among this population in southern California suggested origins for many of the antemortem fractures and suggested potential causes of death for some of the individuals for whom the absence of trauma was noted, because, for example, getting thrown from a horse or bitten by a venomous snake can produce lethal soft-tissue damage.

Drowning was another major cause of traumatic death among the people in pre-1850 southern California, particularly, and obviously so, among those living along the coast or other water sources. Because the individuals recovered from the PVAHP lived a short distance from the ocean and made use of its resources, drowning deaths might have occurred from time to time and would have resulted in no obvious skeletal indicators of causes of death, assuming that the remains could be recovered.

Birth, fire, and heat exhaustion were the three other forms of trauma. As previously mentioned, each of these three types of trauma occurred in frequencies of less than 5 percent (see Table 65). Almost 4 percent of the individuals who succumbed to trauma died during childbirth (see Table 65). Interestingly enough, for three of the individuals who died during childbirth, the death records indicated that attempts were made to deliver the infants through Cesarean section. As previously noted, the population at LAN-62 consisted primarily of younger individuals, and there was an increased probability of death per year for perinatal infants and young women (see Figures 95 and 96). Although only one individual who died during childbirth was recorded at Mission San Gabriel, that only helped to punctuate the dangers of childbirth (see Chapter 5, this volume). Overall, the incidences of deaths caused by complications during childbirth were greatly underrepresented in the mission records and were included where explicit statements exist (John Johnson, personal communication 2012). For example, Johnson (personal communication 2012) has noted many cases at the Chumash missions in which a woman died within a few days of childbirth, yet there were no explicit statements indicating that this was the cause of death. Such an underrepresentation in the records is likely associated with the recording bias described by Hackel (2012). Deaths of infants and deaths during childbirth were such common occurrences that the causes were simply not recorded.

Another 3.5 percent of the trauma victims died during structure fires, a cause of death that would have certainly resulted in an easily identifiable skeletal response (see Table 65). None of the individuals at Missions San Gabriel, San Juan Capistrano, San Luis Obispo, San Luis Rey, or San Fernando Rey died in such a manner, and no thermally altered burials at LAN-62 exhibited a burn pattern consistent with such a death.

The final cause of traumatic death was from heat exhaustion. Only one individual, from Mission San Fernando Rey, died in such a manner (see Table 65). Although rare in this sample, that single death helped to drive home the fact that there were many causes of death besides virulent disease that could have resulted in skeletons' having no indications as to how the individuals might have died.

Conclusion

Analysis of the skeletal remains recovered during the PVAHP provided researchers with a wealth of knowledge regarding paleopathology. Examination of fractures and other trauma at LAN-62 allowed the analysts to make key observations on behavior and social interactions. Unlike in other populations, such as the Mission period burial ground at LAN-264, evidence of interpersonal violence appeared to have been limited to only a handful of individuals. Even so, with regard to blunt-force trauma, there did appear to have been sex-related differences. Although slightly more males exhibited trauma on the cranium, females displayed a more-diffuse pattern and an overall slightly greater frequency of trauma. Of the individuals with estimated sex, trauma to the face was exclusive to males, whereas postcranial trauma was exclusive to females.

Only three burial features, burial Features 112, 267, and 305 at LAN-62, exhibited any clear indications of perimortem sharp-force trauma possibly associated with interpersonal violence. By and large, many instances of sharp-force trauma appeared to have been related more to mortuary behavior than to interpersonal violence. Numerous isolated concentrations of shallow cut marks noted throughout the skeletal remains were suggestive of localized defleshing and dismemberment, possibly incurred by the gravedigger during subsequent burial events. In at least one instance, the locations of the cut marks were reminiscent of Juaneño mortuary rituals as reported by Boscana, which required flesh from the shoulder of a deceased shaman to be cut free and consumed by an individual representing the spirit of Coyote.

Metabolic and infectious conditions observed in the skeletal remains provided some insight into the relative health of the individuals. Limited instances of skeletal indicators of malnutrition, such as porotic hyperostosis or cribra orbitalia, and infection suggested that either the individuals were living comparatively healthier lives than other nearby Native Californian populations or they were succumbing to virulent illnesses before any major skeletal response. Such observations suggest that these individuals were either succumbing to illnesses that rarely left skeletal indicators, such as virulent infectious disease, or to deadly noninfectious ailments, such as cardiovascular disease, and probably not those of a chronic nature. Regardless, when the burial population at LAN-62 is compared to the burial population at LAN-264, one finds that, as with trauma, evidence of infectious disease does appear to be less at LAN-62.

Trends in joint disease, such as osteoarthritis, indicated that males were involved in more activity that used the upper body, such as hauling nets or hunting with bows, and females were engaged in activity that affected much more of the body, such as kneeling while processing food.

As with the paleodemographic analysis, mission records were reviewed, to provide data to which the osteological data might be compared. Although care should be taken when making any direct comparisons, it is important to consider this alternative data set, because it helps to provide some context. As stated by Hackel (2012:77), "[t]hese external factors do not in themselves explain Indian population decline, but they add considerably to our understanding of life and death in early California and by extension other corners of colonial America, and they give us a richer understanding of how Indians lived, worked, died, and even prayed in Spanish and Mexican California."

All told, the analysis of the human remains from the PVAHP provided researchers with a rare glimpse into the health and behavior of the people of the Ballona. In some regards, certain expectations were met: life for native populations during this time in history was dangerous. Many individuals succumbed to infectious illnesses brought to the New World by Europeans, and the stress and strain on native lifeways were monumental and often resulted in conflict. However, a preservation of tradition was also seen in the mortuary behavior, as well as a general maintenance of nutrition.

People of the Ballona

Patrick B. Stanton

Introduction

Bioarchaeological research provides a unique insight into the lifeways of past populations, in terms of life expectancy, disease, health, trauma, ethnicity, and other such elusive aspects of prehistoric cultures. Among the several fundamental research questions posed in the PVAHP, one was to define the people living in the Ballona Wetlands and how they changed over time. In this final chapter, we present the conclusions of the bioarchaeological study and, in doing so, discuss our research on six main research topics: chronology, mortuary observations, paleodemography, variation, dentition, and paleopathology.

Chronology

Determining the age of a burial involves establishing spatiotemporal relationships with the surrounding burials and associations with temporally distinct artifacts within and between burials. To successfully address the main research questions of the project, it was imperative to assign chronological placements to as many burials as possible before the complex questions of mortuary behavior, biological variation, and social or biological groupings among the burials could be addressed. In the PVAHP, the temporal assignments to burials was done by determining the spatial and sequential relationships among the burial features, using a relational database and diagramming (FRED) based on the Harris matrix that was tailored to the needs of the PVAHP (see Chapter 4, this volume, for a discussion of FRED development).

Although several individual archaeological sites were excavated during the PVAHP, the burial area at LAN-62 was, by far, the most complex in terms of stratigraphy, spatial relationships, and material culture. To address key research goals, such as establishing the chronological relationships between outlying burials (especially those in the northeastern portion of the burial area) and the main burial ground and distinguishing historical-period and prehistoric burial areas, it was imperative to delineate specific spatial and sequential relationships. That was done through the FRED.

Over 70 burial features and nearly 25 nonburial features were identified as dating to the Mission period, through a combination of feature-to-feature and feature-to-stratigraphy relationships and association with Mission period artifacts. In contrast, approximately 50 nonburial features and 4 burial features were identified as prehistoric (without designation to a particular cultural period), primarily based on feature-to-stratigraphy relationships. Finally, only 1 burial feature and 1 nonburial feature were identified as dating to the Protohistoric period.

A distinct spatiotemporal pattern was observed in the distribution of Mission period burial and nonburial features and the prehistoric features within the burial ground at LAN-62. Mission period features were located in the southwestern portion of the burial area, in a relatively discrete area measuring 6 by 8 m. Nonburial features associated with possible mourning features in Feature Block 3 were located in a cluster approximately 5 m west of the burial area. The majority of the prehistoric nonburial features (not assigned to a cultural period) were scattered in the burial area, whereas the four prehistoric burial features were located either in the northernmost part of the burial area or in the northern and eastern portions of the main burial concentration, along the southern edge of the historical-period trench (nonburial Feature 16). In terms of Protohistoric period features, the single burial feature dating to that cultural period was located immediately north of the historical-period trench (nonburial Feature 16), and the nonburial feature dating to that cultural period was located approximately 20 m northwest of the main burial area.

Using small groups of closely related burial and nonburial features, other subgroups within the burial area at LAN-62 were identified, to help researchers answer specific questions regarding the formation of the site and how the burial area changed through time. As indicated in Figure 11, nonburial features were scattered throughout the main burial area, in the lower strata. They were primarily associated with domestic activities (e.g., hearths), and a small number of isolated burials were interspersed. Such a distribution pattern was also observed at other sites in the PVAHP and elsewhere in southern California. During prehistoric (pre–Mission period) times, individuals were clearly interred close to where the inhabitants were living. Therefore, it is likely that LAN-62 was not a centralized burial ground for the region prior to the Mission period. At some point prior to the Protohistoric period, the function of LAN-62 changed from a domestic to a ceremonial one. Unfortunately, it is unclear when or why that change occurred, because of ambiguities in the data set.

Analysis of the glass-bead phase data (presented in Chapter 6, Volume 3, this series) indicated that Mission period burials had been placed in the burial area in a patchwork fashion, with no clear sequential pattern or order. That is, there were no specific concentrations of burial features dating to a specific glass-bead phase. That lack of patterning within specific phases of the Mission period was likely due to the process of burial placement, in which previous burials were disturbed in order to place subsequent burials within the confined burial area.

