The Mescal Wash Site: A Persistent Place along Cienega Creek, Southeastern Arizona

Archaeological Investigations at the Marsh Station Traffic Interchange and Pantano Railroad Overpass, Interstate 10, Pima County, Arizona

Volume 2: Chronometric, Artifactual, and Ecofactual Analyses

Edited by
Rein Vanderpot and Michael Heilen

Technical Series 96
Statistical Research, Inc.
Tucson, Arizona

The Mescal Wash Site: A Persistent Place along Cienega Creek, Southeastern Arizona

Archaeological Investigations at the Marsh Station Traffic Interchange and Pantano Railroad Overpass, Interstate 10, Pima County, Arizona

Volume 2: Chronometric, Artifactual, and Ecofactual Analyses

Edited by
Rein Vanderpot and Michael Heilen

With contributions by

Karen R. Adams, Lorrie Lincoln-Babb, Amanda Cannon, Christopher P. Garraty, Dawn M. Greenwald, Janet L. Griffitts, John D. Hall, Joseph T. Hefner, Robert A. Heckman, Michael P. Heilen, Mitchell A. Keur, Stacey Lengyel, Justin Lev-Tov, Penny Dufoe Minturn, Katherine D. Rainey, Susan J. Smith, Rein Vanderpot, Bradley J. Vierra, Arthur W. Vokes, and Robert M. Wegener

Technical Series 96
Statistical Research, Inc.
Tucson, Arizona

2017

CONTENTS

List of Figures xi
List of Tables xvii
Abstract xxiii

1. Introduction, *by Rein Vanderpot* 1
- Site Setting 1
- History of Investigations at the Mescal Wash Site 6
- Site Composition and Chronology 7
- Phase 2 Excavation Methods 12
  - Midden Sampling 12
  - Mechanical Stripping 12
  - Feature Excavation 12
    - Structures 12
    - Extramural Features 12
- Feature Types 13
  - Structures 13
    - Pole-and-Brush Structures 13
    - Houses in Pits 13
    - RHS Houses 13
    - Adobe-Walled Structures 15
  - Extramural Features 15
    - Thermal Features 15
      - Basic Roasting Pits 15
      - Rock-Lined Roasting Pits 15
      - Bell-Shaped Roasting Pits 15
      - Hornos 15
      - Fire Pits 15
      - Hearths 16
      - Rock Clusters 16
    - Nonthermal Features 16
      - Pits 16
        - General Pits 16
        - Bell-Shaped Pits 16
        - Caches 16
        - Borrow Pits 16
      - Activity Surface 16
      - Middens and Trash Mounds 16
      - Dog Burial 16
      - Human Burials 16
- Artifacts and Samples 17
- Research Themes and Goals 17
  - Community and Locale: Mescal Wash as a Persistent Place 17
  - Environment and Subsistence 18
    - Economy: Resource Extraction and Technology 18
    - Demography: Population and Sustainability 18
    - The Social and Cultural Landscape 19
- Summary of Volume 2 19

2. Chronology, *by Stacey Lengyel* 21
- Overview of the Regional Cultural Chronology 21
  - The Paleoindian Period 22
  - The Archaic Period 22
  - The Formative Period 23
  - The Protohistoric Period and Spanish Colonial Era 24
- Methods and Data 24
  - AM Dating 25
    - Calendrical Dating 26
    - Contemporaneity Studies 26
  - Radiocarbon Dating 27
  - Stratigraphic Dating 28
  - Ceramics 29
  - Projectile Points 30
- Locus Chronologies 30
  - Locus A 31
    - AM Contemporaneity Study 32
    - Summary 32
  - Locus C 32
    - AM Contemporaneity Study 35
    - Summary 36
  - Locus D 38
    - AM Contemporaneity Study 42
    - Summary 47
- Synthetic Contemporaneity Study 47
- Summary and Discussion 49

3. Ceramic Artifacts, *by Christopher P. Garraty and Robert A. Heckman*............... 53
Research Background and Analytical Context 55
Regional Interaction, Identity, and Exchange 55
Interaction and Cultural Diversity.......55
Pottery Provisioning and Exchange 56
Site Function and Subsistence Practices 58
Methods..58
Data-Recording Procedures 58
Type and Ware Classification (Initial Sort).....................................59
Painted Wares................................59
Unpainted Wares............................62
Inferring Vessel Form (Expanded Attribute Analysis)............................63
Inferring Vessel Modification 64
Chronological Analyses 64
Quantifying Data 66
Ceramics from Burial Features 67
Site-Wide Results and Patterns 67
Ceramic Artifacts.................................67
Depositional Contexts and Artifact Size 68
Vessel Distributions.........................68
Small-Sherd Distributions.................69
Summary and Interpretation 69
Wares and Type Distributions..................70
Painted Wares................................70
Painted-Ware Distributions among Loci............................78
Unpainted Wares............................80
Unpainted-Ware Distributions among the Loci........................83
Vessel Forms and Functions....................84
General Form Classes 84
Functional Classes and Feature Activities...............................86
Detailed Form-Class Assessments 86
Loci Comparisons 88
Functional-Class Distributions among Ware and Type Categories 91
Size-Class Distributions among Ware and Type Categories..........92
Modified Sherds 94
Individual Locus Results 94
Locus A...94
Painted Wares................................97
Unpainted Wares............................97
Form and Functional Classes............98
Feature Ceramics 98
Ceramic Distribution among Feature Types..........................98
Ceramic Distribution among Individual Features and Feature Types........................103
Modified Sherds 103
Locus B 107
Locus C 107
Painted Wares..............................107
Unpainted Wares...........................111
Form and Functional Classes...........112
Feature Ceramics 112
Ceramic Distribution among Feature Types........................112
Ceramic Distribution among Individual Features and Feature Types........................116
Modified Sherds 121
Locus D...123
Painted Wares..............................123
Unpainted Wares...........................130
Form and Functional Classes...........131
Feature Ceramics 136
Ceramic Distribution among Feature Types........................136
Ceramic Distribution among Individual Features and Feature Types........................138
Early Formative Period 138
Middle Formative A Period...........................138
Middle Formative B Period...........................146
Middle Formative/Late Formative A Period 146
Late Formative B Period......146
Modified Sherds 147
The Principal Research Themes: Detailed Analyses 147
Regional Interaction and Exchange 147
Painted Pottery and Interaction Spheres in the Middle and Late Formative Periods 149
Middle Formative Period 149
Late Formative Period................151
Cultural Affiliation and Pottery Consumption at the Mescal Wash Site ..151
Middle Formative A Period.........152
Middle Formative B Period.........152
Late Formative B Period.............159
A Refined Chronology of Middle Formative Period Pottery Use 159
Site-Wide Changes in Pottery Use 162
The Contemporaneity Groups..........................162

Painted and Unpainted Pottery 163
Changes in Painted-Pottery Use 164
Changes in Unpainted-Pottery Use 166
Changes in Pottery Use in Loci C and D 167
Locus C 167
Locus D 170
Discussion: Interaction, Exchange, and Social Transformation 174
Site Function and Activities: A Diachronic Perspective 174
Site-Wide Changes in Vessel Morphology 175
Middle Formative Period 175
Changes in General Vessel-Form Classes 175
Changes in Vessel Size 177
Late Formative B Period 177
Changes in Vessel Form and Decoration 177
Changes in Vessel Size 179
Intralocus and Interlocus Comparisons of Vessel Forms 179
Changes in Pottery Form in Loci C and D 180
Locus C 180
Locus D 180
Interlocus Comparisons: The Middle Formative B Period 181
Discussion: Vessel Morphology, Decoration, and Social Change 182
Summary and Conclusion 184
Summary of Results 184
Community History and Social Change in Mescal Wash 184
Hypothesis 1: The Diverse Painted Pottery Indicates the Migration of Groups from Different Areas and Cultural Traditions in the Southern Deserts 186
Hypothesis 2: The Diverse Painted Pottery Indicates Extensive Exchange Relationships with Populations in Various Culture Areas 187
Hypothesis 3: The Diverse Painted Pottery Indicates Differences in Social Identity and Cultural Affiliation among Local Site Inhabitants 188
Final Assessment 189

4. Flaked Stone, *by Michael P. Heilen and John D. Hall* 191
The Multiple Dimensions of Mobility 191
Bifacial Technology and Mobility 192
Explaining Change in Flaked Stone Technology 193
Provisioning Strategies, Flaked Stone Technology, and Mobility 193
Controlling for Time at Mescal Wash 195
Formation Processes at Mescal Wash 196
The Flaked Stone Artifact Sample 197
The Analyzed Sample 201
Spatial Distribution of the Analyzed Sample 201
Methods of Identification and Analysis 201
Recorded Flake Attributes 201
Flaking Debris 201
Recorded Tool Attributes 203
Material Types 203
Estimating Tool and Flake Counts from Fragmentary Artifacts 206
Estimating Tool Counts 206
Estimating Flake Counts 207
Technological Change through Time 207
Cores 207
Hammerstones and Core/Hammerstones 210
Flakes 211
Cortex 213
Discovery Context 214
Bifacial vs. Core-Reduction Technology at Mescal Wash 216
Core Reduction and Disk Core Reduction 218
Platform Preparation and Technological Change 218
Flake Fragmentation 220
Flake Size 221
Special Flake Attributes 224
Used Flakes 224
Retouched Flakes 227
Unifaces 227
Drills 229
Projectile Points 229
Projectile Point Styles 229
Late Archaic Point Styles 235
Formative Period Point Styles 237
Other Point Styles 237
Estimating Numbers of Once-Complete Projectile Points 237
Discovery Context of Points, According to Style 238
Discovery Context of Late Archaic Points 241
Projectile Point Size 242
Bifaces 243

Other Tool Types 245
Choppers....................................245
Scraper 245
Denticulate 247
Pièces Esquillées 247
Raw-Material Preference 247
Temporal Variation in the Use of Whetstone and Sonoita Cherts............249
Core vs. Biface Technologies Revisited 250
Surovell's Mobility Index (M)..............250
Surovell's Core-Reduction Index 253
Reconciling the Differences..................254
Occupation Duration and Projectile Point Discard Rates......................................254
Contemporaneity Groups...........................255
Discussion and Conclusions.......................258
Summary 262

5. Ground Stone, *by Dawn M. Greenwald and Bradley J. Vierra* 263

Methods...264
Morphological Type 264
Artifact Shape and Mano Profile 264
Use Wear 264
Artifact Condition and Dimensions 264
Material Type....................................264
Grinding-Surface Texture 265
Production Investment and Techniques....265
Multiple Functions and Surface Adhesions 265
The Collection..265
Materials...265
Manos 265
Hand Stones 272
Metates...274
Grinding Slabs 278
Mortars and Pestles 278
Palettes...278
Polishing Stones 282
Tabular Tools 282
Censers...289
Other Bowls/Vessels...........................297
Reamers..297
Ornaments..297
Other Artifacts 301
Minerals 306
Ground Stone in Mortuary Features........306
Addressing the Research Issues 309
Mescal Wash as a Persistent Place..........309
Subsistence 314
Manos and Metates 314
Tabular Knives 315
Mortars and Pestles 316
Activities and Activity Organization 316
Cultural Affiliation/Interaction and Exchange 317
Conclusions 318

6. Shell Artifacts, *by Amanda Cannon, Christopher P. Garraty, and Arthur W. Vokes*.....................................321

Analysis Methods 321
Genera and Species 323
The Collection..323
Finished Artifacts 323
Beads 326
Pendants 329
Perforated Whole-Shell Pendants 329
Needles..................................329
Tinklers..................................329
Cut Pendants 331
Geometric-Shaped Pendants 332
Zoomorphic Pendants 332
Bracelets 334
Perforated Shells..........................336
Ring/Pendants 336
Manufacturing Evidence 336
Artifacts in Process 336
Beads in Process 336
Ornaments in Process 337
Bracelets in Process...................337
Reworked Bracelets...................337
Manufacturing Debris 337
Fragmentary Material and Whole Valves 338
Worked Fragments 338
Unworked Fragments and Whole Valves.....................................338
Burned Shell Artifacts 339
Comparisons among Loci 340
Locus A...340
Locus C 340
Locus D...341
Locus F 341
Use of Shell through Time 341
Early Formative Period 341
Middle Formative A Period...................342
Transitional Middle Formative A/B Period 344
Middle Formative B Period...................344
Indeterminate Middle Formative Period Specimens 346
Late Formative B Period 346
Contemporaneity Studies 347
Locus C AM Contemporaneity Groups....................................347
Locus D AM Contemporaneity Groups....................................348
Sitewide AM Contemporaneity Groups....................................348

Discussion and Conclusions 350

7. Bone Artifacts, *by Janet L. Griffitts* 353
- Methods 353
  - Use-Wear Analysis 354
    - Experimentally Produced Use-Wear Patterns 354
    - Use Wear Formed by Contact with Soft Materials 354
    - Use Wear Formed by Contact with Silica Rich Plants 354
    - Use Wear Formed by Pressure Flaking 355
    - Use Wear Formed by Wood Working 355
    - Effects of Burning on Microwear 355
- Analysis Results 355
  - Taxa and Elements Represented 355
  - Proportion of Burned Bone 356
  - Types of Bone Artifacts 356
    - Nonutilitarian Bone 356
    - Utilitarian Bone 360
    - Awls and Other Pointed Tools 363
  - Artifact Types and Frequencies over Time 363
    - Archaic Period 363
    - Early/Middle Formative 363
    - Middle Formative 363
    - Middle Formative A 365
    - Middle Formative B 365
    - Late Formative B 366
    - Undated/Mixed Contexts 366
- Bone Artifacts from Mortuary Features 366
- Comparisons with Other Sites 367
- Summary and Conclusions: Addressing the Research Themes 370
  - Time and Cultural Affiliation 370
  - Ritual or Symbolic Behavior 370
  - Raw Material Use 370
  - Tool Use, Site Function, and Craft Production 370

8. Faunal Bone, *by Justin Lev-Tov and Robert Wegener* 373
- Native Fauna 373
- Research Questions and Chapter Organization 374
- The Collection 375
- Analytical Approach 385
  - Analysis Methodology 386
  - Sample Taphonomy 387
    - Effects of Recovery Methods on the Faunal Collection 387
    - Intramural vs. Extramural Features and Bone Fragmentation 390
  - Dietary Change and Continuity through Time 393
    - Late Archaic 393
    - Early Formative and Early/Middle Formative 393
    - Middle Formative 395
    - Middle Formative A 397
    - Middle Formative B 399
    - Late Formative 399
    - Overview: Dietary Variation through Time 402
    - Evaluation of the Large-Game Index 403
    - Evaluation of the Lagomorph Index . 404
  - Intrasite Temporal Analysis of Diet 404
    - Comparisons of Contemporaneity Groups in Locus C 405
    - Comparisons of Contemporaneity Groups in Locus D 405
    - Comparison of Synthetic Groups (Loci C and D) 409
    - Summary of Feature Group Comparisons 412
  - Intersite Comparison and Game Species Depression 414
    - Hohokam Comparison 414
    - Discussion and Comparison 416
- Seasonality 420
- Conclusions 421

9. Plant Remains, *by Katharine D. Rainey and Karen R. Adams* 423
- The Sample 423
- Methods 429
  - Flotation Samples 430
    - Wood Charcoal 430
    - Reproductive Parts 430
    - Agavaceae 430
    - Ubiquity Calculation 430
    - Diversity Calculation 431
  - Macrobotanical Specimens 431
- Modern Plant Study 432
- Results 434
  - Paleobotanical Inventory 434
    - Reproductive Parts 434
    - Wood and Other Nonreproductive Parts 438
- Interpreting the Plant Record 439
  - Question 1: Wild vs. Cultivated 439
    - Domesticates or Likely Managed Plants 439
    - Wild-Plant Resources: Reproductive Parts 439
      - Change in Diet through Time 444
    - Wood Use Change through Time 448

Question 2: Availability of Plants through Time 448
Availability of Wood through Time...448
Sustainability of Food Taxa through Time.......................................451
Landform Use 451
Ancient and Modern Landscape.......452
Question 3: Seasonality........................452
Question 4: Interlocus Variation............452
Interlocus Variation in Reproductive Taxa......................452
Interlocus Variation in Nonreproductive and Wood Taxa 456
Question 5: Differences by Feature Type...457
Nonthermal Features 458
Bell-Shaped Pits 458
Basin-Shaped Pits 458
Cylindrical Pits.........................458
Structure Floors 458
Thermal Features 458
Hornos...................................458
Bell-Shaped Roasting Pits...........459
Basic Roasting Pits....................459
Rock-Lined Roasting Pits 459
Structure Hearths 459
Conclusions 460

10. Pollen Analysis, *by Susan J. Smith*...........461
Methods..461
Analytical Methods............................463
Results..463
Mescal Wash Archaeological Features 463
Cienega Wash Profiles 468
Conclusions 469

11. Mortuary Analysis, *by Christopher P. Garraty, Mitchell A. Keur, Joseph T. Hefner, Lorrie Lincoln-Babb, and Penny Dufoe Minturn*..............................471
Mescal Wash: Background and Research Themes 473
Site Background and Occupation Sequence 473
Research Themes and Contribution of the Mortuary Analysis 473
Burial Context: Form, Location, and Mode of Interment 474
Modes of Interment 474
Cremations 474
Detailed Classification 474
Contexts and Placement of the Cremations 475
Inhumations................................487
Variability in Modes of Interment among the Loci..........................490
Osteological Analyses..............................490
Analytical Methods 490
Demographic Characteristics 492
Paleodemography 492
Evidence of Pathology 497
Skeletal Pathology 497
Dental Pathology 498
Demographic Factors and Mode of Interment 499
Burial Inclusions: Mortuary Offerings and Cremation Urns 500
Distribution of Mortuary Offerings 500
Identifying Mortuary Offerings 500
Distribution of Burial Offerings by Mode of Interment 503
Distribution of Burial Offerings by Age and Sex 503
Distribution of Burial Offerings per Locus 504
Cremation Urns 506
Body Position and Head Orientation of Inhumations 508
Temporal Assessment of Burial Features.......509
Spatial Distribution: Inferring Formal Burial Areas 512
Burial Area 1, Locus D 513
Burial Area 2, Locus D 515
Burial Area 3, Locus D 515
Burial Area 4, Locus C 518
Comparing the Proposed Burial Areas 519
Variability of Mortuary Practices......521
Variability of Painted Pottery 522
Comparison Summary 523
Summary and Conclusion 523

Appendix 1.A. Summary of Excavated Features at the Mescal Wash Site, by Locus..527

Appendix 2.A. Archaeomagnetic Sampling, Analysis, and Dating Procedures.............545

Appendix 2.B. Radiocarbon Analysis 561

Appendix 2.C. Chronological Data for all Mescal Wash Features............................581

Appendix 2.D. Mescal Wash Chronology........611

Appendix 3.A. Ceramics from the Phase 1 Investigations at Mescal Wash 615

Appendix 3.B. Ceramic Artifacts from Burial Features 623

Appendix 3.C. Ceramic-Attribute Recording 639

Appendix 5.A. Summary of Palettes and Palette Blanks Collected from the Mescal Wash Site 649

Appendix 7.A. Summary of Bone Artifacts Collected from the Mescal Wash Site, by Type, Time, and Context 653

Appendix 9.A. Modern Plant Study for the Mescal Wash Site, Arizona 657

Appendix 9.B. Macrobotanical Specimens, by Locus and Feature 693

Appendix 10.A. Pollen Results as Raw Counts 701

References Cited 707

LIST OF FIGURES

Figure 1. Location of the Mescal Wash site along Cienega Creek 2

Figure 2. Map of the Mescal Wash site 3

Figure 3. Aerial overview of the Mescal Wash site with Cienega Creek in the background 4

Figure 4. Map of greater San Pedro Valley in southeastern Arizona, showing Mescal Wash and other major sites in the region................................. 5

Figure 5. Chronological chart for southeastern Arizona 8

Figure 6. Map of Locus A, showing excavated features... 9

Figure 7. Map of Locus C, showing excavated features.. 10

Figure 8. Map of Locus D, showing excavated features.. 11

Figure 9. Locations of all archaeomagnetic poles from Locus A 33

Figure 10. Weighted probability curve of dated features from Locus A 34

Figure 11. Locations of archaeomagnetically c ontemporary sets of features from Locus C.......... 37

Figure 12. Weighted probability curve of dated features from Locus C 38

Figure 13. Locations of the dated archaeomagnetic poles from Locus D 43

Figure 14. Secular variation curve SWCV2000 provides the most recent depiction of geomagnetic secular variation in the U.S. Southwest over the past 2 millennia....................................... 44

Figure 15. Locations of archaeomagnetically contemporary sets of features from Locus D........ 45

Figure 16. Weighted probability curve of dated features from Locus D 46

Figure 17. Locations of all archaeomagnetic poles from Middle Formative period features at the site... 48

Figure 18. Weighted probability curve of all dated features from Mescal Wash 50

Figure 19. Weighted probability curve for each locus, calculated over the total use life of the site. ... 51

Figure 20. Approximate boundaries of the culture areas and painted-pottery traditions discussed in the text 57

Figure 21. Frequencies of painted-ware classes associated with various regional traditions in the southern deserts, excluding split categories and indeterminate types 73

Figure 22. Photograph of Tucson Basin brown ware sherds or vessels from Mescal Wash............ 74

Figure 23. Photographs and illustrations of Rincon Red-on-brown vessels 75

Figure 24. Photograph of Phoenix Basin buff ware sherds or vessels from Mescal Wash..................... 76

Figure 25. Photograph of Dragoon and San Simon brown ware sherds from Mescal Wash 77

Figure 26. Photograph of Roosevelt Red Ware vessels from Mescal Wash 79

Figure 27. Bar graph showing the percentages of painted-ware classes associated with various regional traditions within each locus 80

Figure 28. Plain ware vessels from Mescal Wash....... 82

Figure 29. Late Formative period Type II red ware bowl fragment.. 83

Figure 30. Figurine fragment from Feature 200, Locus A.. 98

Figure 31. Top and side views of clay bell recovered from PD 7403... 112

Figure 32. Bar graph showing the percentages of painted-ware classes for three time periods in Locus D... 130

Figure 33. Figurine fragment of a humanoid head from Feature 5994, Locus D.............................. 131

Figure 34. Line graph showing changes in the percentages of unpainted-ceramic types for five time periods in Locus D.............................. 132

Figure 35. Bar graph showing the painted-ware-class percentages per period. The Middle Fomative B period percentages were averaged for the three loci... 150

Figure 36. Map showing the locations of features assigned to Feature Groups 1–4 in Locus D, Middle Formative A period................................ 153

Figure 37. Bar graph showing the percentages of painted-ware classes per feature group, Middle Formative A period................................ 155

Figure 38. Map showing the locations of features assigned to Feature Groups 1–3 in Loci A, C, and D, Middle Formative B period.................... 156

Figure 39. Bar graph showing the percentages of painted-ware classes per feature group, Middle Formative B period 158

Figure 40. Map showing the locations of features assigned to Feature Groups 1–3 in Locus D, Late Formative B period.................................... 160

Figure 41. Bar graph showing the percentages of painted-ware classes per feature group, Late Formative B period. 161

Figure 42. Line graph showing changes in the percentages of painted and unpainted wares, based on site-wide Contemporaneity Groups 1–6. 163

Figure 43. Bar graph showing the percentages of painted-ware classes for site-wide Contemporaneity Groups 1–6.. 164

Figure 44. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for site-wide Contemporaneity Groups 1–6 165

Figure 45. Bar graph showing the percentages of unpainted types for site-wide Contemporaneity Groups 1–6 166

Figure 46. Line graph showing changes in the percentages of painted and unpainted wares in Contemporaneity Groups 1–4, in Locus C..... 168

Figure 47. Bar graph showing the percentages of painted-ware classes for Contemporaneity Groups 1–4, in Locus C.................................... 168

Figure 48. Bar graph showing the percentages of unpainted types for Contemporaneity Groups 1–4, in Locus C.................................... 169

Figure 49. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for Contemporaneity Groups 1–4, in Locus C 169

Figure 50. Line graph showing changes in the percentages of painted and unpainted wares for Contemporaneity Groups 1–7, in Locus D ... 171

Figure 51. Bar graph showing the percentages of painted-ware classes for Contemporaneity Group 1–7, in Locus D 171

Figure 52. Bar graphs showing the percentages of unpainted types for Contemporaneity Groups 1–7, in Locus D..................................... 172

Figure 53. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for unpainted types in Contemporaneity Groups 1–7, in Locus D...................... 173

Figure 54. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for painted types in Contemporaneity Groups 1–7, in Locus D...................... 173

Figure 55. Bar graph showing the percentages of general form classes per period...................... 176

Figure 56. Line graph showing changes in the percentages of general form classes for site-wide Contemporaneity Groups 1–6.................... 176

Figure 57. Bar graphs showing the percentages of vessel-size classes per period for unpainted processing/serving vessels and storage/cooking vessels 178

Figure 58. Line graph showing changes in the percentages of general form classes for Contemporaneity Groups 2–4, in Locus C 180

Figure 59. Line graph showing changes in the percentages of general form classes in

Contemporaneity Groups 3, 4, 5, and 7, in Locus D 181

Figure 60. Bar graph showing the percentages of functional categories per period in Locus D 182

Figure 61. Bar graph showing the percentages of painted and unpainted bowls and jars per locus for the Middle Formative B period 183

Figure 62. All flaked stone artifacts recovered from Mescal Wash, by period 200

Figure 63. All flaked stone artifacts recovered from Mescal Wash, by locus 200

Figure 64. Percent of flake specimens classed as debris, by period 204

Figure 65. Cores from Mescal Wash 208

Figure 66. Core-reduction index: relationship of cores and core-reduction flakes 210

Figure 67. Hammerstones from Mescal Wash 212

Figure 68. Ratio of flake specimens with mechanical or chemical cortex, by period 214

Figure 69. Percent of all flaked stone artifacts, by period and recovery context 216

Figure 70. Percentage of all bifacial, core, and unifacial retouch flakes, by period 217

Figure 71. The ratio of flake fragments to the minimum number of flakes at Mescal Wash 220

Figure 72. Average size of complete and incomplete flakes, by period 223

Figure 73. Used flakes from Mescal Wash 225

Figure 74. Retouched flakes from Mescal Wash 228

Figure 75. Drills from Mescal Wash 230

Figure 76. Complete or partial San Pedro points from Mescal Wash 232

Figure 77. Rincon and Rillito projectile points from Mescal Wash 233

Figure 78. Hohokam Serrated projectile points from Mescal Wash 234

Figure 79. Miscellaneous arrow point fragments from Mescal Wash 235

Figure 80. Late Archaic–style projectile points from Mescal Wash 236

Figure 81. Miscellaneous Formative period arrow points from Mescal Wash 238

Figure 82. Miscellaneous dart points from Mescal Wash 239

Figure 83. Projectile point tool information equivalents (TIEs) 240

Figure 84. The recovery location of Late Archaic, Middle Formative, and Late Formative projectile point styles 240

Figure 85. The dimensions of San Pedro and Hohokam Serrated projectile points 243

Figure 86. Bifaces from Mescal Wash 244

Figure 87. Utilized flake chopper from Mescal Wash, Feature 3681 246

Figure 88. Flaked cobble denticulate from Mescal Wash, Feature 6129 248

Figure 89. The percentage of projectile point TIEs made on Sonoita or Whetstone chert, by period. 250

Figure 90. Surovell's mobility index (M) and the ratio of bifacial-thinning flakes to core-reduction flakes, by period. 252

Figure 91. Percentage of bifacial- and core-reduction flakes, by contemporaneity group 256

Figure 92. Percentage of plain, ground, and faceted flake platforms, by contemporaneity group. 257

Figure 93. Relationship of Surovell's mobility index (M) with Surovell's core-reduction index (c/bt), by contemporaneity group 259

Figure 94. Manos from the Mescal Wash site 269

Figure 95. Manos from the Mescal Wash site (*continued*) 273

Figure 96. Metates from the Mescal Wash site 275

Figure 97. Metates from the Mescal Wash site (*continued*) 276

Figure 98. Grinding slab from Feature 7692, Subfeature 22 279

Figure 99. Gyratory crusher from Stripping Unit 2493 280

Figure 100. Pestles from the Mescal Wash site 281

Figure 101. Palettes shaped by grinding and decorated through incising 283

Figure 102. Shaped and incised palettes and palette fragments from Feature 7880 284

Figure 103. Palettes shaped by grinding 285

Figure 104. Palette shaped by grinding and pecking 286

Figure 105. Palettes made from naturally shaped cobbles 287

Figure 106. Palette blanks 288

Figure 107. Miniature drilled palette used as a pendant from Feature 8655 289

Figure 108. Censers from Feature 7880................... 290

Figure 109. Censers from Feature 11442................. 291

Figure 110. Censers from the Mescal Wash site, Feature 1545 292

Figure 111. Censers from the Mescal Wash site 293

Figure 112. Censers from the Mescal Wash site (*continued*) 294

Figure 113. Censers from the Mescal Wash site (*continued*) 295

Figure 114. Censers from the Mescal Wash site (*continued*) 296

Figure 115. Stone bowl from Feature 448 298

Figure 116. Reamers and multifunctional reaming tools.. 299

Figure 117. Beads from the Mescal Wash site 300

Figure 118. Ornaments from the Mescal Wash site 301

Figure 119. Ornament blank from Feature 7461 301

Figure 120. Circular mano/shaft straightener collected as PP 796 302

Figure 121. Axes from Mescal Wash 303

Figure 122. Stone ring or donut stone from Feature 3681 304

Figure 123. Pipes or tubes.. 304

Figure 124. Phallus-shaped object from Trench 97 .. 305

Figure 125. Cruciform from Feature 8655............... 305

Figure 126. Pot lids 306

Figure 127. Biconcave object from Feature 5518..... 307

Figure 128. Sample size versus richness for five time periods and undated contexts...................... 310

Figure 129. Shell beads.. 326

Figure 130. Shell ornaments 331

Figure 131. *Glycymeris gigantea* cut shell bird pendants 333

Figure 132. *Glycymeris gigantea* bracelets and ring/pendants.. 335

Figure 133. *Glycymeris gigantea* ornament blank from structure Feature 3869..................... 337

Figure 134. *Hexaplex nigritus* columella from structure Feature 2192............................... 339

Figure 135. Examples of ornaments or possible ornaments.. 360

Figure 136. Examples of awl 364

Figure 137. Proportions of materials contacted by pointed tools... 371

Figure 138. Proximal left humerus of a turkey found in a Middle Formative structure 397

Figure 139. Correspondence between sample sizes and taxonomic richness by period............. 402

Figure 140. Dean’s (2007b) four- and five-category evenness index averages vs. those for Mescal Wash 417

Figure 141. Four-category evenness index values for individual sites from Dean (2007b) vs. Mescal Wash (red squares) 419

Figure 142. Five-category evenness index values for individual sites from Dean (2007b) vs. Mescal Wash 419

Figure 143. Richness for Mescal Wash site reproductive taxa, by time period 449

Figure 144. Evenness for Mescal Wash site reproductive taxa, by time period 449

Figure 145. Richness of Mescal Wash site nonreproductive and wood taxa, by time period.......... 450

Figure 146. Evenness of nonreproductive and wood taxa, by time period 450

Figure 147. Diversity of Mescal Wash site reproductive taxa, by locus.. 455

Figure 148. Evenness of reproductive taxa, by locus 455

Figure 149. Richness of nonreproductive taxa and woods, by locus... 456

Figure 150. Evenness of nonreproductive taxa and woods, by locus 457

Figure 151. Map of Mescal Wash showing the locations of the excavated burial features........... 472

Figure 152. Plan view and cross section of Feature 561, a secondary pit cremation in Locus D.. 478

Figure 153. Plan view and cross section of Feature 320, a secondary pit cremation in Locus C.. 479

Figure 154. Plan view and cross section of Feature 4850, a secondary urn cremation in Locus D.. 481

Figure 155. Plan view and cross section of Feature 6090, a secondary urn cremation in Locus C.. 482

Figure 156. Plan views and cross sections of Features 3704 and 4221, primary cremations in Locus D.. 484

Figure 157. Plan views and cross sections of Features 4069 and 4798, primary cremations in Locus D.. 485

Figure 158. Plan view and cross section of Feature 4794, a secondary pit cremation in Locus D 486

Figure 159. Plan view and cross section of Feature 3604, a secondary pit cremation in Locus D.. 487

Figure 160. Plan view and profile of Feature 6123, a possible informal inhumation in Locus C........ 491

Figure 161. Survivorship curve for the pooled sample.. 495

Figure 162. Mortality-hazard curve for the pooled sample.. 495

Figure 163. Comparative survivorship curves for the Mescal Wash and Libben sites 496

Figure 164. Comparative mortality-hazard curves for the Mescal Wash and Libben sites 497

Figure 165. Survivorship curve for the combined Mescal Wash sample from excavations by Statistical Research, Inc., and EcoPlan Associates, Inc. 498

Figure 166. Plan view and cross section of Feature 4886, an inhumation in Locus C................. 505

Figure 167. Illustration of stone censer recovered from Feature 4069 in Locus D........................... 507

Figure 168. Plan view of Feature 10645, a flexed inhumation in Locus D 512

Figure 169. Map of Burial Area 1 in Locus D.......... 514

Figure 170. Map of Burial Area 2 in Locus D.......... 516

Figure 171. Map of Burial Area 3 in Locus D.......... 517

Figure 172. Map of Burial Area 4 in Locus C 520

LIST OF TABLES

Table 1. Chronology for the Mescal Wash Site............ 7

Table 2. Summary of Features Excavated at the Mescal Wash Site (Both Phases).......................... 14

Table 3. Artifacts and Samples Collected and Analyzed (Phases 1 and 2)................................... 17