An important research issue for the PVAHP was to delineate evidence of epidemics. It is often very difficult to identify individuals who died during epidemics, because skeletal indicators are either absent or too broad to allow identification of the cause of a lesion. Some burial features recovered from LAN-62 consisted of multiple individuals who appeared to have been interred simultaneously. To glean evidence of epidemics from the burial population at LAN-62, two subgroups identified in the FRED were analyzed (see Chapter 4, this volume, for details on the subgroups). These subgroups exhibited clear feature relationships, had good chronometric data (they dated to between A.D. 1800 and 1816), and served as "snapshots" of the burial area during that specific period of time. If epidemics were represented in the subgroups, then it is conceivable that burial integrity would be relatively high for those individuals who died during the epidemics, because one would expect them to have been interred around the same time, but that pattern of preservation was not observed in either of the subgroups. Of course, the absence of such a pattern does not preclude the presence of epidemics, because ethnohistorical and historical records have documented them (Walker and Johnson 1992). It does suggest, however, that individuals who died during epidemics were not interred in mass graves at LAN-62. Instead, individuals were interred singly, in doubles, or sometimes in groups of three. The level of preservation and the intrusiveness of subsequent burials pointed to a continuous and relatively uninterrupted period of use during the Mission period.

Finally, one subgroup was examined to identify discrete social groups, but the information gathered from the examination of that subgroup was ambiguous. Although the majority of the individuals in the subgroup exhibited a uniform mortuary behavior, the observations were very similar to those recorded for the entirety of the burial area (see Chapter 4, this volume). Thus, the pattern observed in the subgroup followed the greater trend of the burial area and was probably not indicative of any mortuary pattern particular to one social group or time period.

Mortuary Observations

Using the FRED, the burial population was divided into two groups: non–Mission period burials and Mission period burials. The non–Mission period burials consisted of prehistoric, Protohistoric period, and indeterminate-temporal-period burials. (Note that the temporal divisions in this volume are distinct from those made in Chapter 6, Volume 5, this series.) Overall, burial features at LAN-62 consisted of fully flexed primary inhumations and uncommon or rare representations of partial or complete cremations for the non–Mission period burial population. The Mission period population followed a similar pattern but with no partial cremations. That was consistent with other Late to Mission period sites in the region, such as Medea Creek (LAN-243), Mullholland (LAN-246), and Humaliwo (LAN-264) (Galdikas-Brindamour 1970:Table 1; Martz 1984:309, 320, 409), as well as the Middle period component of LAN-264 (Martz 1984:239).

Additionally, the burials from LAN-62 were, by and large, oriented to the southeast and east among the non–Mission period population and southeast and south among the Mission period population. Furthermore, the non–Mission period burials generally faced down or north; Mission period burials generally faced west, and northwest and down were common. Most of the burials in both groups were interred on their left sides (see Chapter 5, this volume, for detailed discussions).

Curiously, the orientations of the burials in both populations at LAN-62 were generally quite different from the orientations of burials at other sites in the region. Burials at the Medea Creek site (LAN-243), the Middle and Mission period burials at Humaliwo (LAN-264), and the burials at Calleguas Creek (VEN-110), Century Ranch (LAN-227), Port Hueneme (VEN-662), and Newland Hillside (ORA-282) were all primarily oriented to the west (Brooks 1968; Hudson 1969:26; King et al. 1968; Martz 1984:239, 309, 320, 409; Raab 1994:26; Sutton 2008). By contrast, burials at Yaanga (LAN-1575/H) were primarily oriented to the north (north, northwest, and northeast) (Adams 1999). The Mulholland site (LAN-246) burials were orientated east and northeast (Galdikas-Brindamour 1970:Table 1).

Burials with individuals interred on the left or right side were, however, commonly represented at many of the sites in the region, including LAN-243, LAN-1575/H, LAN-227, and the Mission period burials at LAN-264, VEN-662, VEN-110, and ORA-282 (Brooks 1968; Hudson 1969:26; King et al. 1968; Martz 1984:309, 320, 409; Raab 1994:26; Sutton 2008). Note that the position of individuals in the LAN-227 burials was evenly divided between left side, right side, and prone, and individuals in the LAN-1575/H burials were placed on both the left and right sides, although burial on the left side was more common.

The mortuary observations were very different for the other sites excavated during the PVAHP (LAN-54, LAN-193, LAN-211, and LAN-2768). First, although some burned bone was found in the sediments at these sites, all of the burial features were inhumations. Unlike at LAN-62, there was a slight preference for semiflexed over fully flexed inhumations. Furthermore, there was a relatively even distribution of burials oriented generally northeast, northwest, or southwest. These orientations were more similar to the general regional tendency than to LAN-62. Although the left side was the most common burial position observed at LAN-62, individuals were rarely interred on the left side at the other PVAHP sites, which had greater frequencies of supine interments. Finally, burials tended to face south at these four sites.

Although small in number, several burial features were identified as partial or complete cremations. Eighteen partial cremations were recovered at LAN-62. With the exception of four partial cremations, all were found in an area extending northwest–southeast along the northeastern border of the burial area, immediately south of and roughly parallel to the historical-period trench (nonburial Feature 16). These burials consisted of partially disarticulated and jumbled concentrations of minimally burned human-skeletal remains. Additionally, for several partial cremations, evidence of burning was located on the superficial skeletal landmarks, suggesting that at least some tissue was present on the remains that shielded the deeper portions of the skeleton from contact with the heat source. Furthermore, the majority of the partial cremations consisted of a pelvis with the proximal one-third to one-half of one or both femora still articulated. Half of the primary partial cremations with associated femora exhibited early postmortem transverse or spiral fractures of the femoral shaft. Frequently a cranium (represented in various levels of completeness) and other articulated segments were also recovered. Although these segments usually consisted of vertebral elements, other segments, such as a hand or an articulated tibia and fibula, were also recovered. Beyond a few scattered fragments, very little remained of the thorax, limbs, and extremities of these individuals. This burial type was relatively evenly distributed among both male and female adults. Subadults were also represented but to a lesser extent. Individuals younger than 12 years (i.e., fetuses, infants, and children) did not appear to have been treated in this fashion.

Unfortunately, no specific ethnographic information detailing this particular burial practice was available, hindering any investigations that might shed light on this peculiar mortuary practice. King (1982:147–151), however, reported that at least three burial features recovered from Medea Creek (LAN-243) had been partially cremated. The treatment of one of these individuals (burial Feature 133) was nearly identical to that of many of the partial cremations found at LAN-62. King (1982:149–150) wrote:

> This is a body cut in two at the chest: only the lower part is presenting articulation. The lower body is sprawled on its back with the right femur cut above the knee and missing the distal end, drawn up toward the right shoulder; the left leg is extended and missing below the knee. At the left rib cage was a cluster of burned bone fragments, including ribs, clavicle and skull. These appear to be the missing bones from the upper part of the body heaped together. A burned tibia and fibula were beside the left femur: these appear to be the cut lower leg laid in its approximate proper location. A radius and ulna were placed where the right leg would have been if it had been extended; this could be a part of one of the missing arms.

A projectile point was found in association with the left side of the rib cage for this individual, which raises the possibility that this individual died from some traumatic event (King 1982:150). Although King described the legs of this individual as having been cut, as opposed to broken, and indicated that the individual had been purposely bisected, the similarities between this burial at Medea Creek and the partial cremations at LAN-62 are noteworthy. As previously mentioned, the only partial cremation with any cut marks was burial Feature 108, and they were located in association with the ribs.

King suggests six possible reasons for this particular mortuary activity, also a rare occurrence at LAN-243. These reasons include foul play, capital punishment, sacrifice, cannibalism, feuding/war, and political subjugation/punitive attack (King 1982:154). However, these hypotheses fail to adequately explain the behavior behind the partial cremations at LAN-62, because there was no evidence of malfeasance or punishment among these partial cremations. The femoral fractures could have been produced just as likely by trauma as through expansion during a thermal event. Additionally, the cut marks observed on the ribs associated with burial Feature 108, especially those on the first rib, were similar to those found in association with a postmortem defleshing activity and were also not likely traumatic in nature. There was no clear evidence to support the theory that these partial cremations were the result of some traumatic event. The cut marks associated with them, however, might have been preparatory in nature, allowing articulated burials to be reduced to more-manageable components, for transportation or consolidation. Several of the partial cremations, burial Feature 108 for instance, appeared to have been disarticulated and burned in place, indicating that the remains had been uncovered for some graveside ritual.

Possible partial cremations were also noted by Hudson (1969) at the Santiago Canyon site (ORA-237), where three crania were found beneath the remains of hearthstones, ash, and burned bone. Two of the crania, though found beneath the same hearth, did not exhibit any evidence of burning. The third cranium had been burned and was associated with femoral fragments. Similarly, William Deane indicated that he found a cluster of four crania at LAN-62 that only exhibited evidence of burning on one side (Thiel 1953). Although Wheeler (2004:51) suggested that the crania from Santiago Canyon may have been taken as trophies, it is equally plausible that this behavior may have been related to kin worship, such as the ritual activity associated with the Mourning Ceremony. These treatments are similar to the treatment of the partial cremations at LAN-62, albeit missing pelvic and substantial postcranial elements, and although they are dissimilar in appearance from the partial cremations at LAN-243, the treatment of these crania does strike a similar chord.

Only eight cremations were identified from LAN-62: six non–Mission period and two Mission period. Roughly 2 percent of the scattered human bone had been burned, suggesting that there may have been more cremations in the burial area, but subsequent inhumations had disturbed them. The cremations were nearly evenly divided between juveniles and adults, although the sex of only one adult, a female, could be estimated. The cremations associated with LAN-62 were located in three clusters scattered throughout the burial area. The first concentration consisted of two cremations in the north-central portion of the main burial concentration, immediately south of the historical-period trench (nonburial Feature 16). The second concentration consisted of three cremations in the western portion of the main burial concentration. The two Mission period cremations were associated with that concentration. The final concentration was the most diffusely scattered of the three concentrations and consisted of three cremations in the eastern portion of the burial area, all juveniles (two infants and one subadult). The locations of all these cremation concentrations generally overlapped with the locations of the partial cremations.

Both partial and complete cremations appeared to have been burned in a low-oxygen environment wherein temperatures did not usually exceed 800°C, although the presence of vitrified sand and organic materials suggested that some cremations reached temperatures of at least 900°C. One possible reason for that disparity and also for the differences in degree of cremation (complete vs. partial) is that there may have been differences in the amounts and types of fuel available for use at the times of the cremation events. Represented in these thermally affected burial features were willow, bigcone Douglas-fir, sagebrush, and California sycamore. The split dependency on lowland and highland species is indicative of several possible behavioral patterns. Perhaps it suggests that a seasonal use of resources or overuse of local resources required the population to travel farther afield to gather the necessary provisions. Equally as plausible is opportunism, wherein local wood was supplemented with wood that the Spanish found less desirable (e.g., branches) and with scavenged, unmilled building supplies.

The number of burials and the level of complexity of the burial area at LAN-62 were unique. As indicated in Chapter 6, this volume, LAN-62 consisted of a relatively discrete concentration of burials that had been continually impacted by subsequent burial events. The LAN-62 burials were concentrated in a roughly 28-by-14-m area, and the bulk of the burials were located in an approximately 19-by-11-m area in the southwestern portion of the burial area. The burial area was over a meter in depth. Most of the burials were intrusive to other burials or had been impacted by other burials as well as nonburial features. Regarding the use of family plots, Harrington (1929:172) noted, "if bones were unearthed in the digging of a grave they were respectfully laid aside and carefully reburied before the new interment was completed." This description accurately describes the behavior seen in many of the burials at LAN-62, such as burial Feature 250 (see Chapter 5, this volume), in which earlier burials had been intruded upon by subsequent burial events. During these burial events, the earlier remains were often moved aside or placed around or on top of the intrusive burial.

Large, contemporaneous burial areas are rare in the Gabrielino/Tongva territories. Other known Gabrielino/Tongva burials areas consist of only a couple-dozen isolated burials in small couplets or clusters. In fact, the appearance of the burial area at LAN-62 was unique among the Gabrielino/Tongva but was nearly identical to the burial areas associated with the Chumash, such as Medea Creek (LAN-243), Humaliwo (LAN-264), and Simo'mo (VEN-26), where discrete family plots were continual used, sometimes to the detriment of skeletal preservation (Gamble et al. 2001; King 1982; Orr 1943, as cited in Martz [1984:157]). Because of the proximity of LAN-62 to the Chumash borderlands and the similarities between LAN-62 and the Chumash burial areas (at Humaliwo, Simo'mo, and Medea Creek) and, less so, between LAN-62 and other Gabrielino/Tongva burial areas, there is a likelihood that substantial cultural interaction between the Chumash and the Gabrielino/Tongva had occurred, leading to the adoption by the Gabrielino/Tongva of some Chumash cultural practices, particularly those associated with burial-area layout. However, as indicated below in the Human Variation section, the individuals associated with LAN-62 were clearly Gabrielino/Tongva.

Paleodemography

Determining an estimate of the number of individuals interred at LAN-62 over the course of time was challenging because of varying levels of preservation. In addition, the repeated use of the burial area, wherein previous burials were moved to accommodate placement of new burials, resulted in a complex arrangement of burials and the interlacing of individuals in some burials with individuals in other burials. The MNI and MLNI, using the LI, were calculated for the entire burial population. At LAN-62, the MNI was 349, and the MLNI was 377. Those numbers include both the non–Mission period and Mission period populations. The reader is directed to Chapter 6, this volume, for detailed discussions on the methods used to determine the MNI and MLNI.

Several interesting trends were noted in the burial population at LAN-62. First, female individuals greatly outnumbered males; the ratio ranged from 1.5:1 for the non–Mission period burial population to approximately 3:1 for the Mission period burial population. When compared to baptismal records from Missions San Gabriel and San Fernando Rey, which included people from the village of Guaspet (the village most likely associated with LAN-62), however, the female-to-male ratio was in reality closer to 1:1 (see Chapter 6, this volume). Such disparity was likely linked to a variety of reasons, including the lack of sex data for juveniles in the burial population, misidentification because of sexual dimorphism, preservation bias, and the larger population represented in the baptismal records. Based on multivariate-logistic-regression analysis of nonmetrical sex traits (see Chapter 7, this volume), several of the "male" individuals may have been misidentified as "female." Observations at LAN-62 seemed to mirror those by Walker and Johnson (1992), who documented a dramatic decrease in the number of Chumash women of childbearing age during the Mission period, leading to an imbalance in the sex ratio of men to women by 1822.

Although very few children and young adolescents were represented in the non–Mission and Mission period burial populations at LAN-62, there was a distinct spike in mortality for fetal and infant individuals. That was expected, because the very young often succumb to infectious diseases, but also, because of the postcontact epidemics that threatened southern California, it was an exceptionally dangerous time for the very young. For example, Walker and Johnson (1992:132–135) indicated that between 1790 and 1844, six to seven epidemics of typhoid, diphtheria, measles, influenza, and small pox occurred. Many of these diseases can result in miscarriage, which might explain the presence of the many near-term fetuses at LAN-62 in both burial populations.

After infancy, the number of individuals represented in both the non–Mission and Mission period burial populations declined until late adolescence. In the Mission period burial population, there were very few individuals aged between 2 and 4 years and individuals younger than 8 years. Both males and females tended to die relatively early in life, and few individuals represented older generations. The non–Mission period burial population consisted mostly of young adults. Comparison of the summary statistics of the non–Mission and Mission period burial populations showed that the Mission period subset had younger mean ages for females and males, approximately 5 years younger than the mean ages of the non–Mission period burial population. Because no old adults (individuals 50+ years of age) were identified in the Mission period subset, the maximum age (47.5 years) was nearly 25 years younger than the maximum age observed in the non–Mission period population (72 years).

When the summary statistics for the Mission period burial population are compared to those of the population represented in the baptismal records, it is apparent that the living population represented in the baptismal records was generally older. The mean ages for males and females represented in the baptismal records were 7–9 years older than the mean ages for males and females in the Mission period burial population, and the maximum age was approximately 20 years older, although that distinction was likely the result of inaccuracies in the aging of older individuals in the burial population. Such skewing toward the younger ages might have been related to the inherent methodological biases associated with paleodemography (see Chapter 6, this volume).

To compare the skeletal data and the burial records in an empirical fashion, estimated survivorship and hazard functions for each sample were calculated and tested for significant differences. Using a maximum-likelihood method (i.e., the four-parameter Siler model [see Chapter 6, this volume]), a mean age-at-death for the LAN-62 skeletal sample of 27.8 years (absolute error <0.001) and a mean age of living individuals of 18.2 years (absolute error <0.002) were calculated. These indicated that the population was relatively young compared to modern standards. It is interesting to note that the estimates derived from hazards analysis were not dramatically different from those derived from the life-table analysis.

The LAN-62 skeletal data were also compared to the entire burial-record sample from Missions San Gabriel and San Fernando Rey and the Guaspet sample culled from the full records from Missions San Gabriel and San Fernando Rey. The Siler competing-hazard models converged normally for all three samples (Holman 2000). However, the ratios of infants to children and mid-range juveniles in the LAN-62 skeletal sample and the Guaspet sample resulted in extreme values for the estimated infant-mortality parameters, α_1 and β_1, particularly for those two groups (see Table 31). The likelihood-ratio tests were significant in the comparisons of the LAN-62 skeletal data and all mission records (χ^2 = 158.96; *p* = .000; *df* = 5) and the subset of Guaspet records (χ^2 = 420.07; *p* = .000; *df* = 5). Figures 100 and 101 demonstrate these differences. Survivorship lowered considerably after 25 years of age for the LAN-62 skeletal series when compared to the mission records. Figure 101 presents a comparison plot of survivorship for the LAN-62 skeletal sample and the Guaspet records. One possible explanation for the survivorship distribution is the overnumeration of infants in the Guaspet records. In that data set, nearly 30 percent (n = 14) of the entire sample fell into the 0–1-year age class. Moreover, 23 percent (n = 11) of the Guaspet sample was between 1 and 16 years of age, but there were no individuals in the 7–12-year age class.

Next, the age-at-death distributions for individuals older than 4 years were examined using a 2-parameter Gompertz model (see Chapter 6, this volume) to test the influence of infant mortality on the overall model. The models each converged normally, and the likelihood-ratio test comparing the two distributions was significant (Λ = 12.1; *p* = .001; *df* = 2). This demonstrated that survivorship was much lower in the skeletal sample and had likely been affected by the small sample of Guaspet records. However, examination of the survivorship curve revealed a clear pattern. The Guaspet individuals had a relatively lower mortality through middle age than the LAN-62 skeletal sample but a higher survivorship through old age.

Finally, we examined the sex-specific mortality of the LAN-62 skeletal data set, using the 2-parameter Gompertz model (see Chapter 6, this volume). Within the skeletal sample, females outnumbered males nearly 3 to 1. The age-at-death distributions for males and females (and a pooled, combined age-at-death distribution) were calculated, using a 2-parameter Gompertz model. Mortality did not significantly differ by sex for the LAN-62 skeletal data ($\Lambda = 1.5$; $p = .90$; $df = 2$). In other words, the probability that a male would die at any age was roughly equal to the probability that a woman would die at that same age. Examination of the survivorship curve demonstrated a slightly higher (but statistically insignificant) survivorship for males than for their female counterparts (see Figure 102).

Human Variation

An important research question for the PVAHP was related to the ethnic and cultural identities of the populations residing in the Ballona Wetlands. Where did these people of the Ballona Wetlands come from? Historically, this area has been settled by the Gabrielino/Tongva, and the Chumash were located only a few miles north of the project area.