Table 4. Archaeomagnetic Dates for Features in Locus A... 31

Table 5. Archaeomagnetic Dates for Features in Locus C... 35

Table 6. Locus C Archaeomagnetic (AM) Groups 36

Table 7. Archaeomagnetic Dates for Features in Locus D... 39

Table 8. Radiocarbon Dates for Features in Locus D... 40

Table 9. Stratigraphic Relationships among Pairs of Locus D Archaeomagnetic-Sampled Features...... 44

Table 10. Locus D Middle Formative Period Archaeomagnetic (AM) Groups 44

Table 11. Synthetic Middle Formative Period Archaeomagnetic (AM) Groups 49

Table 12. Ceramic Artifacts, by Locus....................... 54

Table 13. Summary of Recorded Variables................. 60

Table 14. Painted-Pottery Wares, Types, and Date Ranges... 61

Table 15. Type Definitions for Plain Wares and Red Wares 63

Table 16. Braun Functional Categories...................... 65

Table 17. Ceramic Artifact Types, by Locus.............. 68

Table 18. Ceramic Artifact Types, by Locus.............. 69

Table 19. Painted-Ware and Painted-Ware-Type Counts, by Regional Tradition............................. 71

Table 20. Unpainted-Ware-Type Counts and Percentages, by Locus 81

Table 21. Counts and Percentages of General Form Classes, by Locus.. 85

Table 22. General Form Classes, by Feature Type...... 87

Table 23. Counts and Percentages of General Functional Categories, by Locus 87

Table 24. Counts and Percentages of Size-Class Categories, by Locus... 88

Table 25. Counts and Percentages of Detailed Functional Categories, by Locus 89

Table 26. Counts of General Functional Categories, by Ware and Type Category................................ 90

Table 27. Distribution of Size-Class Categories, by Regional Ware Tradition...................................... 92

Table 28. Modified-Sherd Frequencies, by Locus 94

Table 29. Counts and Percentages of Ceramic Artifacts, Locus A.. 95

Table 30. Counts and Percentages of General Form Classes, Locus A, by Period 99

Table 31. Detailed Functional Categories, Locus A.... 99

Table 32. Summary of Ceramic Artifacts by Feature Type, Locus A 100

Table 33. Contingency Table Showing Observed and Observed-Minus-Expected Percentages of Wares, by Feature Type, Locus A 101

Table 34. Summary of General Form Classes, by Feature Type, Locus A 102

Table 35. Ceramic Artifacts, by Age and Feature, Excluding Features of Indeterminate Age, Locus A 104

Table 36. Painted Wares, by Age and Feature, Locus A 105

Table 37. Form Classes, by Age and Feature, Locus A 106

Table 38. Modified-Sherd Frequencies, by Feature, Locus A 106

Table 39. Counts and Percentages of Ceramic Artifacts, Locus C 108

Table 40. Counts and Percentages of General Form Classes, Locus C 113

Table 41. Detailed Functional Categories, Locus C 114

Table 42. Summary Of Ceramic Artifacts, by Feature Type, Excluding Burials, Locus C 115

Table 43. Contingency Table Showing Observed and Observed-Minus-Expected Percentages of Wares, by Feature Type, Locus C 117

Table 44. General Form Classes, by Feature Type, Locus C 117

Table 45. Ceramic Artifacts by Age and Feature, Excluding Features of Indeterminate Age, Locus C 118

Table 46. Painted Ware, by Age and Feature, Locus C 120

Table 47. Form Classes, by Age and Feature, Locus C 122

Table 48. Modified-Sherd Frequencies, by Age and Feature, Locus C 122

Table 49. Counts and Percentages of Ceramic Artifacts, Locus D 124

Table 50. Counts and Percentages of General Form Classes, Locus D 132

Table 51. Detailed Functional Categories, Locus D 134

Table 52. Summary of Ceramic Artifacts, by Feature Type, Locus D 137

Table 53. Contingency Table Showing Observed and Observed-Minus-Expected Percentages of Wares, by Feature Type, Locus D 137

Table 54. General Form Classes, by Feature Type, Locus D 138

Table 55. Ceramic Artifacts, by Age and Feature, Excluding Features of Indeterminate Age, Locus D 139

Table 56. Painted Wares, by Age and Feature, Excluding Features of Indeterminate Age, Locus D 141

Table 57. Form Classes, by Age and Feature, Excluding Features of Indeterminate Age, Locus D 144

Table 58. Modified-Sherd Frequencies, by Age and Feature, Locus D 148

Table 59. Regional Ware Percentages, by Locus and Component 150

Table 60. Counts and Percentages of Painted Wares Assigned to the Middle Formative A Period, by Feature Group and Structure, Locus D 154

Table 61. Counts and Percentages of Painted Wares, by Structure Group/Locus, and Structures Assigned to the Middle Formative B Period, Loci A, C, and D 157

Table 62. Counts and Percentages of Painted Wares Assigned to the Late Formative B Period, by Structure Groups, Locus D 161

Table 63. Site-Wide Contemporaneity Groups and Inferred Date Ranges 162

Table 64. Contemporaneity Groups and Inferred Date Ranges, Locus C 167

Table 65. Contemporaneity Groups and Inferred Date Ranges, Locus D 170

Table 66. Summary of Major Findings 185

Table 67. Number of Flaked Stone Artifacts Recovered from Mescal Wash 198

Table 68. Analyzed Sample of Flaked Stone Artifacts by Locus 202

Table 69. Sample of Complete and Proximal Flakes from Mescal Wash 202

Table 70. Sample of Flaked Stone Debris from Mescal Wash 203

Table 71. Analyzed Flaked Stone Artifacts by Material Type 205

Table 72. Core Types Identified at Mescal Wash and the Core-Reduction Index (CRF/Core) 209

Table 73. Hammerstones by Period and Extent of Battering 211

Table 74. Cortex Types for Proximal Flakes at Mescal Wash 215

Table 75. Discovery Context of Proximal Flakes from Mescal Wash 215

Table 76. Bifacial vs. Core-Reduction Flakes from Mescal Wash 218

Table 77. Platform Types of Complete Flakes from Mescal Wash 219

Table 78. Flake Types Identified at Mescal Wash 222

Table 79. Average Size (in mm) of Platform-Bearing Flakes from Mescal Wash 223

Table 80. Used Flakes by Use-Wear Type 224

Table 81. Observations on Utilized Edges on 20 Used Flakes (in mm)..................................... 225

Table 82. Retouched Flakes by Reduction Type 227

Table 83. Unifaces by Period and Recovery Context... 228

Table 84. Flaked Stone Drills by Design 229

Table 85. Projectile Point Tool Information Equivalents (TIEs) by Material Type................. 231

Table 86. Dimensions of Select Projectile Point Styles from Mescal Wash................................... 242

Table 87. Bifaces by Blank Type at Mescal Wash 243

Table 88. Miscellaneous Flaked Stone Tool Types from Mescal Wash, by Recovery Context........... 245

Table 89. Surovell's Mobility Index (M) and Core-Reduction Index... 252

Table 90. Flaked Stone Tool Types by Contemporaneity Group 256

Table 91. Bifacial vs. Core-Reduction Index by Contemporaneity Group 257

Table 92. Flake Platform Types by Contemporaneity Group 258

Table 93. Surovell's Mobility Index (M) by Contemporaneity Group 259

Table 94. Ground Stone Material Types 266

Table 95. Artifact Types within the Ground Stone Collection... 267

Table 96. Mano Material Types 268

Table 97. Mano Shape, by Production Investment.... 268

Table 98. Mano Shape, by Surface Texture 270

Table 99. Mano Shape and Ground Surfaces........... 270

Table 100. Mano Shape, by Grinding Intensity, Location, and Extent 271

Table 101. Comparisons among Whole Manos with Trough Wear,Curved Ends, and Multi-directional Grinding... 274

Table 102. Metate Type, by Material Type 277

Table 103. Metate Type, by Production Investment.. 278

Table 104. Censer Data 296

Table 105. Stone-Ornaments Data 300

Table 106. Minerals, by Modification....................... 307

Table 107. Artifacts Recovered from Mortuary Features.. 308

Table 108. Production Investment, by Time Period... 311

Table 109. Wear Intensity, by Time Period............... 312

Table 110. Material Type, by Time Period................ 312

Table 111. Material Grain, by Time Period 312

Table 112. Artifact Type, by Time Period................ 313

Table 113. Ground Stone Type, by Loci C and D Temporal Groups 314

Table 114. Ground Stone Activity Groups, by Time Period.. 315

Table 115. Summary of Shell Species 322

Table 116. Shell Artifact Types................................ 324

Table 117. Distribution of Shell Artifacts at Mescal Wash 325

Table 118. Shell Beads.. 326

Table 119. Shell Artifacts by Feature Type............... 327

Table 120. Shell Artifacts Types by Time Period...... 328

Table 121. Shell Pendants.. 330

Table 122. *Glycymeris gigantea* Bracelet Types....... 335

Table 123. Burned Shell Artifacts from Feature and Nonfeature Contexts 340

Table 124. Distributions of Shell Artifacts Over Time 342

Table 125. Shell Species by Time Period................. 343

Table 126. Comparisons of Shell Artifact Frequencies (MNI) among Feature Groups Based on Spatial Proximity 345

Table 127. Shell Counts (MNI) per AM Contemporaneity Group in Locus C 348

Table 128. Shell Counts (MNI) per AM Contemporaneity Group in Locus D.................. 349

Table 129. Shell Counts (MNI) per Sitewide AM Contemporaneity Group for Middle Formative Period Features 349

Table 130. Bone Artifacts from Mescal Wash, by Type and Time.. 357

Table 131. Nonutilitarian Bone Artifacts and Possible Bone Artifact from the Mescal Wash Site, by Time Period and Context 358

Table 132. Awls, Flakers, Handles, and Fragments from Mescal Wash, by Time Period and Context (not including burials) 361

Table 133. Bone Artifacts from Mortuary Features... 368

Table 134. Tool Uses as Interpreted by Microwear Analysis 372

Table 135. Species List for the Mescal Wash Site (All Periods)... 376

Table 136. Faunal Content of Locus D at the Mescal Wash Site by Time Period 377

Table 137. Faunal Content of Locus A at the Mescal Wash Site by Time Period 382

Table 138. Faunal Content of Locus C at Mescal Wash by Time Period... 382

Table 139. Faunal Content of Loci B, E, and F at the Mescal Wash Site by Time Period 384

Table 140. Effect of Recovery Method on Frequency of Size-Classed Bone Fragments............ 388

Table 141. Percentage of Bones Recovered from Feature Types, by Fragment-Size Class............. 389

Table 142. Amount of Burned Bones by Feature Type 390

Table 143. Comparison of Bone-Fragment Sizes in Locus D Middle Formative A Features 391

Table 144. Comparison of Burning Intensity and Frequency on Bones from Locus D Middle Formative A Features... 391

Table 145. Comparison of Relative Frequencies of Skeletal Regions (all taxa) for Locus D Middle Formative A Features 392

Table 146. Comparison of Taxonomic Content and Frequencies from Locus D Middle Formative A Features 392

Table 147. Species List for Late Archaic Contexts at Mescal Wash 394

Table 148. Species List for Early Formative Contexts at escal Wash 394

Table 149. Species List for Early/Middle Formative Contexts[a] at Mescal Wash 395

Table 150. Species List for Middle Formative Contexts at Mescal Wash 396

Table 151. Species List for Middle Formative A Contexts at Mescal Wash 398

Table 152. Species List for Middle Formative B Contexts at Mescal Wash 400

Table 153. Species List for Middle/Late Formative Contexts[a] at Mescal Wash 400

Table 154. Species List for Late Formative Contexts at Mescal Wash.. 401

Table 155. Artiodactyl and Modified Lagomorph Indexes for Each Period..................................... 403

Table 156. Faunal Content of Locus C Contemporaneous Groups 406

Table 157. Large-Mammal Element Distribution within Locus C Contemporaneous Groups 406

Table 158. Faunal Content in Locus D Contemporaneous Groups 407

Table 159. Large-Mammal Element Distribution within Locus D Contemporaneous Groups 408

Table 160. Comparison of Features 3679 and 11342 at Locus D.. 409

Table 161. Comparison of Features 438 and 7880 at Locus D 410

Table 162. Faunal Content of Synthetic Groups (Loci C and D) 411

Table 163. Large-Mammal Element Distribution in Synthetic Groups (Loci C and D) 412

Table 164. Comparison of Synthetic Features from Group 5 413

Table 165. Comparison of Synthetic Features from Group 6 413

Table 166. Correspondence between Mescal Wash and Hohokam Chronologies 416

Table 167. Simpson's Index Data from Mescal Wash for Dean's Four-Category Index 417

Table 168. Simpson's Index Data from Mescal Wash for Dean's Five-Category Index 418

Table 169. Analyzed Flotation Samples from the Mescal Wash Site, by Locus 424

Table 170. Time Periods Represented by the Flotation Samples 429

Table 171. Feature Types Represented by the Flotation Samples 429

Table 172. Taxa Used in Diversity Testing 431

Table 173. Modern Landscape Study Plants Also Found as Charred Pieces in Flotation Samples and Macrobotanical Specimens, by Landform ... 432

Table 174. Taxon and Common Names of Charred Plant Taxa Identified in This Study..................... 433

Table 175. Charred Reproductive Taxa Present in the Macrobotanical Specimens 434

Table 176. Overall Ubiquity of Plant Taxa from Flotation Sample Contexts.................................. 435

Table 177. Description of Grass Family Grains........ 437

Table 178. Native Grasses Found on the Modern Landscape near the Mescal Wash Site................ 438

Table 179. Nonreproductive and Wood Taxa Present among the Macrobotanical Specimens.. 439

Table 180. Flotation Sample Ubiquity, by Feature Type 440

Table 181. Flotation Sample Ubiquity of Taxa, by Time Period.. 445

Table 182. Potential Habitats of Plants Found in the Archaeobotanical Samples but Not Observed in the Modern Landscape Study Area.. 451

Table 183. Ubiquity of Taxa from the Flotation Samples, by Locus... 453

Table 184. Distribution of Archaeological Pollen Samples, by Locus and Context......................... 462

Table 185. Number of Dated Features at Mescal Wash with Analyzed Pollen Samples................. 462

Table 186. Pollen Types Identified from Archaeological Contexts, Ecological and Cultural Significance, and Sample Ubiquity......................... 464

Table 187. Ubiquity of Pollen Aggregate Taxa from Archaeological Samples............................ 465

Table 188. Cotton Pollen in Mescal Wash Samples.. 465

Table 189. Contextual Patterns from Pit Structures (Excludes Adobe and Pole-and-Brush Structures) and Extramural Bell-Shaped Pits............. 466

Table 190. Summary Pollen Data by Locus from Structure Floor Samples 467

Table 191. Pollen Concentration Data Rounded to Nearest 10 Grains from *Cienega* Profile Samples and Average Concentration from Five Structure Fill Samples................................ 468

Table 192. Summary of Burial Features Excavated in Mescal Wash................................. 474

Table 193. Attributes of Secondary Pit Cremations (n = 21) at Mescal Wash............................ 476

Table 194. Attributes of Secondary Urn Cremations (n = 5) at Mescal Wash.............................. 480

Table 195. Attributes of Primary Cremations (n = 4) at Mescal Wash 483

Table 196. Attributes of Inhumations at Mescal Wash.. 488

Table 197. Ages, Sex, and Recovery Contexts for 48 Individuals Subjected to Osteological Analysis 493

Table 198. Demographic Structure of the Mescal Wash Sample.. 494

Table 199. Frequencies and Ratios of Adult Male, Adult Female, and Juvenile Burials from Mescal Wash 494

Table 200. Parameter Estimates of the Siler Age Model for the Mescal Wash and Libben Sites 497

Table 201. Distribution of Juveniles and Adults,by Inhumation and Cremation 499

Table 202. Mortuary Offerings and Possible Offerings (Excluding Burial Urns) 501

Table 203. Counts and Ratios of Burials with and without Associated Goods, by Mode of Interment 503

Table 204. Counts and Ratios of Burials with and without Associated Goods, by Age Group of Interred Individuals 504

Table 205. Counts and Ratios of Burials with and without Associated Goods, by Sex of the Interred Individuals 505

Table 206. Counts and Ratios of Burials with and without Associated Goods, by Locus 506

Table 207. Body Positions and Head Orientations for 15 Inhumations Excavated at Mescal Wash 508

Table 208. Inferred Temporal Affiliations for 21 Burial Features from Mescal Wash 510

Table 209. Distribution of Modes of Interment among the Four Proposed Burial Areas 521

ABSTRACT

Report Title: The Mescal Wash Site: A Persistent Place along Cienega Creek, Southeastern Arizona; Archaeological Investigations at the Marsh Station Traffic Interchange and Pantano Railroad Overpass, Interstate 10, Pima County, Arizona; Volume 2: Chronometric, Artifactual, and Ecofactual Analyses

Report Date: 2016

Project Sponsor: Arizona Department of Transportation and Federal Highway Administration

Contract Number: ECS Contract No. 00-64 (TRACS No. . H7473 01C)

Permit Numbers: State of Arizona Blanket Antiquities Permit No. 2000-55bl; Arizona State Museum Permit No. 2000-92ps; Burial Memorandum of Agreement No. 00-21; ASM Repository Agreement No. 865; State Highway Right-of-Way Permit No. 78066; Union Pacific Railroad Contract Folder No. 01904-64.