Craniometric analysis is one avenue of study that can contribute to issues related to cultural affinity. An initial study examined the cranial indexes derived from seven individuals of indeterminate temporal association from LAN-62 and compared them to information presented on the remains of individuals from LAN-1575/H (Yaanga), LAN-264/H (the Malibu site), and the southern Channel Islands. The individuals recovered from LAN-1575/H and the southern Channel Islands have been associated with the Gabrielino/Tongva. The remains recovered from LAN-264/H, on the other hand, have been associated with the Chumash. Though certainly not a representative sample, these seven individuals did provide some clues that helped to describe the LAN-62 skeletal population. LAN-264/H is an excellent comparative example, because it is located in a similar ecological niche as LAN-62, and it has a large Mission period burial area in addition to a separate prehistoric burial area. LAN-1575/H is also a good example in this discussion, because the burials dated to the Protohistoric and Mission periods and allowed meaningful comparisons. Goldberg (1999) reported that, overall, the individuals associated with LAN-1575/H were dolichocranic and had a mean cranial index of 68.81; that is very close to the mean cranial index associated with the LAN-62 population. She compared the LAN-1575/H individuals to the prehistoric component from LAN-264 (Walker et al. 1996) and Gifford's (1926a, 1926b, 1936, 1971) Santa Catalina Island and San Clemente Island data and found that of the three samples, the individuals from LAN-1575/H (and therefore also LAN-62) were more similar to the island populations (with mean cranial indexes of 71.48 and 74.47, respectively) than the Humaliwo population (with a mean cranial index of 78.74). Based on this information, the individuals recovered from LAN-62 appeared more similar, skeletally, to those recovered from LAN-1575/H than those from LAN-264.

Although six of the seven individuals from LAN-62 were dolichocranic, one individual was more mesocranic. Although that individual might represent general skeletal variation, it may likewise indicate that individuals from other neighboring groups might be represented at LAN-62. Unfortunately, the sample size was too small to make any definitive statements, and mitochondrial-DNA analysis was not an option. Regardless, relative proximity to Chumash territory and to Gabrielino/Tongva villages even closer to the Chumash border, as well as similarities in mortuary practices at LAN-62 to those of the Chumash, indicated that the cultural lines were not impenetrable but were more likely semipermeable. It is not outside the realm of possibility that some intermarrying might have occurred.

To explore the range in variation of the LAN-62 sample further and to document the cranial variability of that population fully, the craniometric data from LAN-62 were compared to multiple Native American groups, using canonical-variate analysis. Mahalanobis-distance analysis and canonical-variate analysis using W. W. Howells's craniometric database was used to compare all craniometric information from LAN-62 to five Native American samples: Arikara, Blackfoot, pooled California (which consisted of a population of burials from LAN-54, Zuma Creek [LAN-174], the Los Altos site [LAN-270], LAN-1575/H, LAN-3057, ORA-119-A, and ORA-1587), Santa Cruz Island (Chumash), and Windover (an Archaic period population from Florida). Although LAN-54 was excavated and analyzed during this project, the purpose of the analysis was to attempt to categorize the much larger population at LAN-62. Inclusion of that population into the pooled California population helped to increase a limited sample size and also provided a means to link the individuals recovered from LAN-62 to nearby LAN-54. The results indicated that the people represented at LAN-62 were more biologically similar to the pooled California sample (see Chapter 7, this volume, for detailed discussions). That conclusion was not unexpected and provided further support for the results of the cranial-index analysis. Based on these two analyses, it would appear that the individuals represented at LAN-62 were most likely related to southern Native Californians, likely the Gabrielino/Tongva.

Dentition

Research on prehistoric diet on the Channel Islands and the adjacent mainland has demonstrated a change from a terrestrial hunting-and-gathering economy to one of marine exploitation (Lambert and Walker 1991; Walker and DeNiro 1986; Walker and Erlandson 1986; Walker et al. 1996). That possible shift in subsistence economies was determined partly by the analysis of dental remains from prehistoric California burial populations.

The Early period hunting-and-gathering diet included acorns, tubers, and roots—food products abundant in carbohydrates. Grit, introduced during food processing and preparation, accelerated the rate of enamel loss and crown reduction. The individuals recovered from LAN-62 had low to moderate dental-caries frequencies compared to some of the early indigenous California comparative populations with diets focused on terrestrial foods. On the other hand, compared to later comparative populations who relied on marine and lagoon resources, the LAN-62 sample had slightly higher dental-caries frequencies. In other words, dental-caries frequencies at LAN-62 fell between dental-caries frequencies attributed to comparative populations reliant on terrestrial foods and those reliant on marine resources. These results suggested that the people of the Ballona Wetlands had a diet abundant in proteins from the ocean and, to a lesser extent, from terrestrial sources. Carbohydrates were likely consumed on a regular basis, but the degree of wear suggested that they were likely derived from fibrous plant materials that obliterated tooth surfaces before dental caries could substantially impact the teeth.

Food types and the amounts consumed may have varied between males and females for other southern California indigenous populations (Lambert and Walker 1991; Walker 1980; Walker and Erlandson 1986). Based on dental patterns, such differences could not be discerned in the LAN-62 population. Dental-caries frequencies were not significantly different between males and females.

Social organization and differential mortuary treatment due to status have not been ascertained for the people associated with the burial area at LAN-62. Therefore, dietary differences between individuals based on status could not be addressed.

Enamel hypoplastic defects were observed in approximately 25 percent of the LAN-62 population. That was low compared to many populations from prehistoric and historical-period times. Though comparatively low, that frequency was not insignificant in terms of population health. Serious illnesses or epidemics likely affected the group at specific times. The presence of enamel defects on several individuals indicated a certain level of survivorship.

The teeth of the adult individuals from LAN-62 exhibited degrees and types of dental wear similar to those observed in other indigenous California populations (Molnar 1971; Walker 1978). General levels of dental wear ranged from very extreme and uneven (substantial exposure of dentine with varying directions of wear on the occlusal surfaces) to a more moderate, even wear (less reduction of crown height and dentine exposure and flat occlusal surfaces). These differences were generally age related; older individuals exhibited more extreme attrition than younger individuals did. Unintentional dental modification due to task-related activity was observed for a number of individuals in the sample. That task-related wear was equally distributed between males and females, but the tasks may have been sex-specific.

Nearly half of the population with alveolar bone evinced abscesses. Most of the localized losses of alveolar bone resulted from infection in the pulp chamber due to severe attrition. The LAN-62 frequency for chipped teeth was considered moderate, but it was higher than what has been observed for agricultural populations. Inclusions from food processing contributed to enamel chipping, as well. Interesting observations that attested to inclusions in foods included the presence of small pebbles imbedded in the alveolar bone of three adult females.

Dental anomalies were present among the LAN-62 population. A number of individuals had teeth with atypical morphologies or that were malpositioned. Explanations for abnormal dental conditions include genetics or association with a physiological syndrome.

Dental morphologic traits were recorded for at least 83 of the LAN-62 inhumations with minimally worn permanent teeth, using the Arizona State University Dental Anthropology System (Turner et al. 1991). Observations suggested that LAN-62 interments had the most extreme expressions recorded for some nonmetrical dental traits, including shoveling of the maxillary incisors, upper-molar parastyle, and lower-molar root numbers. Such high grades of expression of these traits exceeded those that have been typically observed in a number of southwestern indigenous populations from Arizona or northern Mexico. Nevertheless, when the LAN-62 population was compared to several other Native American populations from the greater Southwest, a degree of relatedness was established, particularly to groups from the Uto-Aztecan linguistic family. However, no comparative data for other indigenous groups from California, like the Chumash, were available. The dental-morphology data now available for an indigenous southern California population (LAN-62) should assist future researchers in the collection and comparison of California groups. With such data, the origins and migrations of the indigenous peoples of California may be explored. Overall, the dental sample from LAN-62 is considered representative of the entire burial population (see Chapter 8, this volume, for details).

Paleopathology

Analyses of the skeletal remains recovered during the PVAHP have provided invaluable data on paleopathology (see Chapter 9, this volume, for detailed discussions). Important observations on behavior and social interactions were made through the examination of fractures and other trauma in individuals recovered from the burial area at LAN-62. Unlike the sections on mortuary observations and paleopathology, because of a limited observable sample size, the entire burial population was combined and analyzed for pathology, regardless of associated time period. Males exhibited more antemortem fractures of the arms and legs than did females, and females suffered fractures of the hand more often than did males. These differences were likely the result of sexual division of labor and differential hazards. Although slightly more males exhibited trauma on the cranium, females displayed a more diffuse pattern and an overall slightly greater frequency of trauma. When trends across LAN-62 were compared to those from the two populations at Humaliwo, it was apparent that the overall blunt-force trauma at LAN-62 was less than that observed in the Mission period population at Humaliwo but slightly more than that seen in the Middle period population from the same site (Walker et al. 1996:Table 15). In other words, the amount of blunt-force trauma observed in the entire burial population at LAN-62 fell somewhere between the frequencies of blunt-force trauma observed for the two time periods associated with the Humaliwo site.

Cranial-vault trauma at LAN-62 consisted of three healed or partially healed circular or elliptical depression fractures. Of the individuals with determined sex, trauma to the face was exclusive to males, whereas postcranial trauma was exclusive to females. Although the amount of trauma was limited, the distribution of fractures had some social implications. First, the exclusivity of facial trauma and the absence of postcranial trauma in the males suggested that these wounds were inflicted in a situation in which the head was the focus for aggression, such as in close combat or a duel (Walker 1989:320). The anterior (and left) placement of these fractures, during which the individual was likely struck in the face by a right-handed assailant, further supports that hypothesis. Furthermore, although the shape of these fractures was comparable to that described by Walker (1989:316–317) for skeletal remains recovered from the Channel Islands, the fractures observed at LAN-62 were nearly twice the size (Walker 1989:Table 2). As suggested by Walker (1989:319), the wounds might have been inflicted by a weapon similar to a Gabrielino/Tongva war club, which was sometimes lined with wooden studs (McCawley 1996:Figures 31 and 32).

At LAN-264, Walker et al. (1996) identified patterns similar to those of injuries identified at LAN-62, with some differences. Cranial injuries were more common among males at both sites, but unlike at LAN-62, where females suffered more hand injuries, the men at Humaliwo had more injuries to the hands. The overall pattern of fractures, bony spurs, and arthritis identified at Humaliwo was consistent with strenuous activity, interpersonal violence, and sexual division of labor (Walker et al. 1996:39). The similarities in skeletal pathologies at Humaliwo and LAN-62 during the two time periods are intriguing and may have resulted from similar activity levels, warfare practices, and societal structures.

Clear evidence of perimortem sharp-force trauma associated with interpersonal violence was rarer than the evidence of blunt-force trauma at LAN-62; only one Mission period burial feature, burial Feature 112, and two non–Mission period burial features, burial Features 267 and 305 (see Chapter 9, this volume, for full descriptions of the sharp-force trauma associated with these features) exhibited any clear indications. In general, many instances of sharp-force trauma appeared more related to mortuary behavior than interpersonal violence. Numerous isolated concentrations of shallow cut marks noted throughout the skeletal remains were suggestive of localized defleshing and dismemberment, possibly caused by the gravedigger during subsequent burial events. In at least one instance, the locations of the cut marks were reminiscent of Juaneño mortuary rituals as reported by Boscana (2005 [1846]), which required flesh from the shoulder of a deceased shaman to be cut free and consumed by an individual representing the spirit of Coyote.

At least one individual at LAN-62 appeared to be represented by a trophy skull. Within burial Feature 213 were two individuals, a 30–40-year-old male primary inhumation and an isolated cranium from a 25–50-year-old possible male. The proximity of the cranium to the primary individual suggested that both sets of remains were buried at the same time and in the same pit, but unlike many other burial features associated with LAN-62, this burial feature was relatively isolated from the commingling of remains common in the main burial area. Furthermore, the difference in the general appearance of the cranial shape for both the primary inhumation, whose cranium exhibited a relatively high vault with shorter cranial length, and this individual, whose cranium exhibited a lower vault profile and a longer cranial length, further suggested that the second individual was from another group. Unfortunately, these differences could not be quantified, because damage in key locations of the cranium prevented craniometric analysis.

Trophy skulls are not outside of the realm of possibility. Cultures throughout the world often took trophies from the battlefield (Bonogofsky 2006). Andrushko et al. (2005) also reported that in central California, forearms were often taken as warfare-related trophies by Native Californian groups. Furthermore, among the Gabrielino/Tongva, captured enemy combatants were either decapitated on the battlefield or taken as hostages, and scalps were taken for trophies or ransomed to the families of the deceased (McCawley 1996:107). Raab (1994:35) noted that burial Feature 24 at Calleguas Creek (VEN-110) included three crania in addition to the primary individual, suggesting that they were evidence of trophy-taking or kin worship. Because of the relatively discrete association between the primary individual and the isolated cranium, the isolated cranium likely held some value for the primary individual in this burial feature, possibly as a trophy. Unfortunately, no cut marks were observed on the cranium associated with the second individual, and although the base of the cranium was missing, suggesting the foramen magnum was enlarged so that the skull could be placed on a post, preservation was such that the damage could not be interpreted as perimortem or postmortem.

In regard to trauma, however, per the mission records, homicide did appear to be a significant cause of death at the missions, suggesting that the lesser evidence in the LAN-62 burial population was likely the result of the inability to identify some trauma because of preservation bias and nonspecific indicators of pathology and trauma.

Metabolic and infectious conditions observed in the skeletal remains provided some insight into the relative health of the individuals. Limited instances of skeletal indicators of malnutrition (e.g., porotic hyperostosis or cribra orbitalia) and infection suggested that the individuals either had lived comparatively healthier lives than other nearby Native Californian populations or had succumbed to virulent illnesses before any major skeletal response. Regardless, when the burial population at LAN-62 was compared to both burial populations at LAN-264, evidence of infectious disease appeared to have been less at LAN-62. Alternatively, as noted above, Walker and Johnson (1992:132–135) indicated that the Chumash were plagued by numerous epidemics of typhoid, diphtheria, measles, influenza, and small pox between 1790 and 1844. Because epidemics were quite common during the period in which LAN-62 was occupied, it is equally plausible that the individuals perished before any illness could affect the skeletons.

Trends in joint disease, such as osteoarthritis, indicated that males were involved in more activities that used the upper body, such as hauling nets or hunting with bows, and females were engaged in activities that affected much more of the body, such as kneeling while processing food.

As with the paleodemographic analysis, mission records were reviewed to provide comparative paleopathological data. Although approximately one-third of the population in the missions succumbed to disease (see Table 65, Chapter 9, this volume), few of the illnesses and diseases cited in the mission records appeared to have been of the type to provoke skeletal response. Certainly, infections associated with lesions might have been related to such conditions as osteomyelitis or syphilis, gastrointestinal conditions might have been related to some forms of cancer, and respiratory illnesses might have been related to pneumonia, which might produce plaque-like osteophytic growths on the pleural surfaces of the ribs, but by and large, the illnesses reported in the death records were usually only associated with soft tissue, because of their virulence or brevity. Also, when the more-local missions, Missions San Gabriel and San Fernando Rey, were examined individually, comparatively few individuals were reported as dying of disease. For instance, smallpox and cholera, the most virulent of the diseases associated with these death records, appear to have been entirely associated with the more-northern missions in the sample, Missions Santa Bárbara, La Purisima Concepción, and San Luis Obispo. Most of the individuals at Missions San Gabriel and San Fernando Rey succumbed to unspecified illnesses, although both individuals who died from rabies were from those two missions. Note that the variability among the missions regarding statements about individuals who died from disease had little to do with a lack of disease and was more often the result of variability in recording proclivities among missionaries.

Furthermore, as indicated by Hackel (2012), the mission cause-of-death records exhibited a certain degree of bias. First of all, the violent, abrupt, and dramatic deaths were more apt to be recorded than deaths associated with more "normal" causes. Second, males were represented more frequently in the records, probably because their work tended to be more dangerous or took them away from home. Finally, causes of death for many infants and young children were not recorded. According to Hackel (2012:82), of the 25,000 Native Californian children who died before the age of 10 in the missions, only 338 had causes of death recorded, likely because infant mortality was such a common occurrence that the deaths were deemed normal.

Examination of the PVAHP individuals revealed that few exhibited lesions associated with infectious disease. In fact, only a handful of individuals displayed any periostitis or osteomyelitis (see Table 60). Such observations suggested that these individuals succumbed either to illnesses that rarely left skeletal indicators, such as virulent infectious disease, or to deadly noninfectious ailments, such as cardiovascular disease, and probably not those of a chronic nature. Though certainly not directly comparable, Mission period cause-of-death records and other ethnographic data demonstrated the diversity of illnesses that befell the native populations and further highlighted the dangers of the preindustrial, pre-antibiotic world in which these individuals lived.

Summary

The burials from the PVAHP, particularly at LAN-62, have provided a rare glimpse into the Native Californian cultures of the Los Angeles Basin. Based on craniometric analysis, material culture, and mission records, we have concluded that the people of the Ballona, particularly during the later periods, were Gabrielino/Tongva. The mortuary practices observed during the PVAHP at LAN-62 were similar to those that have been observed in Chumash burial areas several miles north of the site, where discrete burials areas that were possibly subdivided into family plots and subsequent burials in those plots that often disturbed previously interred individuals have been found. Although LAN-62 is associated with the Gabrielino/Tongva, because of its proximity to the Chumash borderlands, a substantial amount of cultural interaction likely occurred. That was further hinted at by the presence of at least one mesocranic individual in the burial population. Although ancestry has a strong cultural component, and that individual might represent genetic diversity within the population, the presence of the individual might represent some intermarriage and interaction between the people of LAN-62 and those within the Chumash borderlands, as has been similarly hypothesized for the individuals associated with LAN-246 (Galdikas-Brindamour 1970).

LAN-62 was generally a younger population with more females than males. The larger population of females in the skeletal population at LAN-62 seemed to mirror observations by Walker and Johnson (1992) that a decrease in the number of Chumash women of childbearing age led to an imbalance in the sex ratio of men to women by 1822. Furthermore, numerous fetal and infant individuals were represented in the burial population at LAN-62. Although little evidence of infectious disease was observed in the burial population at LAN-62, many diseases leave little or no skeletal evidence, and it is well documented that many individuals in the New World succumbed to infectious illnesses introduced by Europeans. Numerous very-young individuals (i.e., fetuses and infants) were also represented. Such diseases would have seriously impacted the very young, and some diseases, such as measles and typhoid, would have resulted in miscarriages.

Beyond the turmoil and population stress to which the people of the Ballona were subjected, as indicated by the dental analysis and the relative stability of mortuary practices throughout the burial area at LAN-62, it is apparent that the preservation and practice of cultural traditions continued in the Ballona despite changes in the cultural and physical landscapes.

Abscess: An infection resulting in the formation of a pus pocket within a cavity in healthy tissue. Dentally, abscesses occur when bacteria is introduced through an opening, such as a pulp chamber exposed from caries, breakage, or dental attrition, or as a result of periodontal disease. Formation of a dental abscess can occur at the tooth root (periapical abscess) or in the surrounding tissue (periodontal abscess).

Acetabulum: Surface on the innominate where the femoral head articulates; part of the hip joint.

Acromioclavicular joint: Articulation of the clavicle and acromion of the scapula; forms the bridge over the shoulder joint.

Adductor tubercle: The insertion for the adductor magnus muscle on the inner surface of the femur, behind the knee joint.

Adipocere: Sometimes referred to as grave wax or mortuary wax, adipocere is the result of a chemical reaction of water, hydrogen, bacterial enzymes, and fat deposits on the body at the time of death, leaving behind the insoluble fatty acids. Formation of adipocere requires a wet or moist environment, and its presence has been recorded on remains over 100 years old. Adipocere inhibits the process of decomposition. The formation process is sometimes referred to as saponification.

Alveolar resorption: Anatomically, teeth are located within the alveolus of the maxilla and mandible. When a tooth is lost (regardless of the reason) and not replaced, the alveolus will close up/seal itself closed, essentially being resorbed.

Alveolus: A small, saclike dilation or socket in which the root of a tooth is nestled.