Agencies: Arizona State Land Department, Arizona State Historic Preservation Office, Arizona State Museum, Arizona Department of Transportation, and Federal Highway Administration

Project Title: The Marsh Station Archaeological Project (MSAP)

Archaeological Consultants: Statistical Research, Inc. (SRI), 6099 E. Speedway Blvd., Tucson, AZ 85712; (520) 721-4309

Principal Investigator: Jeffrey H. Altschul, Ph.D. (2000–2005); Stephanie M. Whittlesey, Ph.D. (2006); Rein Vanderpot, M.A. (2007–2016)
Project Director: Rein Vanderpot, M.A. (2000–2006)
Field Director: William L. Deaver, M.A., and Robert Wegener, M.A. (2000–2001)

Project Description: In 2000 and 2001, SRI, completed phased archaeological data recovery at the Mescal Wash site (AZ EE:2:51 [ASM]), located at the Marsh Station Traffic Interchange and Pantano Railroad Overpass, Interstate 10, Pima County, Arizona. Phase 1 fieldwork was conducted between June 19 and July 27, 2000; Phase 2 fieldwork was conducted between January 16 and June 15, 2001. A total of 1,197 field person-days was expended during these periods. This work was conducted in support of the reconstruction of the existing interchange and overpass by the Arizona Department of Transportation. During the investigations, SRI identified 2,314 archaeological features, of which 474 features (not counting intramural subfeatures) were excavated. The excavated features included 97 structures and 377 extramural features (48 of which were burials).

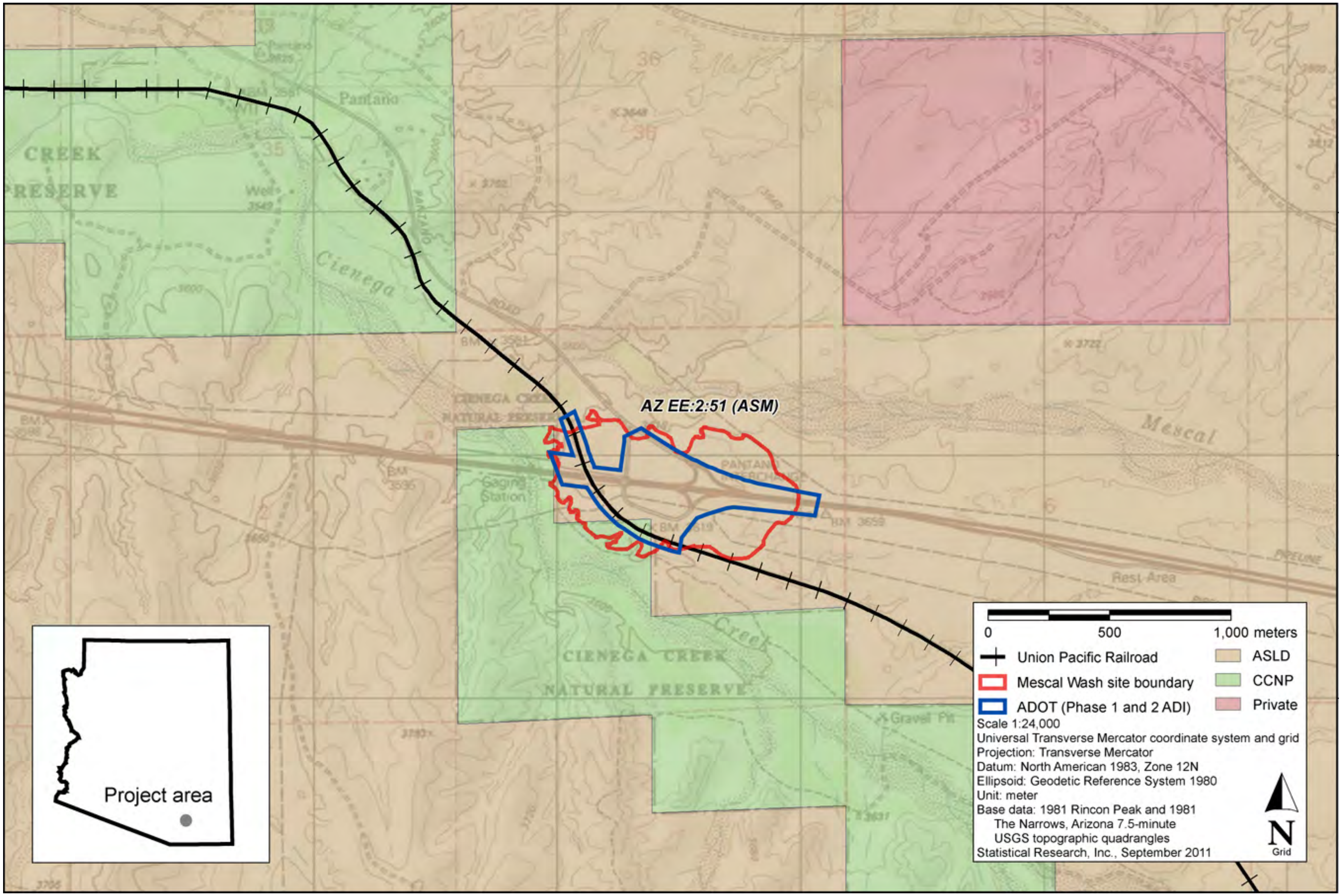
Land Status: Arizona State Land Department, Union Pacific Railroad, Arizona Department of Transportation, and private (including Cienega Creek Natural Preserve [Map 1])

Location: Township 17 South, Range 17 East, Section 1, on the 1981 The Narrows, Arizona, 7.5-minute U.S. Geological Survey topographic quadrangle (Map 1)

NRHP-Eligible Properties: Mescal Wash site (AZ EE:2:51 [ASM]), Criterion d, 1996

Recommendations: SRI recommends that the investigated portions of the Mescal Wash site have been effectively mitigated, and no further research potential exists for the portion of the site within the existing Arizona Department of Transportation right-of-way. Enough of the site remains intact in noninvestigated areas to retain its NRHP eligibility status. Any future ground-disturbing activities within site boundaries outside of the Arizona Department of Transportation right-of-way should be preceded by an appropriate plan of work in consultation with the appropriate agencies and stakeholders.

Curation Facility: Arizona State Museum, University of Arizona, Tucson



Map 1. The Mescal Wash site (AZ EE:2:51 [ASM]) and surrounding area, showing landownership (Arizona State Land Department [ASLD], Cienega Creek Natural Preserve [CCNP], and other, private ownership) and right-of-way areas (Arizona Department of Transportation [ADOT] Area of Direct Impact and Union Pacific Railroad [UPRR]).

CHAPTER 1

Introduction

Rein Vanderpot

This document is the second of three volumes presenting the results of a data recovery program conducted by Statistical Research, Inc. (SRI), at the Mescal Wash site, AZ EE:2:51 (Arizona State Museum [ASM]), in Pima County, southeastern Arizona (Figure 1). The site is located in Section 1, Township 17 South, Range 17 East (The Narrows 7.5-minute U.S. Geological Survey [USGS] quadrangle, 1981), on land administered by the Arizona Department of Transportation (ADOT), the Union Pacific Railroad (UPRR), and the Arizona State Land Department (ASLD). ADOT's proposed reconstruction of the existing Pantano Railroad Overpass and the Marsh Station traffic interchange (TI) at Interstate 10 would impact large portions of the archaeological site. To fulfill its obligations under a variety of state and federal historic preservation laws, ADOT contracted with SRI to mitigate the adverse effects resulting from the construction efforts. SRI conducted phased data recovery in 2000 and 2001 (the Marsh Station Archaeological Project [MSAP]), sponsored by ADOT under ECS Contract No. 00-64 (TRACS No. H2390 01E) and under the terms and conditions of State Highway Right-of-Way (ROW) Permit No. 78066 and State Land Permit No. 2000-92ps.

During Phase 1, SRI identified eight loci (Loci A–H), of which all but Locus H were completely or partially within ADOT's proposed area of direct impact (ADI) (Figure 2). Phase 1 testing included all or portions of six loci (Loci A–F); Loci G and H were mapped but not subjected to testing or surface collecting. Nearly 1,300 m of backhoe trenches and 1,315 m² of stripping units were excavated (Vanderpot and Altschul 2000). Of the 237 archaeological features found in the ADI, 26 features were tested or completely excavated. During Phase 2, the backhoe stripped overburden from large areas in Loci A–D (13,259 m^2, or 3.3 acres) (Vanderpot 2001) (Figure 3). The revised ADI included the southern half of Locus A, most of Locus B, all of Locus C, and most of Locus D but eliminated two tested loci (Loci E and F) (see Figure 2). In this project phase, a total of 2,077 new features were exposed, and 96 structures and 338 extramural features were excavated.

In Volume 1, we presented the locus and feature descriptions, as well as the project background. This volume contains the artifact and other specialized analyses, which, in turn, provide much of the empirical basis for the synthetic studies to be presented in Volume 3. This introductory chapter presents summaries of the Mescal Wash site and its setting, previous investigations, chronology, field methods, and project research themes and goals.

Site Setting

The Mescal Wash site is located on a broad, mesa-like terrace at the confluence of Mescal Wash and Cienega Creek and covers nearly a square kilometer in area (see Figures 2 and 3). The terrace is about 700 m wide and slopes gently to the south, its steep sides dropping 12–15 m to the drainages below. Elevation ranges from 3,590 to 3,650 feet above mean sea level (AMSL). The site is located in an ecological transition zone between the Sonoran Desert and the Chihuahuan grasslands. Cienega Creek flows north through the broad Empire Valley, bordered on the east by the Whetstone Mountains and Mustang Mountains, on the south by the Canelo Hills, and on the west by the Santa Rita and Empire Mountains (Figure 4). Perennial water flows through most of the lower half of the creek, in particular above The Narrows, a bedrock constriction about 5 km south of the site. Along much of its course are large areas of slow-flowing, ponded water. These lushly vegetated, riparian marshlands (or *cienegas*) have given the creek its name. Cienega Creek was not entrenched during

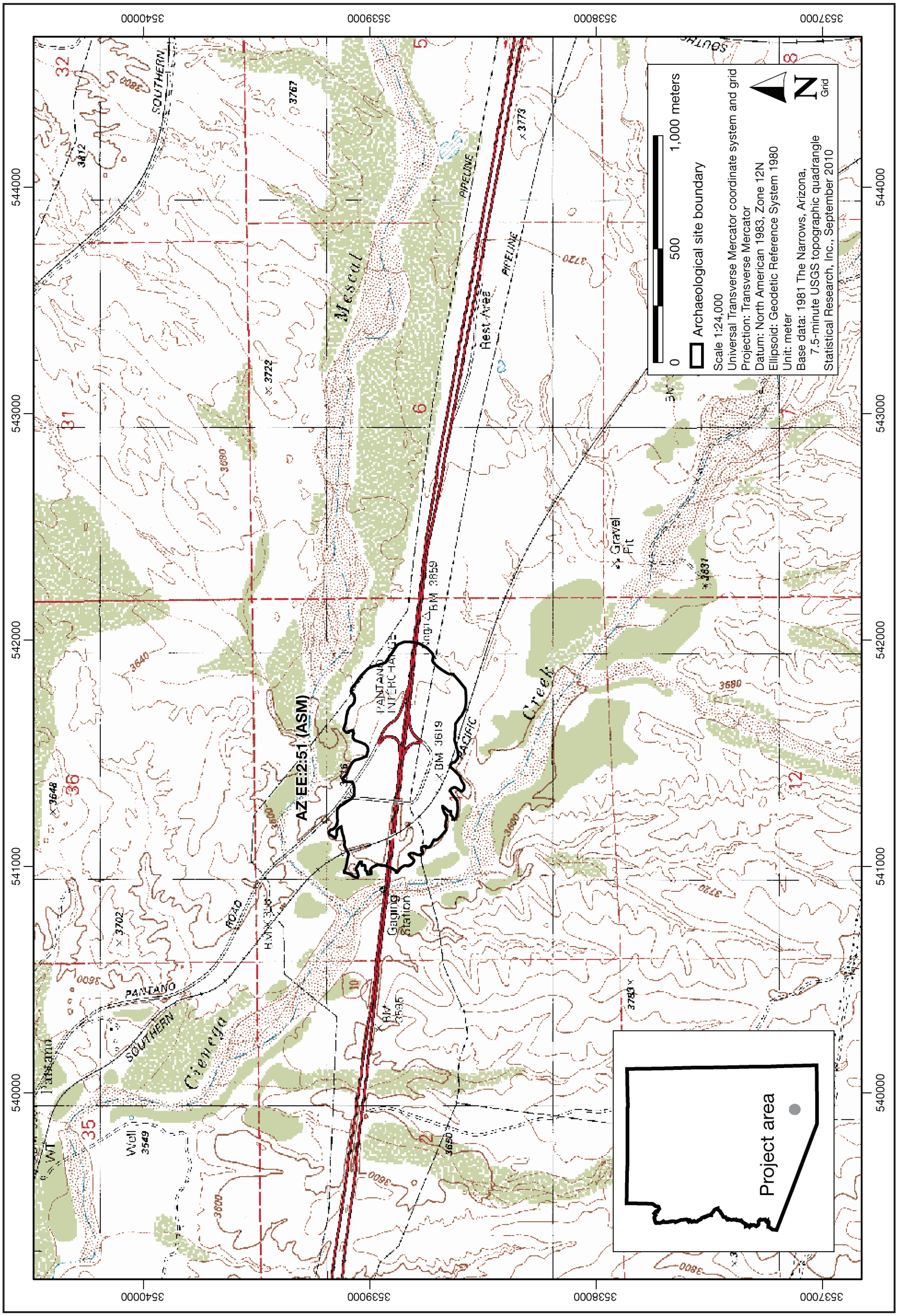


Figure 1. Location of the Mescal Wash site along Cienega Creek.

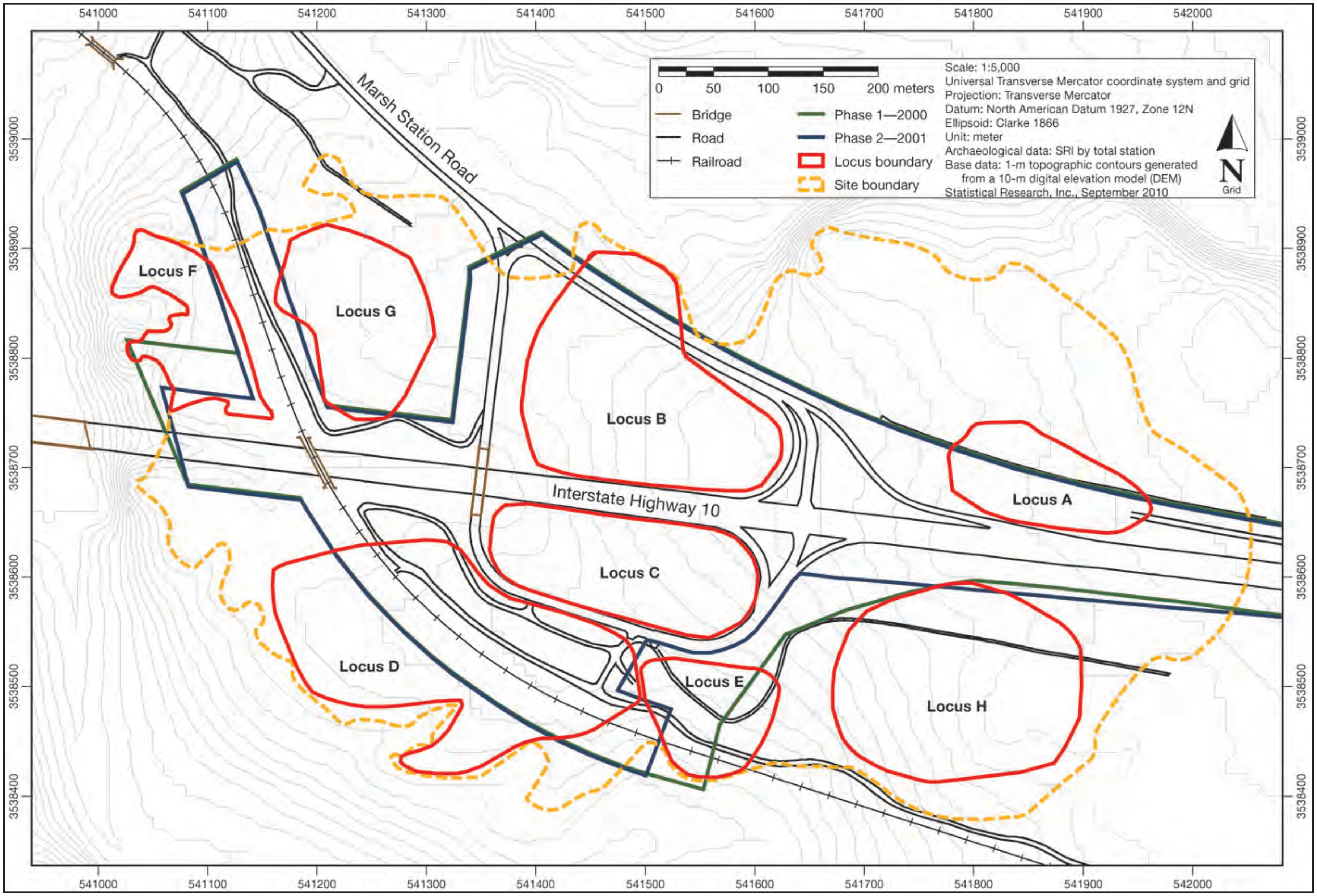


Figure 2. Map of the Mescal Wash site.