Ameloblasts: Cells that create and deposit enamel on teeth.

Ankylosis: Stiffening or fusion of a joint.

Ankylosing spondylitis: The best known of a class of inflammatory arthritides (plural of arthritis) known as spondyloarthropathies. Tendency toward erosive, reactive bone growth and fusion of adjacent bones (ankylosis); may also include the mineralization of attachment areas of soft connective tissue (syndesmophytes). Most often involves the vertebral column and sacroiliac joints. Occurs more often in males than females.

Antemortem: Before death.

Anterior: (frontal, ventral) Toward the front; opposite of *posterior*.

Aperture: In general, a medium-sized to large opening.

Apex: Cranially, the highest point on the skull, which also lies in the same vertical plane as the porion (the skull must be in the Frankfort horizontal position). Also, the top of a pointed structure (e.g., of the patella, the head of the fibula, or the petrous portion of the temporal bone).

Apical (teeth): Toward the top of a tooth's root; opposite of *occlusal*.

Appendicular: Of or relating to an appendage or limb (i.e., arms and legs).

Appendicular skeleton: Consists of the 63 paired bones of the upper and lower limbs (appendages) and the pectoral and pelvic girdles; does not include the sacrum.

Arthritis mutilans: A form of rheumatoid arthritis that involves degeneration/destruction of the joint. Can result in severe deformities (typically hands and feet).

Articulation: A joint (can be movable or fixed).

Auricular surface: The surface on the innominate where the innominate articulates with the sacrum. A part of the sacroiliac joint.

Axial: Referring to the axial skeleton; of or relating to the head and trunk of the body.

Axial skeleton: The skeleton of the axis of the body, which consists of 80 bones and includes the skull, hyoid, sternum, ribs, vertebrae, sacrum, and coccyx.

Behavioral indicator: Evidence of habitual patterns of activity left on the skeleton (including the dentition).

Biceps: Muscle of the upper arm (anterior placement) that allows the arm to lift and carry.

Blunt-force trauma: Physical trauma caused to a body part via impact from a blunt object (e.g., a club).

Brachialis: The muscle (flexor) located at the lower/inferior portion of the humerus; inserts into the ulna and allows the arm to lift (flexes the elbow).

Buccal: Toward the cheek; opposite of *lingual*.

Calcaneus: A heel bone, the largest of the tarsal bones that make up the ankle; makes up the most of the heel.

Calcination: Process of applying high heat (not to a melting point) that results in loss of moisture and decomposition of elements. Typically used in reference to bone that has been burned to a point at which it no longer contains organic material.

Calculus: Substance composed of mineralized plaque and trapped food deposited on the tooth surface (tartar).

Calvaria: (skullcap, calvarium) The superior portion of the braincase or the roof of the cranial vault; formed by portions of the frontal, parietal, and occipital bones.

Canal: (duct, tubelike passage) A narrow, tubular channel.

Cancellous bone: Inner spongy bone (also referred to as trabecular bone).

Caries: Decay of bone, especially teeth; the common dental term is *cavity*.

Cariogenic: Processes conducive to the formation of carious lesions.

Carious lesion: A localized area of decay on the tooth; a cavity/diseased area of the tooth.

Carpal: Referring to the bones of the wrist or in reference to the phalanges of the hand (bones of the fingers).

Caudal: Toward the tail (coccyx).

Cavity: A hollow space or depression.

Cementoenamel junction: The point on a tooth where the enamel of the crown and the cementum of the root meet; also referred to as the CEJ.

Cementum: The tissue of the tooth that covers the root and acts as a surface to which ligaments that anchor the tooth in the socket attach.

Cervical: Of or relating to the neck; referring to the seven vertebrae that constitute the neck.

Chatter: Multiple staggered clash marks. Basically, when cutting something, the little "hiccups" in the cut that are sometimes produced.

Clavicle: Collar bone; articulates with the sternum (breastbone) and scapula (shoulder blade).

Cloaca: Hole in a bone for drainage of pus and other fluids related to infection; passage in a bone, leading to a sequestrum and located at an involucrum.

Coccygeal: Of or relating to the vertebrae that make up the tail bone (coccyx), following the lumbar vertebrae of the lower back.

Coccyx: Tail bone; rudimentary vertebra that makes up the base of the spinal column.

Collagen: The primary organic portion of bone, cartilage, tendon, and other tissues (fibrous protein); soft, fibrous connective tissue.

Coronal plane: A vertical plane that passes through the body (or a structure [e.g., skull]) from side to side (i.e., parallel to the coronal suture) and divides the body (or structure) into anterior and posterior portions; lies perpendicular to the median plane.

Coronal suture: A suture following the coronal plane, separating primarily the frontal bone from the left and right parietal bones of the skull.

Cortical bone: A dense outer layer of bone (compact bone).

Commingled: Mixed or mingled together. Osteologically, the mingling of skeletal remains from more than one individual.

Condyle: A rounded, knuckle-like projection often associated with articular eminences/joints (e.g., the lateral and medial condyles of the femur, the left and right condyles of the mandible, and the occipital condyles).

Costoclavicular syndesmosis: The attachment of ligament to bone where the first rib articulates to the clavicle.

Cranial: Referring to the skull.

Craniometric: Measurements involving the bones of the skull.

Cricoid: Cartilage associated with the trachea.

Crowding: The malpositioning of teeth resulting in a crowded or bunched appearance.

Cranium: All of the bones of the head, with the exception of the mandible.

Cremation: The process of burning/incinerating bodies, leaving behind burned skeletal remains, ash, and associated debris.

Crest: A raised linear structure that surmounts the surface of a bone or forms its border and is typically more prominent than a ridge (e.g., the iliac crest of the ilium, the supinator crest of the ulna, and the intertrochanteric crest of the femur).

Cribra orbitalia: A localized condition/pathological lesion within the roofs of the orbits; typically occurs in younger individuals. The condition has pitted and porous appearance and is often associated with iron-deficiency anemia.

Dentin: The main, calcareous part of a tooth, beneath the enamel and surrounding the pulp chamber and root canals.

Diaphysis: Shaft (main portion) of a long bone.

Diffuse idiopathic skeletal hyperostosis (DISH): An arthritic condition characterized by abundant (proliferative) bone formation, found occurring at the vertebral column; typically occurs in older individuals. Aggressive ossification of soft tissue, specifically most often involving the ligaments that run alongside and parallel with the vertebral column, producing a dripping-wax appearance.

Disarticulation: The separation of bones from the joints; no longer in an anatomical position.

Distal (body): Away from the trunk; opposite of *proximal*.

Distal (teeth): Away from the median plane of the dental arcade; opposite of *mesial*.

Dorsal: Pertaining to the back (i.e., posterior surface) of the hand (opposite of *palmar*) or the superior surface of the foot (opposite of *plantar*).

Dorsal pubic pitting: Scars/pits/depressions left on the pelvis (dorsal surface of the pubic symphysis) as a result of the process of giving birth ("trauma of parturition").

Eburnation: Bone-to-bone contact resulting in a polished appearance, occurring at joint surfaces where the cartilage has been eroded; diagnostic trait of arthritis.

Ectocranial: Of or relating to the outside of the skull.

Eminence: A variably swollen, projecting area of the bone (e.g., the parietal eminence, the canine eminence of the maxilla, and the iliopubic eminence).

Enamel hypoplasias: Sometimes referred to as linear enamel hypoplasias, enamel hypoplasias are permanent lines or pits on the enamel of teeth that record disruptions in growth, typically as a result of poor nutrition/poor health/disease (systemic growth disruptions in childhood).

Endocranial: Of or relating to the inside of the skull.

Enthesophyte: Bony outgrowths or spurs located at the attachment sites of ligaments or tendons; may occur in degenerative diseases or DISH. Common locations include ischial tuberosity, trochanters, calcaneus, olecranon process of the ulna, and the patella (knee cap).

Enthesis (*pl.* entheses): The point where a tendon inserts into a bone (attaches and moves).

Enthesophytic growth: The growth of enthesophytes, or bony spurs.

Epicondyle: A rounded protuberance located near a condyle, usually serving as an area of attachment for ligaments or tendons.

Epigenetics: Nonmetrical traits, skeletal anomalies/characteristics not normally recorded metrically; recorded as present or absent or (occasionally) by degree of formation.

Epiphysis: The end of a long bone that develops separately from the main portion of the bone. Over time, cartilage ossifies, and the two separated portions of the bone are united.

Exostosis (*pl.* exostoses): Tumorous new bone growth on the surface of a bone. Although sometimes painful, exostoses are rarely life threatening.

External: Toward the outside; opposite of *internal*.

Extremity (*pl.* extremities): Hands, feet, arms, and legs.

Facial skeleton: The skeleton of the face, which is composed of two single bones (the vomer and the mandible) and six paired bones (the zygomatic bones, maxillae, nasal bones, lacrimal bones, palatine bones, and inferior nasal conchae).

Femur (*pl.* femora): The thigh bone; articulates with the innominates (proximally) and with the tibia, fibula, and patella (distally).

Fenestra: A windowlike opening; not present in the human skeleton, but most mammals develop anterior palatine fenestrae.

Fibrocartilage: Cartilage in which the matrix, except immediately around the cells, is largely composed of fibers like those of ordinary connective tissue.

Fibula (*pl.* fibulae): The lateral/outer bone of the lower leg, lateral to the tibia.

Foramen: A circular to ovoid hole or opening through a bone.

Fossa: A general term for a hollowed-out area.

Fovea: A small pit.

Frankfort horizontal plane: A horizontal plane along which the anthropometric landmarks called the porion (i.e., the midpoint of the superior margin of the external auditory meatus) and the orbitale (i.e., the inferiormost point on the inferior margin of the orbit) are positioned; provides a standard orientation of the skull for measuring, describing, and illustrating it.

Frontal plane: See *Coronal plane*.

Gastrocnemius: The extensor muscle of the calf used in standing, running, jumping, and walking.

Gingival: Of or relating to the gums.

Glabella: The anteriormost region (not a point) of the frontal bone above the frontonasal suture and between the superciliary arches. This region generally protrudes anteriorly, but in certain skulls, it may be flat or even depressed. When it is not protrusive, the glabella may be identified by a change in the direction of the frontal bone.

Gladiolus: The body of the sternum.

Greater sciatic notch: Located on the innominate; nerves and vessels travel through this notch. This feature is often examined when attempting to determine the sex of an individual: a wide notch is a female indicator, and a narrow notch is a male indicator.

"Green" bone: Bone that still contains significant collagen/organic material.

Hiatus: A gap or gash-like opening.

Horizontal plane: A horizontal plane that passes through the body (or structure) at right angles to the median and coronal planes, dividing it into superior and inferior portions and creating a cross section of the body (or structure).

Humerus (*pl.* humeri): Upper arm; articulates with the scapula (superiorly) and with the radius and ulna (distally).

Hypercementosis: Thickening of the roots of a tooth to maintain the tooth's position in the jaw; often a response of such conditions as periodontal disease, abscessing, or caries.

Hyperparathyroidism: An elevation of calcium levels (a liberation of calcium) characterized by increasing osteoporosis. Particularly affects the phalanges, alveoli, and cranial vault. Vertebrae may become compressed. The skeleton can become increasingly demineralized because of the osteoclastic activity.

Hypertrophy: Overdevelopment.

Hypocalcification: Deficient or decreased calcification of bone or teeth.

Iliocostal: Of or relating to the muscles that run between the ilium (superior portion of the innominate) and the ribs.

Iliopubic: The location on the innominate where the ilium and the pubis meet.

Inferior: Directional term typically used in reference to bones of the axial skeleton; moving toward the feet; opposite of *superior*.

Inhumation: Burial; placement of remains/a body/a corpse in a grave.

Innominate: The hip bone; made up of three primary areas: the ilium (superior), ischium (inferior/posterior), and pubis (anterior/inferior).

Internal: Toward the inside; opposite of *external*.

Interproximal: Situated between adjoining surfaces.

Interosseous: A space or area between bones.

Involucrum (*pl.* involucra): Hard, sclerotic, heavily vascularized, thickened bone produced by the periosteum in response to infection.

Ischiopubic ramus: The location on the innominate where the pubis and ischium join.

Jugular process: The portion of the occipital bone that forms the posterior aspect of the jugular foramen.

Kyphosis: Abnormal convex/outward curvature of the spine, creating a hunched state.

Labial: Toward the lips; opposite of *lingual*.

Lambda: The juncture in the medial sagittal plane of the lambdoid and sagittal sutures.

Lambdoidal suture: The suture primarily joining the left and right parietal bones of the skull to the occipital bone.

Lateral: Away from the median plane; opposite of *medial*.

Ligamentum flavum: A ligament of the spine that connects the vertebrae on the posterior aspect.

Lingual: Toward the tongue; opposite of *buccal* and *labial*.

Lumbar: Of or relating to the vertebrae that make up the lower back (after the thoracic vertebrae and before the sacral vertebrae).

Lunate: Carpal bone, bone of the wrist (one of eight bones that make up the wrist).

Malleolus: A rounded projection. The only examples are the medial malleolus of the tibia and the lateral malleolus of the fibula.

Mandible: Lower jaw.

Masticatory: Referring to the elements involved in chewing.

Mastoid process: A protuberance located at the posterior portion of the temporal bone, behind the ear.

Maxilla (*pl.* maxillae): The upper jaw; one of the facial bones of the skull.

Meatus: A passage or opening, especially the external opening of a duct or canal.

Medial: Toward the median plane; opposite of *lateral*.

Medial malleolus: Inferior projection of the tibia.

Median plane: A vertical plane that passes through the midline of the body, parallel to the sagittal suture, from front to back and divides it into symmetrical left and right halves. It lies perpendicular to the coronal plane.

Medullary cavity: The cavity in long bones that contains the marrow.

Mental eminence: Chin. See *Mentum*.

Mental symphysis: The joint where the left and right halves of the mandible meet at the chin; fuses early in life.

Mentum: The protruding, anteriormost portion of the mandible.

Mesial (teeth): Toward the median plane of the dental arcade; opposite of *distal*.

Midsagittal plane: See *Median plane*.

Myositis ossificans traumatica: Formation of bone within a muscle due to some physically traumatic event, such as a muscle tear.

Nuchal crest: The crest on the posterior aspect of the occipital bone; an attachment site for the muscles of the neck.

Primary: A term used to describe a burial event in which the fully articulated corpse of an individual is initially and directly inhumed or cremated/partially cremated. Alternatively, in this body of work, a primary individual represents the main individual for which the burial or cremation event was conducted. Primary individuals may be associated with any burial type or treatment.

Occiput: The back of the head; not to be confused with the occipital, which is a specific bone that contributes to the makeup of the back of the skull.

Occlusal (teeth): Toward the chewing surface of a tooth; opposite of *apical*.

Odontoid process: The tooth-like projection on the superior aspect of the second cervical vertebra that articulates with the first cervical vertebra.

Olecranon: The hook-like projection on the proximal end of the ulna that composes part of the elbow.

Os coxae: See *Innominate*.

Ossification: The process of turning into bone.

Osteitis: Inflammation of bone that can result from various insults to the skeleton.

Osteoarthritis: A condition that develops as a result of interruption of or interference with normal joint function and stability, brought about primarily by injury to the joint cartilage and the bone beneath the cartilage and typically occurring in less stable joints, such as the knee. Cartilage is destroyed quicker than it can be repaired. Sclerosis of the injured area as well as the development of bony spicules or spurs (osteophytes); continued damage can result in polishing of the bone (eburnation) due to bone-on-bone contact.

Osteoarthritic: Of or relating to osteoarthritis.

Osteochondritis dissecans: Separation (can be complete or partial) of a piece of bone and cartilage at a joint (often the knee). It is rare and occurs more often in males.

Osteomalacia: In adults, typically a result of vitamin D deficiency or lack of exposure to sunlight whereby bones become weakened because of a lack of calcium; analogous to rickets in children.

Osteometric: Measurements involving the bones of the skeleton.

Osteomyelitis: Infection of bone (and bone marrow), typically bacterial in nature; can cause reduced blood flow to the affected area.

Osteopenia: Generalized reduction in bone-mineral density; can result from any number of factors or can simply be a natural state of lower bone-mineral density for an individual. More common in women than men. Osteoporosis is a type of osteopenia.

Osteophyte: Bony spur or spicule (outgrowth).

Osteophytosis: Development of osteophytes.

Osteoporosis: A systematic (rather than localized) increase in soft tissue at the expense of mineralized tissue; general porosity of the postcranial axial skeleton wherein bones become porous and brittle because of a loss of calcium and other mineral components. More common in older individuals, especially women.

Overjet: Horizontal projection of the upper teeth over the lower.

Palatal: Referring to the superior surface of the mouth, which involves both the maxillae and palatine bones.

Paleoparasitology: The study of parasites in historical-period or prehistoric organic materials, such as plant material and fecal matter.

Paleopathology: The study of ancient diseases.

Palmar: The anterior surface or palm of the hand; opposite of *dorsal*.

Paramasticatory: Relating to use of the teeth as tools.

Parous: Having given birth to one or more viable children.

Pars interarticularis: The isthmus on a vertebra that separates the superior articular facet from the inferior articular facet.

Pars lateralis (*pl.* partes laterales): Portions of the occipital that compose part of the cranial base as well as the left and right sides of the foramen magnum; fused to the pars squama and the pars basilaris; also referred to as the lateral portions.

Pars squama: In the occipital, it forms the largest portion of the bone associated with the posterior portion of the vault. In the temporal, it forms the thin, flat, bladelike superior portion of the bone and is also associated with the side of the vault.

Parturition scars: See *Dorsal pubic pitting*.

Pathognomonic: Of or relating to (characteristic or symptomatic) of a particular disease or condition.

Pectoral girdle: The incomplete ring of bone, composed of the scapulae and the clavicles, that provides for the attachment of an upper limb to the thorax.

Pedal: Referring to the foot/feet.

Pedal symphalangism: Fusion of phalanges of the feet, often the middle/intermediate and distal.

Pelvis: The bones of the hip and buttocks area (left and right sides together).

Pelvic girdle (pelvis): The bowl-shaped ring of bone formed by the two os coxae (laterally) and the sacrum and coccyx (posteriorly) that supports the trunk of the body and transmits the weight of the upper body to the legs.

"Pencil-in-cup" deformity: The deformity, associated with psoriatic arthritis, that occurs when the distal head of a phalanx becomes pointed and the adjacent joint surface becomes cuplike because of erosions.

Perimortem: At or around the time of death.

Periodontal disease: Disease affecting the gums and bone surrounding the teeth.

Periosteal: Of or relating to the periosteum.

Periosteum: Highly vascularized connective tissue on the exterior of a bone that covers all but the joint surfaces. The periosteum produces new bone, serves as an attachment tissue for ligaments and tendons, is innervated, and provides nutrients to the bone.

Periostitis: Inflammation of the periosteum. The reactive, unhealed bone has a more porous, lamellar appearance. Healed periosteal lesions are denser, less porous, and more sclerotic (i.e., thicker and denser).

Petrous portions: Dense, relatively pyramidal bone structures of the temporal bones that form part of the cranial base and house the osseous and nonosseous structures related to hearing.

Phalanx (*pl.* phalanges): Bone of the finger or toe.

Plantar: The inferior surface or sole of the foot; opposite of *dorsal*.

Plaque: New bone formation on the cortical bone at/around areas of inflammation of the periosteum.

Pleura: The membranous covering of the lungs.

Pleurisy: Inflammation of the pleura.

Poirier's facet: Extension of the articular surface of the femoral head onto the anterior femoral neck; often associated with extreme flexion and abduction of the legs in which the femoral neck comes into contact with the rim of the acetabulum. It has been suggested that habitual horseback riding is an activity that might produce these facets.