Figure 3. Aerial overview of the Mescal Wash site with Cienega Creek in the background, view to the southwest.

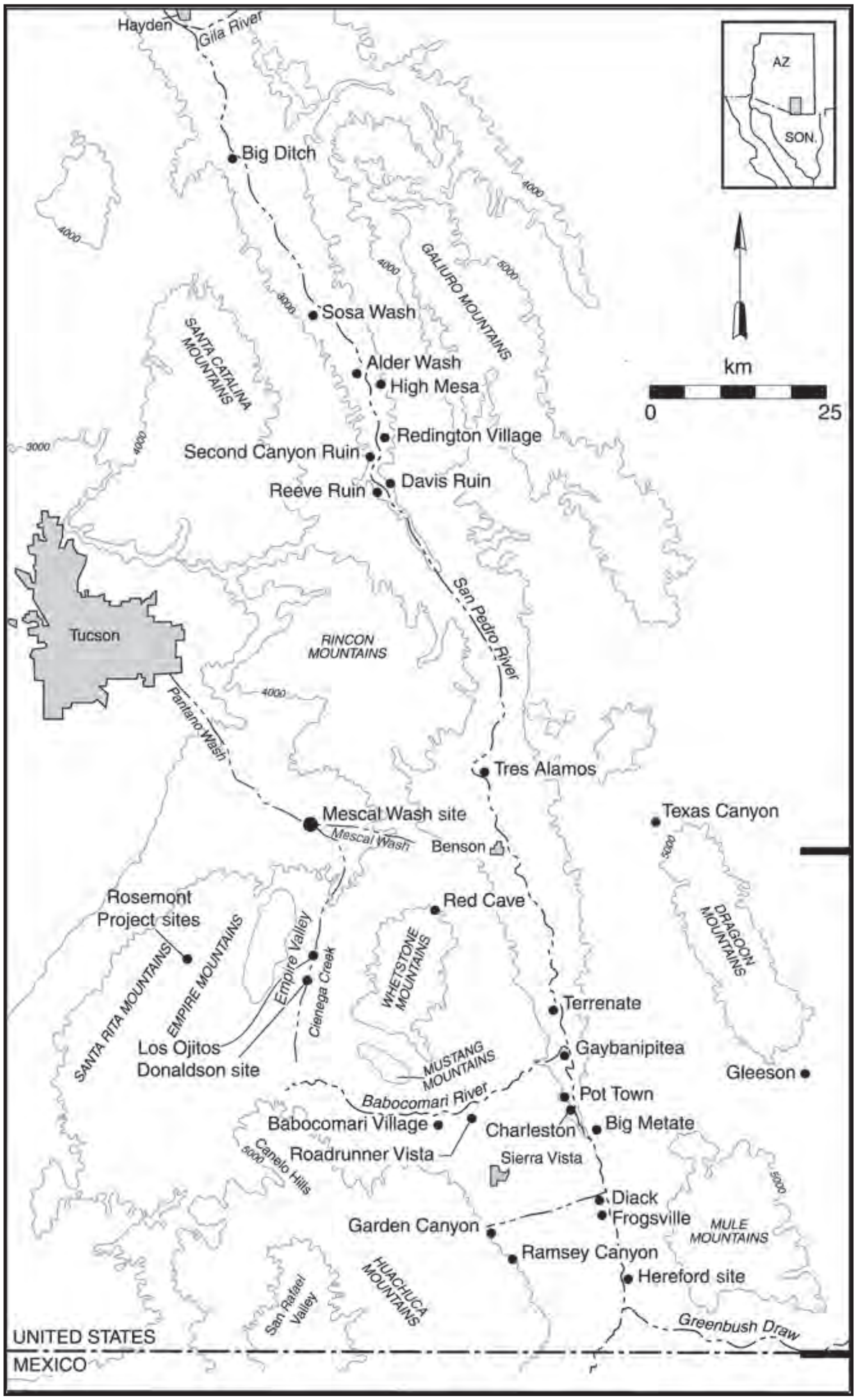


Figure 4. Map of greater San Pedro Valley in southeastern Arizona, showing Mescal Wash and other major sites in the region.

the early historical period, and John Bartlett described the Empire Valley in 1851 as a grassland with drainages that contained swamps and pools of water flanked by head-high grasses (Martin 1963:4). Mesquite has replaced much of these grasslands, and most of the *cienegas* have dried up. An important feature of the valley is the presence, within a small area, of three major plant communities: riparian, grassland, and oak woodland. Furthermore, conifer forest is present a few kilometers away, higher up on the mountains, and Sonoran desertscrub is within easy reach, to the northwest. An ephemeral drainage holding water only during summer rainstorms, Mescal Wash, as the name implies, is flanked by populations of agave. Different suites of economic plant species are present in each of these areas that, together, once formed a year-round reserve of sustenance for aboriginal settlers. This combination of resource diversity, abundance, and accessibility probably was a major reason for the longevity of the Mescal Wash site.

History of Investigations at the Mescal Wash Site

The Mescal Wash site was originally recorded in 1965 by James Ayres, then of the ASM (O'Brien et al. 1987). Ayres examined only a portion of the site and described it as a 50-by-50-m sherd area, assigning it site number AZ EE:2:51 (ASM). The ceramic scatter was located on the terrace above Cienega Creek, on the south side of U.S. Highway 80 (now Interstate 10). In 1987, during survey and testing for a USTelecom fiber-optic cable, Dames and Moore re-recorded the site as a much larger area extending as far north as Mescal Wash (O'Brien et al. 1987). Dames and Moore mapped the site, conducted a systematic surface collection in the northern part, and excavated three 1-by-2-m excavation units. Based on the artifact collections, the site spanned the Middle and Late Archaic periods (4800 B.C.–A.D. 1), as well as the Colonial and Sedentary periods in the Hohokam sequence (A.D. 750–1150).

In 1991, this time for U S West, Inc., SWCA Environmental Consultants (SWCA) conducted investigations for the placement of a second fiber-optic line in the southwestern part of the site. Extensive cultural deposits between the interchange and the edge of the terrace above Cienega Creek were found (Seymour et al. 1992). As a result, the utility cable was rerouted to an existing gas pipeline ROW. Although the investigated site portion encompassed the location originally recorded by Ayres, a new site number, AZ EE:2:164 (ASM), was inadvertently assigned. In 1993, SWCA returned to the site area to conduct a survey along the interstate in advance of the proposed reconstruction of the Marsh Station TI and the Cienega Creek Bridge (Roberts 1993), and the site was given back its initial number of AZ EE:2:51 (ASM). As re-recorded by SWCA, the site largely retained the boundaries as determined by Dames and Moore, although they were extended to the northwest (Roberts 1993:Figure 1).

In February 2000, the Mescal Wash site was revisited by Western Cultural Resource Management (WCRM) during their survey for the AT&T NexGen/Core Project, and a new ASM site card was completed (Kearns et al. 2000; Kearns et al. 2001).

As part of the large-scale 2000 and 2001 investigations by SRI reported herein, SRI also conducted a pedestrian survey, in July 2000, of five proposed temporary construction easements and two proposed ADOT ROW modifications at or adjacent to the site (Wegener 2000). No features were encountered, but surface artifacts were found in one of the construction easements and in both ROW modifications.

In 2003, ADOT proposed relocating and reconfiguring the proposed design of the Marsh Station TI and contracted with EcoPlan to conduct archaeological investigations in advance of the construction. EcoPlan surveyed 250 acres adjacent to the Interstate 10 ROW in 2003 and 2004 (Strohmayer et al. 2005). During the survey, the Mescal Wash site boundary was slightly modified. In addition, EcoPlan conducted limited excavations at the site in 2009 and 2010, including a prehistoric period cemetery in the northern portion of Locus B excluded from SRI's project area (Neuzil 2010a).

WCRM was contracted to survey the Arizona portion of the AT&T NexGen/Core Project, which passed through the Mescal Wash site. Fieldwork took place in 2000, 2001, and 2004 (Baker 2004; Baker and Jones 2004). Under subcontract with WCRM, SRI conducted limited testing at Locus H of the Mescal Wash site, in 2002, as part of the project (Vanderpot and Heckman 2002). S`RI surveyed the area, excavated 226 m of backhoe trenches, identified one feature, and made a controlled artifact collection.

In 2006, William Self Associates (WSA) surveyed the Arizona portion of a pipeline extending from El Paso, Texas, to Phoenix, Arizona, prior to relocation by Kinder Morgan Energy Partners. The survey passed through Locus A of the Mescal Wash site and also through the Marsh Station Road site (AZ EE:2:44 [ASM]), located nearby, on the opposite bank of Cienega Creek (Rawson et al. 2006a, 2006b). As part of an additional monitoring task, a single backhoe trench was excavated at the Mescal Wash site, and artifacts were collected from the impacted area (Millikan and Rawson 2009; Ravesloot et al. 2010).

In 2008, ADOT requested that Sprint's replacement of a fiber-optic conduit and cable be monitored as it passed through the Mescal Wash site. HDR, Inc., contracted with SRI to monitor the work. In addition to monitoring earthmoving activities, SRI archaeologists performed a pedestrian survey in the affected areas within site boundaries and recorded two features, a pit, and a sheet midden (Blake and Graves 2008).

WestLand Resources, Inc., conducted testing and data recovery at the Mescal Wash site as part of the UPRR Pantano Realignment in 2008 (Deaver 2010). Excavation in the north half of Locus A and the northern edge of Locus G uncovered a trash mound, pit structures, human and animal burials, and thermal and nonthermal pits dating to the end of the Middle Formative period.

Site Composition and Chronology

Mescal Wash locus definition was guided first by the distribution of surface artifacts and second by modern roads. Loci A and H, and possibly Loci B and E, appeared to represent distinct archaeological localities. Locus C was defined by roads, rather than by a discrete series of cultural deposits, and probably connected with Locus D to the west and possibly Locus E to the south. Based on size and density of features, Locus D formed the focal point of the site. Railroad construction had cut out a deep swath between Loci F and G, which together probably also formed a single discrete locality. Development activities have dramatically altered the natural setting of the project area. The construction of U.S. Highway 80, Interstate 10, the Marsh Station TI, Pantano Road, and the UPRR line and the routing of various utilities have each impacted the project area. Even so, SRI's excavations uncovered a largely intact habitation site occupied over a period of nearly 3,000 years by several different cultures.

Based on radiocarbon and archaeomagnetic dates, the Mescal Wash site was intermittently occupied between about 1200 B.C. and A.D. 1450, a time span corresponding to the Late Archaic and Formative periods. Middle Archaic period dart points recovered from the site suggest even earlier use, but no protohistoric period artifacts or features were identified. Evidence of historical-period use was limited to the roads, railroad, and utility corridors noted above.

For our purposes, we have divided the Formative period into Early (A.D. 1–750), Middle (A.D. 750–1150), and Late (A.D. 1150–1450) (Table 1; Figure 5). We use this unconventional designation instead of the better known sequence used for the Hohokam and their predecessors because the latter implies a cultural affiliation. As one of our research goals is to investigate cultural affiliation, we believed it best not to make assumptions at the onset. Based on ceramic evidence, the Middle Formative period at the Mescal Wash site can be subdivided into two parts, Middle Formative A (A.D. 750–950) and B (A.D. 950–1150). Although we do not want to use Hohokam terms in discussing the site, it is convenient to say that these two spans of time correspond to the Colonial and Sedentary periods in the Hohokam cultural sequence and also mirror similar periods among the Mogollon and San Simon sequences (see Figure 5). Similarly, the Late Formative period can be divided into Late Formative A (A.D. 1150–1300) and B (A.D. 1300–1450), roughly corresponding to the conventional Early and Late Classic period divisions.

Figures 6–8 are maps of the three main excavation loci (Loci A, C, and D), showing excavated features by type. It was in Locus D that the earliest and the latest features were found. In this locus, we excavated a series of bell-shaped pits and small, circular structures dating to the Late Archaic and Early Formative periods. Only a small portion of this early component was located within the project area, with additional early features likely located in the western portion of the locus, closer to Cienega Creek. Four Late Formative B period adobe-walled houses were found in the same locus (two additional Late Formative B period houses were identified at the site; one was excavated in Locus C, and another was found in Locus E, during Phase 1). It is unclear why Mescal Wash was not occupied during the Late Formative A period. Perhaps a lack of a sufficient water flow in the adjacent creek bed forced the local farmers to a more favorable setting downstream.

The vast majority of Locus D structures were houses in pits found in conglomerates of superimposed houses, all dating to the Middle Formative A period. These dense clusters signify either continuous, long-term habitation or repeated, short-term occupation over several centuries. Locus D contained little evidence of occupation during the Middle Formative B period; in contrast, Locus A and most of Locus C were solely occupied during this time. In Locus A, houses were found isolated, rather than in clusters. In Locus C, they were clustered, but not as densely as in

Table 1. Chronology for the Mescal Wash Site

Time Period	Date Range
Paleoindian period[a]	11,500–8500 B.C.
Archaic period	8500 B.C.–A.D. 1
Early Archaic period[a]	8500–4800 B.C.
Middle Archaic period	4800–1500 B.C.
Late Archaic period	1500 B.C.–A.D. 1
Formative period	A.D. 1–1450
Early Formative period	A.D. 1–750
Middle Formative period	A.D. 750–1150
Middle Formative A period	A.D. 750-950
Middle Formative B period	A.D. 950-1150
Late Formative period	A.D. 1150–1450
Late Formative A period[a]	A.D. 1150-1300
Late Formative B period	A.D. 1300-1450

[a] There was no direct evidence for these time periods at the Mescal Wash site.

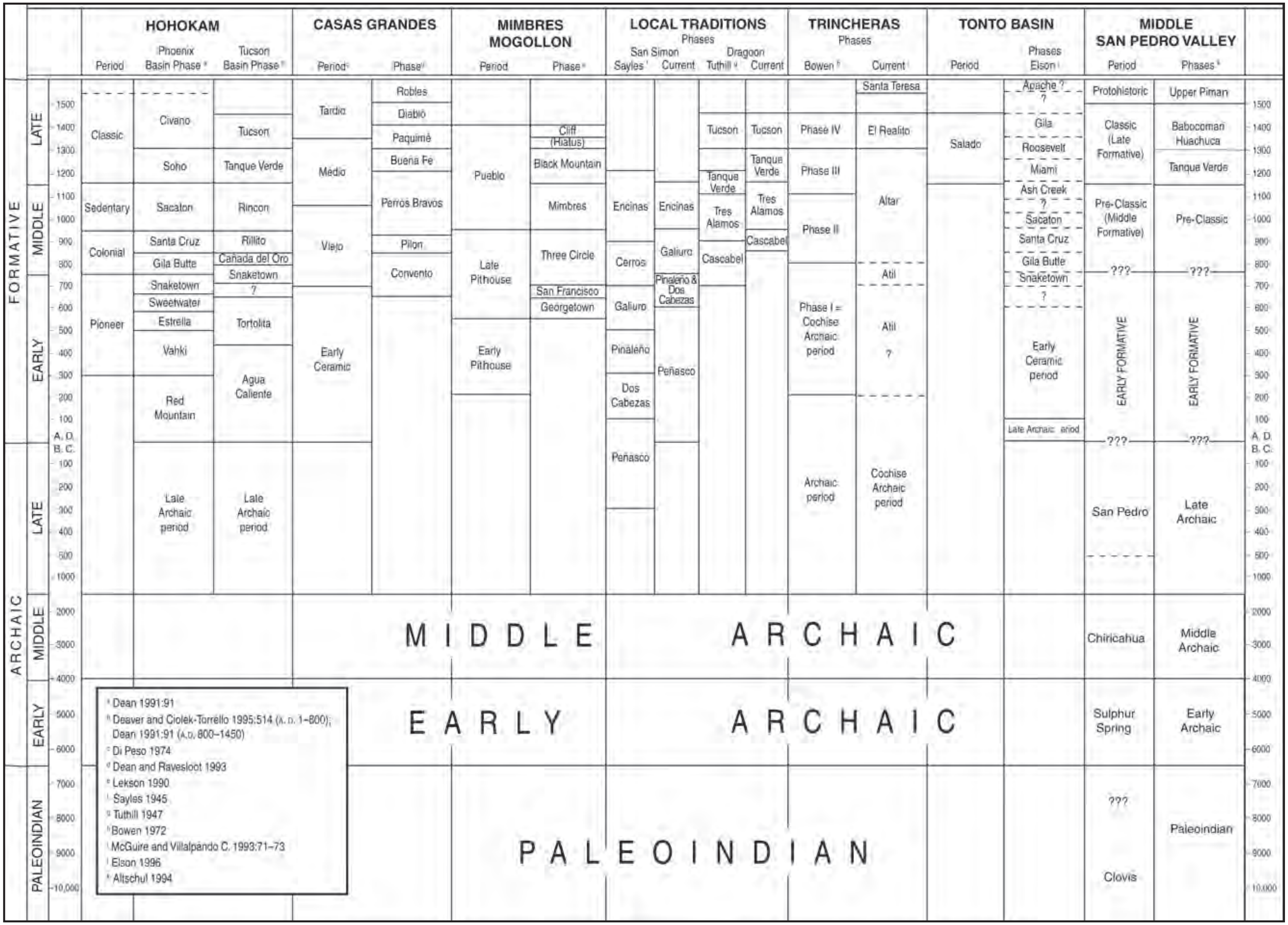


Figure 5. Chronological chart for southeastern Arizona.