Porotic hyperostosis: Condition of iron deficiency resulting in both a thickening of cortical bone in the cranium and the development of cranial-vault lesions with an appearance comparable to pinholes. Typically, these lesions are located on the frontal and parietal bones, although they can occur (rarely) on the occipital.

Postcranial: Referring to part of the skeleton other than the skull.

Posterior: Toward the back; opposite of *anterior*.

Postmortem: After death.

Preauricular sulcus: A canal, varying in size, located on the innominate, inferior to the auricular surface. The presence or absence of this sulcus is often used as an indicator of sex: presence can be an indicator of female sex, and absence can be an indicator of male sex.

Process: General term for a projection (e.g., the anterior clinoid process of the sphenoid, the frontal process of the maxilla, and the coracoid process of the scapula).

Prominence: Another general term for a projection (e.g., the styloid prominence at the base of the styloid process of the temporal bone and the mental prominence of the mandible).

Promontory: Usually refers to a smooth elevation (e.g., the promontory of the sacrum).

Pronation: Medial rotation of the forearm, causing the palm of the hand to face downward or toward the back; opposite of *supination*.

Prone: Facing downward with the back upward; opposite of *supine*.

Protuberance: A small to medium-sized elevation that may be rounded and smooth (e.g., the internal occipital protuberance and the "hyperfeminine" expression of the external occipital protuberance) or distended and peaked (e.g., the "hypermasculine" expression of the external occipital protuberance).

Proximal: Toward the trunk; opposite of *distal*.

Psoriatic arthritis: The occurrence of arthritis (inflammation at the joints) and psoriasis (inflammation of the skin) in an individual; typically occurs in older individuals (40–50+ years of age).

Pubic symphysis: Immovable/fixed joint where the left and right pubis of the innominates articulate. The appearance of the joint surface is often used as an indicator of age.

Pyogenic: Producing/generating pus.

Radius: The outer/lateral bone of the lower arm, lateral to the ulna.

Reactive arthritis: Formerly known as Reiter's syndrome; a chronic form of arthritis involving inflammation of the joints, eyes, and genital, urinary, or gastrointestinal systems; believed to be a reaction to bacterial infection within the genital, urinary, or gastrointestinal systems. Can result in the inflammation of other organs.

Rickets: A metabolic disease that is typically the result of a vitamin D deficiency or lack of exposure to sunlight, affecting infants and children (osteomalacia in adults). Similar to scurvy, it effects areas of rapid bone growth. Skeletal manifestation can often manifest itself in the bowing of long bones.

Ridge: A flaring, linear elevation that is intermediate in development between a line and a crest and commonly results from the confluence of two adjacent surfaces (e.g., the lateral and medial supracondylar ridges of the humerus, the longitudinal ridge of the ischium, and the vertical ridge of the patella).

Spondyloarthropathy: A family of chronic diseases of the spine (e.g., ankylosing spondylitis).

Sacral: Referring to the vertebrae found at the sacrum; part of the tailbone area; the vertebrae following the lumbar vertebrae of the lower back.

Sacroiliac joint: The joint where the innominate and sacrum articulate.

Sacroiliitis: Inflammation of the sacroiliac joint that can often result in ankylosis of the joint.

Sagittal plane: See *Median plane*.

Sagittal suture: Suture at the skull that separates the left and right parietal bones.

Scalene: Of or relating to the scalenus/scalene muscles, which run along the lateral edges of the vertebrae of the neck and aid in flexure of the spinal column and in respiration.

Scapula (*pl.* scapulae): Shoulder blade; articulates with the clavicle (collarbone) and humerus (upper-arm bone).

Schmorl's node: A herniated nodule of cartilage extruded through a portion of the perimeter of the vertebral body or into the vertebral body's end plate, often near its center.

Sclerotic: A reaction resulting in a thickened, highly vascularized bone.

Semilunar notch: The crescent-shaped structure on the proximal end of the ulna, where the humerus articulates.

Secondary: A term used to describe a burial event in which the remains of an individual are inhumed or cremated in one location, and then, after a culturally determined span of time, recovered for redeposition in another location. Alternatively, in this body of work, a secondary (or additional) individual describes individuals in a burial feature that are represented by fragmentary or highly disturbed remains. These individuals had initial burial events, and the burials were disturbed, fragmented, and scattered by subsequent events. Most are represented by only a few elements, such as teeth, phalanges, or bone fragments.

Septal aperture: A foramen, sometimes large, through the olecranon fossa of the distal humerus.

Sequestrum (*pl.* sequestra): An island of dead cortical bone, often surrounded by thickened, sclerotic, vascularized bone (involucrum).

Seronegative spondyloarthropathies: Collection of erosive conditions, including ankylosing spondylitis, psoriatic arthropathy, and Reiter's disease. These conditions share a suite of clinical traits that includes inflammation of ligamentous insertions (entheses) and vertebral and sacroiliac joints, an association with HLA-B27 (an antigen in the blood) and ongoing infectious disorders, soft-tissue lesions and inflammations, and asymmetric arthritis.

Sexual dimorphism: Physical/size differences between males and females.

Sharp-force trauma: Physical trauma caused to a body part via impact (cutting or stabbing) from a sharp object/instrument, such as a bladed weapon.

Sinus: A cavity or a channel.

Skull: The skeleton of the head, which includes the bones of the braincase and those of the facial skeleton.

Spall: A chip, fragment, or splinter of bone.

Spine: A narrowly elongated projection that is typically broad at its base and blunter than a stylus (e.g., the anterior superior iliac spine, the ischial spine, and the anterior nasal spine of the maxilla).

Spondylolysis: Stress fracture of a vertebra, most often occurring in the lumbar vertebrae but can also occur in the thoracic vertebrae; usually results in the detachment of the superior and inferior portions of the posterior neural arch.

Squatting facets: Facets occurring on the bones of the ankle (talus and distal tibia) resulting from the repeated activity of squatting.

Sternal: Referring to the region of the chest at and around the sternum.

Sternal foramen: A developmental defect of the sternum in which incomplete fusion of the third and fourth sternal bodies produces a small foramen.

Sternum: Breastbone; articulates with the clavicle and ribs.

Subchondral: Beneath the cartilage.

Subpubic angle: The angle created by the joint of the pubic symphysis where the pubes of the right and left innominate meet. It is often used as an indicator of sex: an angle of greater than 90° is indicative of a female, and an angle of less than 90° is indicative of a male.

Sulcus: A trench or channel.

Superior: Toward the head; opposite of *inferior*.

Supination: Lateral rotation of the forearm that causes the palm of the hand to face anteriorly and the ulna and radius to lie parallel to one another; opposite of *pronation*.

Supine: Facing upward with the back down; opposite of *prone*.

Supernumerary: Extra; usually used in reference to teeth.

Supraorbital margins: The upper rim of the orbit (eye socket); often used as an indicator of sex: a narrow, sharp margin is indicative of a female, and a thick, blunt margin is indicative of a male.

Suture: The joining of two or more bones at an immovable articulation/joint.

Synchondrosis: Fixed articulation of two bones rigidly fused by cartilage.

Symphysis: Fibrocartilaginous fusion between two bones (e.g., pubic symphysis or symphysis menti/mandibular symphysis).

Syndesmophytes: Vertical bony growths attached to ligaments and typically occurring at the spine; often associated with such diseases as ankylosing spondylitis; they occur laterally and anteriorly.

Synovial joint: Movable joint.

Talus: The ankle bone that articulates with the tibia and fibula.

Taphonomy: The conditions and processes that affect remains of an individual after death.

Tarsal: Of or relating to the seven bones of the ankle or in reference to the bones of the toes (tarsal phalanges).

Tarsal coalition: A congenital defect in which bones of the feet can form osseous (bony) or nonosseous (soft-tissue) bridges that impend flexibility of the joints of the tarsals and metatarsals; some types of tarsal coalition are asymptomatic, whereas other types can produce flat-footedness and pain.

Temporomandibular fossa: The point of articulation of the mandible to the temporal bone of the cranium; also referred to as the temporomandibular joint or TMJ.

Thyroid (cartilage): The largest of the cartilage that composes the laryngeal skeleton.

Triceps brachii: The extensor muscle found on the posterior aspect of the arm.

Thoracic: Referring to the vertebrae that constitute the back, following the cervical vertebrae of the neck and before the lumbar vertebrae of the lower back.

Tibia (*pl.* tibiae): Shin; medial/inner bone of the lower leg.

Torus: A swollen or bulging projection in the shape of a bar or strut (e.g., a supraorbital torus of the frontal bone, an occipital torus, a mandibular torus, and a palatine torus).

Transverse plane: See *Horizontal plane*.

Trauma: Injury; can be physical or mental in nature.

Trochanter: An expansive roughened area of bone that is much larger than a tuberosity. The sole examples are the greater and lesser trochanters of the femur.

Tubercle: A small, variably rounded, roughened elevation that is smaller than a tuberosity (e.g., the infraglenoid tubercles of the scapula, the dorsal tubercle of the radius, and the pubic tubercle of the pubis).

Tuberosity: A medium-sized, variably rounded, roughened elevation that is often larger than a tubercle (e.g., the tibial tuberosity, the gluteal tuberosity of the femur, and the deltoid tuberosity of the humerus).

Ulna: The inner bone of the lower arm, medial to the radius.

Urethritis: Inflammation of the urethra.

Vertex: The highest point on the skull when the skull is in the Frankfort horizontal position; it may coincide with the apex.

Ventral: Of or relating to the abdominal area of a quadruped; not typically used for humans, but would refer to the anterior.

Ventral arc: A ridge of bone on the anterior surface of the pubis. This morphological characteristic is used as an indicator of sex.

Vertebral: Relating to the vertebral column commonly referred to as the spine.

Vitrified: Glasslike (shiny and nonporous); often a result of heat fusion.

Xiphoid process: One of three parts of the sternum, it is the bladelike inferiormost portion.

Zygomatic bones: Cheek bones, paired bones of the skull.

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