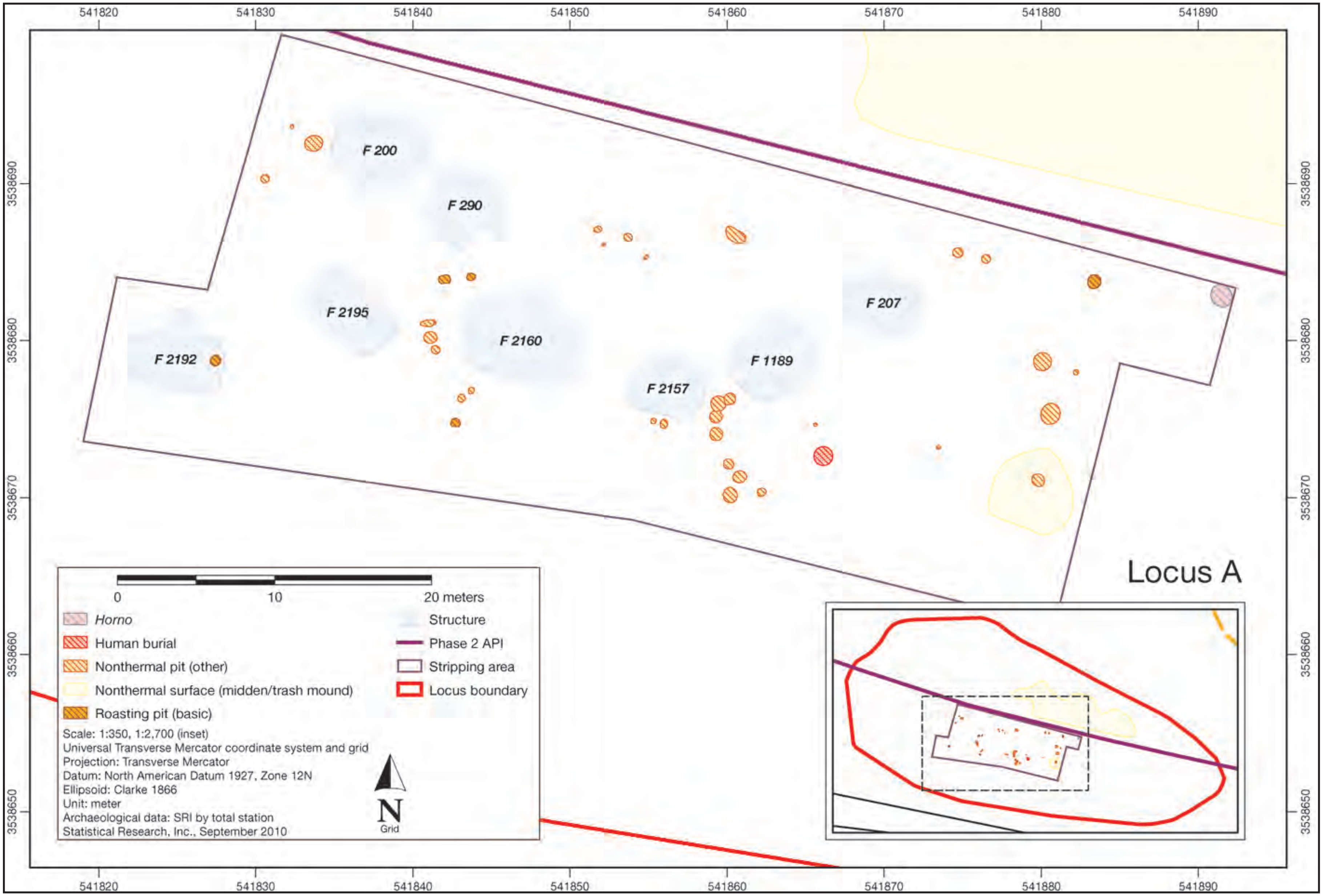


Figure 6. Map of Locus A, showing excavated features.

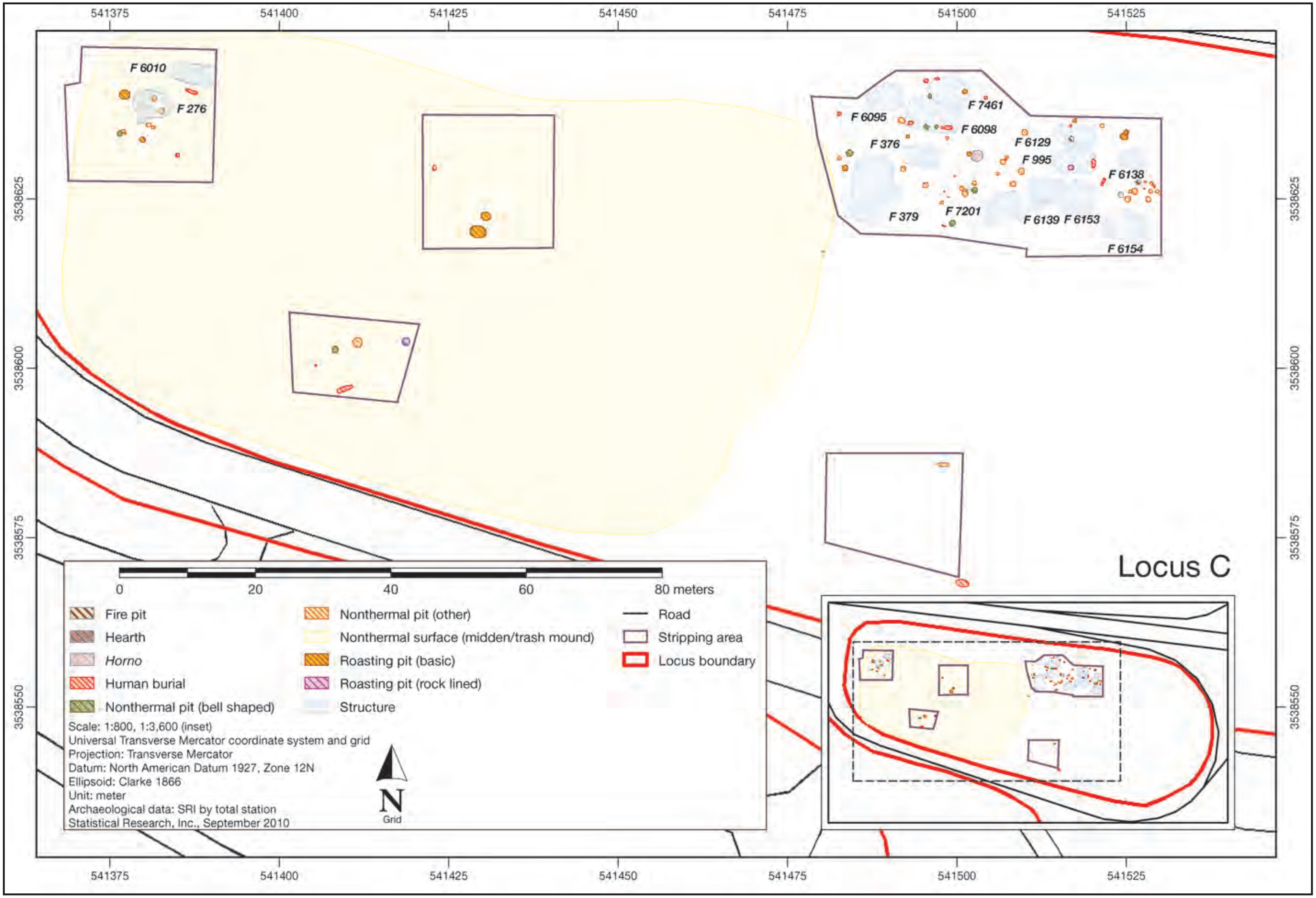


Figure 7. Map of Locus C, showing excavated features.

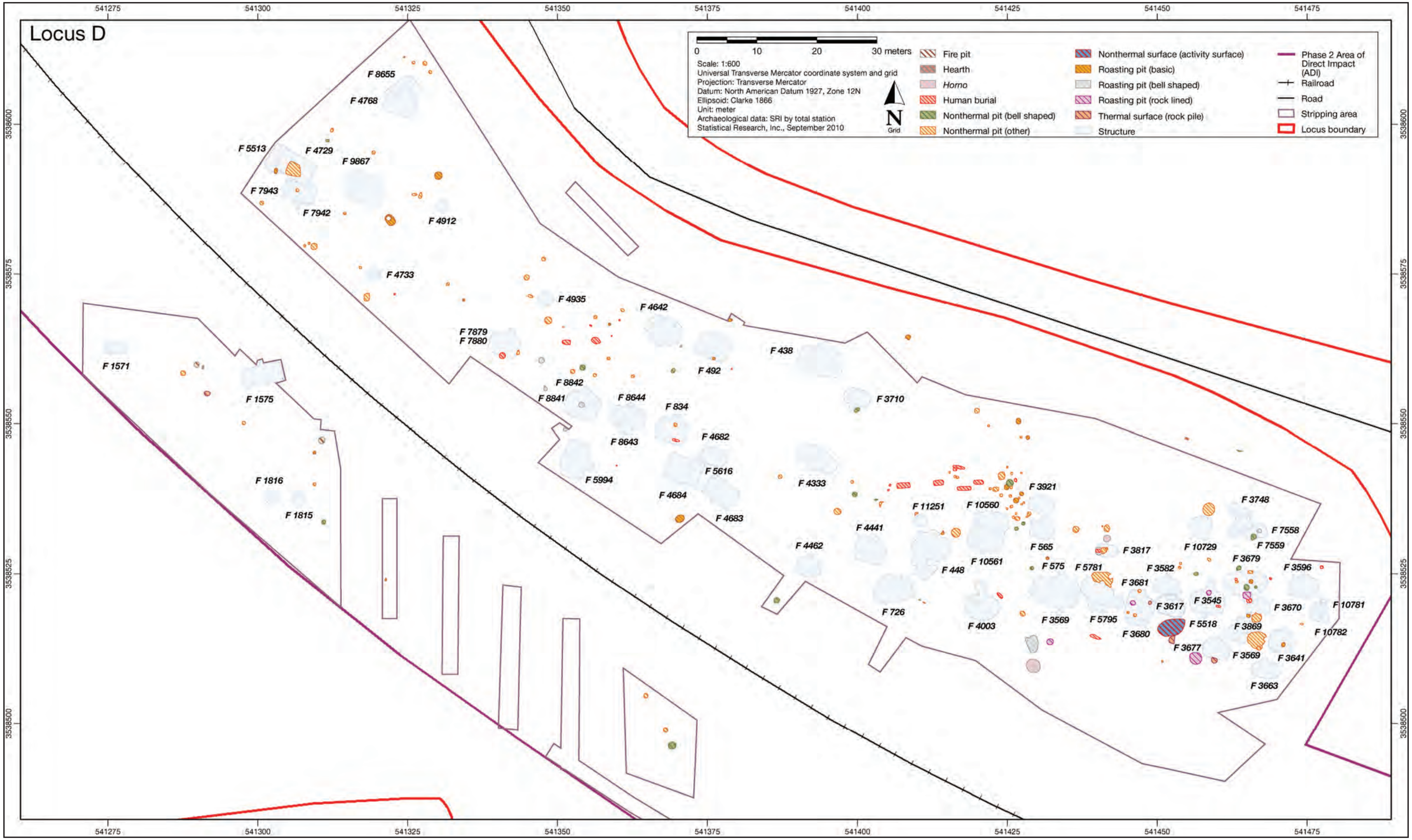


Figure 8. Map of Locus D, showing excavated features.

Locus D. Site layout always remained informal, lacking a ball court or platform mound, and with none of the structures arranged in courtyards or enclosed by compound walls.

Phase 2 Excavation Methods

Midden Sampling

Middens and trash mounds inform on several key research issues, in particular those focusing on subsistence and site structure and formation. Therefore, selected middens were sampled with 2-by-2-m test pits to obtain paleobotanical samples and other materials. Midden deposits in Loci A and B were visible on the surface as discrete trash areas or mounds. In Locus C, a large midden area was buried under a thick layer of modern overburden, and in Locus D, an even larger midden area had been partially buried and also exposed by road and railroad building. The deposits were shallow (10 cm) in Locus B but thick in the other loci (22 cm in Locus A, 35 cm in Locus C, and 40 cm in Locus D).

Mechanical Stripping

Following the midden sampling, large portions of overburden in Loci A–D were mechanically stripped to expose the tops of features (see Figures 3 and 6–8). In Locus A and in the portion of Locus D located north of the railroad, backhoe stripping was done in a large, single block that was subdivided into smaller units to control artifact collection. In Loci B and C and in the southern portion of Locus D, disjointed series of stripping units of various sizes were excavated. Placement of the units was based on the Phase 1 testing results, with a focus on areas with the greatest feature density. Stripping was restricted by the corridor of the El Paso Natural Gas line in Locus C, the railroad crossing in Locus D, the Interstate 10 access ramp between Loci C and D, and Interstate 10, itself.

Feature Excavation

Features exposed during stripping were marked with spray paint, tentatively classified according to type, and given feature numbers. Reopened features originally discovered in Phase 1 retained their old numbers. Features found underlying or intruding into features being excavated also were given numbers and were drawn on the plan maps for the main features. In several portions of the site (in particular, Locus D), feature density was so high that superimposition was the norm. When individual features could not immediately be discerned in the dark-stained surface, the entire stain was classified as “multiple features” and given a single number. Upon excavation, the individual features were assigned their own numbers, but the “multiple features” number was retained as an organizational device, although not considered part of the total features count.

Structures

Mechanical stripping provided us with plan-view information on house shape and size, orientation, and clustering. Structure excavation was complete or partial. Complete excavation was reserved for houses that appeared to be well preserved, were burned, contained in situ floor artifacts, had unique architectural traits, or were part of a feature conglomerate that was excavated in its entirety. Most of the structures were first evaluated with a 2-by-2-m or smaller test unit, usually placed over the doorway and hearth, then dug in 10-cm levels and screened through $^1/_4$-inch mesh. The rest of each structure was excavated in halves or quarters, with only the floor fill (i.e., the about-5-cm-thick layer above the floor surface) screened. The top fill was excavated mechanically or by hand, with all observed artifacts collected. If complete excavation was desired but sampling by means of the control unit was considered sufficient, the upper fill outside the test pit was removed mechanically, and only the floor fill was screened. As a rule, all intramural pits, including postholes, were excavated. These floor features included large numbers of bell-shaped pits and other storage features. All other floor features were excavated and documented with the same level of detail as were extramural pits. Partial excavation of structures generally entailed mechanical exploration without the excavation of a control unit, the main goal being to expose hearths for excavation and archaeomagnetic sampling.

Extramural Features

About 15 percent of the exposed extramural features were excavated. Selection for excavation was based on feature type and location. Before excavation, extramural features were classified into various types, based on their surface exposures. Although not identifiable in plan view, possible bell-shaped pits were flagged in a suspected Late Archaic/Early Formative period area of Locus D where features of this type were found during Phase 1. Some early pits were identified based on diagnostic lithic artifacts exposed in the fill. They also were tentatively marked based on a high calcic content in the fill. Representative samples of each extramural feature type were selected for excavation, with an emphasis on less-common types, such as bell-shaped pits. Where we could recognize features associated with particular houses, a relatively large sample of features was chosen. In Locus D, a large number of extramural features were found underlying or intruding into the features being excavated, and many of these also were excavated. Thirty-seven nonthermal pits were probed in the search for burials. Probing was done by removing several shovelfuls of fill without collecting samples, although observed artifacts were collected.

Feature Types

Of the 2,314 archaeological features identified at Mescal Wash, 97 structures, 363 extramural features, and 14 multiple features were excavated. The features displayed a wide range of architectural styles and functional types (Table 2; see Figures 6–8). All excavated features (including "multiple features") are summarized in Appendix 1.A. Detailed descriptions, depictions, and tabulations of these features are provided in Volume 1; the following sections provide information about the different types.

Structures

We identified four basic types of structures at Mescal Wash: pole-and-brush, house-in-pit, recessed-hearth-style (RHS), and adobe-walled structures. Most of the pole-and-brush houses date to the Late Archaic/Early Formative period, the houses in pits and RHS houses date to the Middle Formative period, and the adobe-walled structures date to the Late Formative period.

Pole-and-Brush Structures

Nine pole-and-brush structures were excavated (all in Locus D), representing two basic types. Five (Features 4753, 4518, 4912, and 7558 and 7559) were built in shallow pits, and four others (Features 1815, 1816, 4935, and 11251) were surface structures with no house pits. This house style is similar to that of Late Archaic and Early Formative period structures documented throughout southern Arizona (Gregory 2001; Mabry et al. 1997). Most contained a wall groove encircling the unprepared floor area, and had perimeter postholes. Other than a gap in the wall groove in seven of the houses, there were no signs of formal entrances. They had an average floor area of 4 m^2. None of the houses had burned, and no floor artifacts were present. A Cienega phase projectile point was collected from a posthole in one of the houses, and small numbers of plain ware sherds were found in the fill of most structures. Most of the structures date to the Late Archaic of Early Formative periods, with one (Feature 7559) assigned to the Middle Formative period.

Houses in Pits

Most of the site's excavated structures date to the Middle Formative A period, the time when the site reached its population peak, and nearly all were found in Locus D. Houses in pits also were typical for the succeeding Middle Formative B period. The structures varied in size, shape, and orientation, but the majority were reminiscent of Hohokam houses in pits (Haury 1976). Overbuilding was considerable during this time, and house pits were reused in the cases of seven pairs of structures (Features 3679/3868, 10781/10782, 3545/5518, 7942/7943, 5986/7978, 7879/7880, and 8643/8644); in Feature 7697, three structures were superimposed in the same house pit.

RHS Houses

The Middle Formative B period houses included eight examples of what seems to be a local architectural style. They were pit houses wherein the floor portion in front of the entrance of each formed a circular and straight-walled depression. The hearth in each, surrounded by three postholes, was in the center of this sunken area. The postholes suggest that each area had its own special roof. Remnants of reed matting may indicate that a bench partially encircled the hearth. A similar architectural style was documented during excavations in the late 1930s and 1940s by the Amerind Foundation, at Gleeson near the Dragoon Mountains (Fulton and Tuthill 1940) and at Tres Alamos along the San Pedro River (Tuthill 1947). At Mescal Wash, RHS houses were found in Loci A, C, and D. The style was epitomized by a large house (Feature 379) in Locus C, where a series of 12 parallel grooves in the floor outside the recessed area suggested a raised floor. This variant of the recessed-hearth style has not been previously documented. Measuring 10 by 6 m, this house was not only the largest structure excavated at the site, it was also one of the few houses at the Mescal Wash site with an east-facing entryway, and it is likely that this large house had a communal function.

It is noteworthy that Feature 200 in Locus A showed evidence of a major remodeling episode during which the recess was filled and leveled and a new hearth was built at the upper level, thereby returning to the previous architectural style, resembling that of the Hohokam. Furthermore, a pair of burned houses with recessed hearths (Features 995 and 6098) in Locus C were adjoined or clipped by two later, conventional pit structures (Features 7461 and 6129) intrusive into the entrances of the first. Except for the absence of recessed hearths, the intrusive houses were identical to the earlier ones, including the same orientation and deep storage pits in the same locations. Both earlier houses also contained intrusive inhumations, perhaps signifying ritualistic abandonment. The recessed-hearth style of architecture forms the single-most-unique aspect of the Mescal Wash site. Its presence at Tres Alamos and

Table 2. Summary of Features Excavated at the Mescal Wash Site (Both Phases)

Feature Type	Locus A Phase		Locus B Phase		Locus C Phase		Locus D Phase		Locus E Phase		Locus F Phase		Total Phase		Total
	1	2	1	2	1	2	1	2	1	2	1	2	1	2	
Structures															
Pole and brush	—	—	—	—	—	—	—	9	—	—	—	—	—	9	9
House-in-pit	—	5	—	—	—	11	—	57	—	—	—	—	—	73	73
Recessed hearth	—	3	—	—	—	3	—	2	—	—	—	—	—	8	8
Adobe walled	—	—	—	—	—	1	—	4	—	—	—	—	—	5	5
Unknown	—	—	—	—	—	—	—	1	—	—	1	—	1	1	2
Subtotal, structures	—	8	—	—	—	15	—	73	—	—	1	—	1	96	97
Extramural Thermal Features															
Roasting pit, basic	—	5	—	—	—	11	7	17	—	—	—	—	7	33	40
Roasting pit, bell-shaped	—	—	—	—	—	—	2	6	—	—	—	—	2	6	8
Roasting pit, rock-lined	—	—	—	—	—	2	1	5	—	—	—	—	1	7	8
Horno	—	1	—	—	—	1	—	2	—	—	—	—	—	4	4
Hearth	—	—	—	—	—	1	—	1	—	—	—	—	—	2	2
Firepit	—	—	—	—	—	4	—	5	—	—	—	—	—	9	9
Rock cluster/rock pile	—	—	—	—	—	—	—	4	—	—	—	—	—	4	4
Subtotal, extramural thermal features	—	6	—	—	—	19	10	40	—	—	—	—	10	65	75
Extramural Nonthermal Features															
Pits															
Nonthermal pit, general	—	32	—	—	1	36	2	83	—	—	—	—	3	151	154
Nonthermal pit, bell-shaped	—	—	—	—	—	8	2	20	—	—	—	—	2	28	30
Cache	—	—	—	—	—	—	—	3	—	—	—	—	—	3	3
Borrow pit	—	—	—	—	—	—	—	7	—	—	—	—	—	7	7
Subtotal, extramural nonthermal pits	—	32	—	—	1	44	4	113	—	—	—	—	5	189	194
Midden/trash mound	—	2	—	1	—	1	—	1	—	—	1	—	1	5	6
Activity surface	—	—	1	—	—	—	—	1	—	—	—	—	1	1	2
Animal burial (nonhuman)	—	—	—	—	—	1	—	—	—	—	—	—	—	1	1
Human burials															
Primary cremation	—	—	—	—	—	—	—	4	—	—	—	—	—	4	4
Secondary urn cremation	—	—	—	—	—	3	—	2	—	—	—	—	—	5	5
Secondary pit cremation	1	—	—	—	1	6	3	8	2	—	—	—	7	14	21
Inhumation	—	—	—	—	—	8	1	9	—	—	—	—	1	17	18
Subtotal, human burials	1	—	—	—	1	17	4	23	2	—	—	—	8	40	48
Subtotal, extramural nonthermal features	1	34	1	1	2	63	8	138	2	—	1	—	15	236	251
Total Number of Excavated Features															
Total	1	48	1	1	2	97	18	251	2	—	2	—	26	397	423[a]

[a] This count does not include the 37 probed features or the 14 multiple features.

Gleeson—and likely at other, not-yet excavated sites in this part of southeastern Arizona—suggests it was an indigenous cultural development, perhaps associated with the Dragoon "culture."

Adobe-Walled Structures

Six adobe-lined pit structures were found widely apart in Locus C, in the western half of Locus D, and in Locus E. Five of these (in Loci C and D) were excavated, and all date to the Late Formative B period. Feature 235 (excavated in Locus C) was a rather shallow pit structure that retained part of an adobe wall. The remaining four excavated adobe structures (Features 1575, 4683, 4684, and 4729) were all in Locus D. Two neighboring houses, Features 4683 and 4684, may have been contemporaneous. The four structures occupied a broad arch in the western half of the locus. One (Feature 4729) was the latest house in an impressive cluster of four superimposed structures. Rectangular in shape, the adobe structures were generally larger than the older houses in pits. They were made of free-standing, above-ground walls of puddled adobe. The structures were accessed through narrow, stepped entryways. Each of the structures possessed a shallow floor pit at the threshold of the entryway, interpreted as a puddling area, for adobe mixing. Each of the adobes had a roughly similar floor plan consisting of a series of interior postholes placed in an evenly-spaced, regular grid next to the well-worn, plastered surface of the hearth area. This suggests that the floors had been raised, possibly for storage purposes. All of the Locus D adobe-walled structures had been burned and had fairly extensive floor assemblages. No associated compound wall was found. Similar houses were excavated by Di Peso (1956:Figure 83) at the Paloparado site (San Cayento del Tumacacori). The presence of not more than a few scattered houses at Mescal Wash is no unique phenomenon for this time period. It fits well within the pattern of nucleated settlements surrounded by sparser occupations noted throughout the region.

Extramural Features

The 363 extramural features excavated at Mescal Wash consisted of 75 thermal features, 251 nonthermal features, and 37 indeterminate pits that were probed only (see Table 1.2 and Figures 1.6–1.8). It was from the excavated pits that we expected to learn much about the site's economy. Large and small, thermal and nonthermal bell-shaped pits were used for storage, as well as for food baking.

Thermal Features

Of the excavated thermal features, 71 were pits and 4 were fire-cracked-rock clusters. Pit types consisted of roasting pits (including "basic", rock-lined, and bell-shaped types), *hornos*, fire pits, and hearths.

Basic Roasting Pits

Basic roasting pits were common throughout the site area, and nearly 40 were excavated in Loci A, C, and D. The pits varied in size and shape (basin, conical, and cylindrical forms were noted), but all had fills of fire-affected rock, charcoal, and ashes. Roasting pits were used copiously throughout the site's history, and they are an important feature type for the study of household food processing.

Rock-Lined Roasting Pits

This unique type of roasting pit has slab-lined, often heavily oxidized walls and several large rocks covering its base. Eight rock-lined roasting pits (Features 6187 and 9409 in Locus C, and Features 432, 3366, 3668, 3878, 4120, and 4702 in Locus D) were selected for excavation. Several excavated in the southeastern portion of Locus D originated near the modern ground surface, suggesting that they date to the late prehistoric period. The fill of some of these roasting pits contained abundant faunal bone and flaked stone but few ceramics.

Bell-Shaped Roasting Pits

Bell-shaped roasting pits were excavated only in Locus D. Most were large and had evidence of repeated use. It is uncertain whether they were reused storage pits or were constructed specifically for roasting purposes. Based on spatial context and artifacts (including early plain ware and red ware ceramics) in the fill, this type of roasting pit is early and perhaps predates the rock-lined pits. The bell-shaped roasting pits at Mescal Wash were similar in shape to bell-shaped *hornos* documented in the Sulphur Springs Valley by Fulton and Tuthill (1940) at Gleeson and nearby, in the same area, by Trischka (1933). These features appeared to be restricted to the early Ceramic (i.e., Early Formative period) horizons across southern Arizona and northern Mexico.

Hornos

Hornos, defined as roasting pits with diameters of 1 m or more and coated with a thick, carbonized rind, were rare at the site. Ethnographically, *hornos* were often used for agave processing during special cooking events for an entire community. Four *hornos* were excavated, one (Feature 1149) in Locus A, one (Feature 7153) in Locus C, and two (Features 3818 and 4220) in Locus D.

Fire Pits

As defined for this project, fire pits are small pits with oxidized walls. Nine of these features were excavated (Features 1141, 6145, 6146, and 10380 in Locus C and Features 1555, 1794, 4649, 5520, and 10692 in Locus D). The fill contained ash but few or no fire-affected rocks.

These features might have functioned as informal extramural hearths, possibly used for heat, rather than for cooking.

Hearths

The two extramural hearths found in Loci C (Feature 7195) and D (Feature 1556) were similar to the formal hearths found in houses. They were plastered, and it is possible that they were inside unrecognized ramada areas or that they belonged to destroyed houses.

Rock Clusters

Four small rock clusters (Features 1582, 3579, 3672, and 3673) were excavated in Locus D. All contained fire-affected rocks, including lithics. There was little subsurface depth, and the rocks probably represented cleanout episodes of nearby roasting activities.

Nonthermal Features

Pits

A relatively large number of nonthermal pits were excavated, many in the search for bell-shaped pits. For 37 nonthermal pits, excavation consisted of not more than probing to look for burials, and for these probed features pit type remained indeterminate.

General Pits

Features in this class are of the "basic" style—basin-shaped pits that vary in size and have nondescript fill. Rectangular, cylindrical, conical, and other shapes are also classified under this basic style. In most cases, the functions of these pits remain unknown, even after complete excavation. Many probably had a storage function, with smaller pits serving as basket rests or pot rests. The large number of pits of this type identified at the site attests to their importance.

Bell-Shaped Pits

Thirty extramural bell-shaped pits were excavated, most in Locus D and none in Locus A. Storage is the most plausible function attributed to these features. A number of the Locus D features had fill containing numerous bifacial-thinning flakes and no ceramics; some included dart points. Radiocarbon dates obtained from *Zea mays* and other plant materials indicated that several of these pits dated to the Late Archaic period (Features 411, 3557, 3976, 3983, and 4849) or the Late Archaic/Early Formative period (Feature 4312) (see Appendix 2.B).

Caches

Three nonthermal pits in Locus D (Features 1545, 7501, 11442) were identified as caches. All three features contained censors or censor fragments.

Borrow Pits

Borrow pits also are included in the nonthermal-pit category. The six excavated features of this type (all found in Locus D) were of varying shapes and sizes and, as the name implies, were likely used to obtain fill for use elsewhere. In general, they were excavated because they were initially thought to be pit structures.

Activity Surface

Two activity surfaces were partially excavated. Feature 364 in Locus B consisted of a flat surface without a wall or floor features from which an axe head, a mano, and a piece of hematite were collected. A single activity surface (Feature 11342) was excavated in Locus D. Most of the feature—noted as an artifact-rich, level area with an unprepared use surface and without pits or postholes—was exposed during mechanical stripping.

Middens and Trash Mounds

These excavated refuse receptacles ranged from an artifact scatter with little subsurface depth in Locus B to broad sheet middens in Loci C, D, F, and G to formal trash mounds in Locus A. Much of the top surfaces of the middens in Loci C and D had been removed by road-building activities. Four middens (Features 999, 1018, 2143,and 11352) and two trash mounds (Features 522 and 672) were tested with 2-by-2-m or smaller units, primarily to obtain samples.

Dog Burial

One prehistoric period dog burial (Feature 7330) was excavated in Locus C. The burial was found in a well-defined, shallow pit and contained what was believed to be an entire skeleton.

Human Burials

In all, 48 burials were excavated in Loci A, C, D, and E. The burials included 4 primary cremations, 21 secondary pit cremations, 5 secondary urn cremations, and 18 inhumations.

The four primary cremations each consisted of a subrectangular pit containing interior postholes. All four pits were oriented roughly east-west. The base and walls of each of these pits were heavily oxidized, suggesting that they were used multiple times. Little cremated bone remained in these crematoriums. One of the features included a stone censer, a bone awl, and a portion of a vessel. The features were found in a cemetery area in the north-central portion of Locus D.

Secondary cremations were found in several cremation areas and scattered across Loci A, C, D, and E. In several cases, the secondary pit cremations were each capped with an inverted bowl or jar, including a Sacaton Red-on-buff jar, a plain ware bowl, and a red ware jar. One of the secondary urn cremations was also covered with a plain ware bowl. Secondary-urn-cremation vessels included a fragment of a Tres Alamos Red-on-white jar.

Inhumations were the most common burial type. Varying as to location and orientation, many were found intruding into houses or pits. Flexed and sitting types were documented. Grave goods were sparse and included a Dragoon Red-on-brown bowl and an Archaic period dart point.

Artifacts and Samples

Approximately 107,774 artifacts (ceramics, lithics, and worked faunal bone), 10,341 pieces of unworked faunal bone, 1,629 botanical samples, and 107 archaeomagnetic samples were collected from the site during the two phases of the project. Counts of artifacts and ecofacts per class, as well as counts of botanical and archaeomagnetic samples collected from the site, are provided in Table 3. This table also indicates what portions of these collections were analyzed.

Table 3. Artifacts and Samples Collected and Analyzed (Phases 1 and 2)

Category and Class	Collected	Analyzed
Ceramic		
Sherds	54,076	54,076
Restorable vessels	74	74
Other	2	2
Lithics		
Flaked stone	51,937	9,443
Ground stone	1,309	1,309
Shell		
Worked	247	247
Unworked	65	65
Faunal bone		
Worked	64	64
Unworked	10,341	10,307
Botanical		
Flotation samples	776	112
Pollen samples	640	52
Charred wood/plant samples	213	103
Archaeomagnetic samples	107	94

Research Themes and Goals

Prior to the commencement of fieldwork, SRI prepared a treatment plan for the Mescal Wash site in which, as part of the overall research strategy, a historic context was developed (Altschul et al. 2000:5–14). Identifying longevity as a key attribute for the site, the research design centered on investigating the parameters of the ancient community at Mescal Wash. In essence, we wanted to understand the factors and processes that repeatedly drew people from diverse backgrounds to this locale. Broadly considered, this historic context might be considered "an archaeology of place" defining the factors that promoted community development and change. It is a nested concept, ranging from single settlements to regions, and similarly, the research themes summarized below are organized in procession, from the Mescal Wash community to its environment, its economy, its demography, and, finally, its regional landscape. These themes are intertwined, and they overlap with each other, rather than forming stand-alone topics. The Mescal Wash research design will be revisited at length in Volume 3; the main purpose of the following summaries is to provide links to the analytical chapters presented in this volume.

Community and Locale: Mescal Wash as a Persistent Place

Mescal Wash was the scene of repeated occupation over a period of several thousand years by several different cultures. Therefore, the site provides an ideal setting in which to examine processes of community development, in particular the concept of persistent places. Some locales in southern Arizona experienced repeated, intensive occupation, often by several different populations, creating an impression of deep sedentism that persisted for centuries. These favored locales may correspond to what Schlanger (1992:97) has labeled "persistent places" in Anasazi history, defining them as "places that were repeatedly used during long-term occupations of regions. They are neither strictly sites (that is, concentrations of cultural materials) nor simply features of a landscape. Instead, they represent the conjunction of particular human behaviors on a particular landscape." Schlanger's argument suggests that persistent places emerge as the result of the particular qualities or characteristics intrinsic to particular places. Qualities promoting the formation of persistent places are of three modes: (1) environment, (2) cultural facilities or features, and (3) artifactual materials. People are attracted to reusing places because of their intrinsic environmental or ecological attributes, pre-existing cultural features, or exploitable tools and raw materials. To Schlanger (1992:105), "multicomponent assemblages are the clearest indicators of persistent places that can be identified from the archaeological record preserved on the modern ground surface."

Our basic task was to confirm that the Mescal Wash site indeed represents such a persistent place and to identify whether similar changes have occurred there. What was the role of Mescal Wash in the overall settlement system? Rather than labeling the site as one of several types (i.e., farmstead, hamlet, or village), we need to think in terms of occupation duration, intensity, and continuity and to apply or develop metrics that can be used to monitor and compare these factors. Developing a detailed site chronology is the first step in beginning to answer these questions. A spatial analysis of the site, including a detailed study of the architectural and extramural features, is a second step.

Environment and Subsistence

Before seeking to investigate social, ideological, and other aspects influencing change in ancient communities, we need to look at the physical and biological environments, to explain site location and type. Situated at an ecological crossroads along a riparian zone (*cienega*) between grassland and desert, the Mescal Wash site offered its occupants access to highly diverse economic resources. The site appeared to have functioned, after its simple beginnings as a hunter-gatherer base camp, as a mixed, forager-farmer *ranchería* during much of its long history. Although agriculture must have played a significant role since Late Archaic period times, wild plant and animal resources always remained important. We have many questions about the ancient environment and the site's subsistence base, their relationship to each other, and how each changed over time. What were the amount and productivity of arable land, including characteristics of soils; the type and predictability of water sources; and the influence of paleoenvironmental factors, such as fluctuations in average precipitation? How fertile were the soils for particular farming technologies? As a first step, we need to reconstruct the geomorphic history of Cienega Creek and Mescal Wash, as well as the local climatic history. Assessing agricultural productivity also involves determining the mix of crops cultivated (or encouraged) and how it changed through time. Wild plant and animal resources have to be cataloged, as few, if any, southwestern populations were solely dependent on cultivated foodstuffs. What resources were available in the immediate vicinity and at increasingly larger distances? What was the mix of wild plants that were collected, and how did this mix change through time?

In addition, we need to understand the past environment. Did the past environment differ from the present one, and in what ways? Can paleoclimatic and paleoenvironmental data be correlated with demographic, subsistence, and settlement information? We also have to be concerned with the culturally modified or anthropogenic environment. The interaction between people and their environment was culturally conditioned and mutually reinforcing. Human activities altered and transformed the physical and biological environments, often to the point of degradation. Therefore, we need to model human and environmental interactions through time, which involves a synthesis of many factors, including food, building material, fuel, water, landscape changes, and sustainability. We have to determine whether local plant foods were depleted. Through faunal analysis, we need to evaluate temporal changes in use and availability of faunal resources. We can then use the vertebrate faunal remains to assess changes in the paleoenvironment, by focusing on environmentally sensitive taxa, such as rodents, amphibians, and riparian-dwelling animals. Temporal changes can also be assessed in terms of cultural processes, taxonomic processes, and environmental change. We need to examine how changes in agricultural investment correlate with prey selection, hunting methods, and animal-food-processing technology.

Economy: Resource Extraction and Technology

This broad category of variables seeks to understand how people extract and use energy from their environments and how they develop, refine, and use technologies to accomplish these undertakings. Technological organization, subsistence and economy, foraging scheduling, agricultural technology, and processes of agricultural intensification are among the primary factors. Extracted resources include stone (for tool manufacture), wild plants (for food and fiber), and animals (for food, clothing, and tools). Sourcing raw lithic materials, identifying plant remains, and faunal analysis could allow us to quantify these data. Environmental studies can provide information about agricultural techniques. Other topics of technology specific to Mescal Wash include the study of flaked stone, ground stone, ceramic, bone, and shell artifacts, as well as the array of food-processing and -storage features found at the site.

Demography: Population and Sustainability

Demographic variables are traditionally viewed in relation to economic variables. Agricultural strategies and population size are closely linked. We are particularly interested in knowing the size of the population at Mescal Wash at different points in time. What was the optimal population size, based on a sustainable economy? Could we estimate the maximum population that could be supported for brief periods of time by a more intensive economy? Among the variables to explore are population size and composition, occupational duration and intensity, size and composition of domestic groups, activity organization, and stages in domestic-group cycling. Mobility and site reoccupation also have to be considered. We are especially interested in knowing whether the people living at Mescal Wash represented a largely isolated, independent group or were seasonal visitors from larger, more-permanent communities that were based elsewhere. Demography and community organization may undergo a cyclical sequence that is necessary to understand if we are to reconstruct community histories, particularly at persistent places. Thus, we compiled information about abandonment processes at Mescal Wash, determining whether abandonment was gradual, sudden, or catastrophic.

The Social and Cultural Landscape

Finally, we are interested in relating the Mescal Wash population to the larger, regional community. Southeastern Arizona remains one of the most archaeologically intriguing but also least understood parts of the U.S. Southwest. By Late Archaic period times, settlement of southern Arizona had expanded into rich, moist river valleys, such as the Santa Cruz and San Pedro (Mabry et al. 1997); along secondary streams, such as Cienega Creek (Eddy and Cooley 1983; Huckell 1995); and to canyon mouths in the larger mountain ranges (Vanderpot 1997). *Bajada* and piedmont settings were used, as well (Altschul and Jones 1990; Huckell 1984a; Roth 1996; Vanderpot 1997; Whalen 1971), prompting some to speculate that a dual-*bajada* settlement system existed (Fish et al. 1992).

In Formative period times, the Hohokam and Mogollon, and local cultures (e.g., "Dragoon") yet to be named and fully investigated, emerged from the Archaic period population base. Southeastern Arizona, in particular, became a crossroads for diverse cultures. These included a local Mogollon group named the San Simon Branch (Sayles 1945), the Tucson Basin Hohokam, and local cultures characterized by unique ceramic styles and architecture (see Altschul et al. 1999; Altschul et al. forthcoming; Di Peso 1951; Fulton 1940; Fulton and Tuthill 1940). Late in prehistory, the region experienced the sweeping demographic shifts and unsettled economic and social conditions that characterized much of the southern Southwest. Influences from Chihuahua (Casas Grandes) to the southeast, the enigmatic Salado culture to the north, and western New Mexico (Mogollon) all filtered into southern Arizona at the same time that small family groups (Anasazi) were fleeing the Colorado Plateau, southward along the San Pedro River (Altschul et al. 1999; Di Peso 1958; Fish and Fish 1999; Whittlesey and Heckman 2000; Woodson 1995). Remains of all these cultures intermingled and overlapped within southern Arizona, often at the same sites. The region's populations appear to have taken second stage to major cultural developments elsewhere. To varying degrees, local communities interacted with their better-known neighbors, often accommodating immigrants, and, at times, were outnumbered by colonists. That these communities persisted in the face of more-dominant neighbors is interesting, but what is more intriguing is that they seem to have retained their unique identities.

The location of Mescal Wash, itself, also suggests a cultural crossroads. The great variability in cultural traits, such as architectural styles, ceramics, and burial practices, suggests that people borrowed cultural concepts from other groups in surrounding areas. Or perhaps it was the other way around, and these other groups actually moved to the site. If so, what were the factors and the processes that repeatedly drew people from diverse cultural backgrounds to this locale? By asking specific questions, such as "From where does the recessed-hearth architectural style originate?" we may be able to address more general problems, such as "What constitutes cultural identity, and how can we avoid imposing inappropriate archaeological concepts (i.e., Hohokam) on groups living along cultural boundaries?"

Summary of Volume 2

To facilitate the synthetic studies presented in Volume 3, the various analysts of cultural and environmental materials were directed to frame their work to address those research questions most appropriate to their respective data sets. This introductory chapter closes with a brief discussion of these analyses and the specific research questions that guided the analysts. Following this introductory chapter, Chapter 2, prepared by Stacey Lengyel, provides an overview of the project chronology, which serves as a diachronic framework for the subsequent analyses. After presenting an outline of the cultural history and chronology of southeastern Arizona, Lengyel discusses the methods used to build the Mescal Wash chronology. The findings of the analyses are first summarized by locus, after which a synthesis for the site as a whole highlights the temporal and spatial patterns of site use.

The remaining chapters contained herein can be broadly divided into two parts. The first part (Chapters 3–6) presents the artifactual data collected from the site, and the second part (Chapters 7–11) is concerned with the ecofactual data. Chapter 3 opens the examination of artifacts with a presentation of the results of the analysis of ceramic sherds, reconstructible and whole vessels, and other clay artifacts recovered from the site. In their discussion, authors Christopher Garraty and Robert Heckman explore the issues of site function, subsistence practices, social change, regional interaction, identity, and exchange. Chapter 4 presents the results of the flaked stone analysis conducted by Michael Heilen, John Hall, and Bruce Bradley. Focusing on changing patterns of land use and mobility as apparent from flaked stone technology, the chapter provides a compelling breakdown of changes in site use, community structure, and occupation duration and intensity. The analysis of ground stone, tabular tools, and minerals is presented by authors Dawn Greenwald and Bradley Vierra in Chapter 5. The analysis results are used, first, to elaborate on Mescal Wash as a persistent place and, then, to explore issues of subsistence, community activities and activity organization, and cultural affiliation/interaction and exchange. In Chapter 6, Amada Cannon, Christopher Garraty, and Arthur Vokes use the shell-analysis results to compare shell use among the different loci, looking at differences in shell use over time and placing the collection in a regional perspective. Chapter 7 presents the bone-artifact analysis conducted by Janet Griffitts, who discusses technology and site function by looking at craft production, tool use, and raw-material selection.

Chapter 8 opens the ecofactual analyses with a discussion of the faunal remains by Justin Lev-Tov and Robert Wegener. The authors explore dietary variation through time, intrasite patterning in faunal use, site abandonment processes, and provide a comparison with sites in the greater region. In Chapter 9, Katherine Kolb and Karen Adams use the archaeobotanical materials to discuss differences in plant use over time, seasonality, variation in plant use between different loci, and correlations between plants and specific feature types. Chapter 10 presents the pollen analysis conducted by Susan Smith, who explores the evidence for cultigens and native plants used for food and other purposes. Off-site samples from *cienega* and alluvial deposits are discussed to address questions about the site's paleoenvironment. Finally, Chapter 11 presents the results of the analysis of human remains conducted by Christopher Garraty, Mitchell Keur, Joseph Heffner, Lorrie Lincoln-Babb, and Penny Minturn. The authors use the various contextual and osteological attributes of the burials and skeletal remains to infer the site's mortuary practices and how these changed over time. Specific topics include demography and pathology, distribution of mortuary offerings, and spatial distribution and comparison of formal burial areas.

In addition to the chapters summarized above, this volume also contains 12 appendixes that present the excavated-features inventory (Appendix 1.A), archaeomagnetic procedures (Appendix 2.A), radiocarbon-analysis results (Appendix 2.B), chronological data for features (Appendix 2.C), archaeomagnetic feature comparisons (Appendix 2.D), ceramic data from Phase 1 (Appendix 3.A), ceramic artifacts from burials (Appendix 3.B), ceramic-recording attributes (Appendix 3.C), ground-stone-palette summaries (Appendix 5.A), bone-artifact data (Appendix 7.A), the modern-plant study (Appendix 9.A), the macrobotanical-specimens inventory (Appendix 9.B), and the pollen data (Appendix 10.A).

CHAPTER 2

Chronology

Stacey Lengyel

For over 3,000 years, the area encompassed by the Mescal Wash site repeatedly drew individuals and groups from a variety of cultural backgrounds, resulting in a rich but complicated archaeological record. One of our primary tasks was to delineate the parameters that contributed to this area's continued popularity with various groups and promoted community development and change (Altschul et al. 2000:5). Indeed, longevity itself was considered to be a key attribute of the Mescal Wash community, and this view structured much of our analysis. Given the time depth represented by cultural deposits at the site and the diachronic focus of many key research themes, temporal control and the ability to date discrete contexts was crucial.

The analyses discussed below were directed toward addressing temporal issues related to site use at a variety of scales. The first task was to obtain calendrical-age estimates for each of the investigated features. Chronometric analyses were focused on dating structures and specific extramural features, such as bell-shaped pits, but attempts were made to date all investigated features. The individual dated contexts were then combined, to develop chronologies for each of the three main activity loci that were investigated (Loci A, C, and D). This task was geared toward reconstructing developments within the confines of a single locus, to facilitate the investigation of questions pertaining to site structure and growth. Archaeomagnetic (AM) contemporaneity studies formed a primary component of the individual locus chronologies by providing high-resolution sequences of feature abandonment during the Middle and Late Formative periods. Finally, the loci chronologies were combined, and an AM contemporaneity study was conducted for the entire site. The resulting synthetic chronology provides project analysts with the temporal framework necessary to address primary research themes, as well as to pursue other questions related to site use.

The analyses and discussion that follow are presented in five sections. In the first, a brief outline of the relevant culture history and chronology of southeastern Arizona is provided. The second section discusses the chronometric and archaeological methods used to build the chronology, including AM dating, radiocarbon dating, ceramic cross-dating, stratigraphy, and projectile point typologies. Next, the findings of these analyses are summarized by locus, and the results of each AM contemporaneity study are presented, followed by a synthetic contemporaneity study conducted for the site that highlights the broader temporal and spatial patterns of site use. Finally, the temporal data from all three loci are synthesized into the overall site chronology.

Overview of the Regional Cultural Chronology

The Mescal Wash site is located within a physiographic and cultural transition zone, and as such, residents of the community undoubtedly were affected by cultural trends in neighboring areas. In particular, developments in the Santa Cruz River floodplain to the west and the San Pedro and San Simon Valleys to the east would have impacted the trajectory of the local community. It is likely that people living at Mescal Wash were affiliated to some extent with one or more surrounding cultural traditions, and the social and cultural composition of the Mescal Wash population through time is one of several demographic questions that will be addressed through synthetic analyses. A holistic understanding of the community's development necessitates consideration of the larger world with which the population interacted. What follows is not an exhaustive discussion of regional chronological issues but, rather, a general overview of the more prominent signatures of culture history in southeastern Arizona. Because the nature of the population's social and ethnic composition through time is a key question, this overview is presented within broad developmental stages and periods and avoids invoking temporal units associated with specific traditions, such as “Hohokam” or “Mogollon”. For more-detailed discussions, the reader is directed to several recent regional syntheses (Clark et al. 2006; Van West et al. 1997:139–191; Whittlesey 2003; Whittlesey et al. 1994).

The Paleoindian Period

The earliest occupation of the Americas is attributed to the Paleoindian period (ca. 11,500–8500 B.C.). Paleoindians are generally described as organized in small, highly mobile bands of hunter-gatherers adapted to a climate that was significantly cooler and wetter than today (Martin and Plog 1973:44; Meltzer 1993). Paleoindian sites are often associated with the remains of such extinct animals as mammoth, camel, and giant sloth, a pattern that has led many to argue that the subsistence strategy of Paleoindians focused on the hunting of big game to the near exclusion of other resources (Kelly and Todd 1988; Waguespack and Surovell 2003). In recent years, a broader-based subsistence strategy has been proposed for Paleoindians, one that included the exploitation of a variety of plants, as well as the large animal species (see Meltzer and Mead 1985).

A number of Paleoindian traditions have been identified in the Americas, of which Clovis (ca. 11,500–11,000 B.P.) was the most widespread (Haynes 1993). Some of the best known of these early sites, such as Murray Springs, Naco, and Lehner Ranch, are located along the San Pedro River in southeastern Arizona (Haury et al. 1953, 1959; Hemmings 1970), but no evidence of Clovis has been located within the immediate vicinity of the project area.

The Archaic Period

The Archaic period (8500 B.C.–A.D. 1) in southern Arizona is much better documented than the preceding Paleoindian period. This is especially true of the latter part of the period and is largely the result of a recent surge in archaeological investigations related to development in and around the Santa Cruz River floodplain. Like the Paleoindian period, the Archaic period is usually characterized by an economy focused on the exploitation of wild plant and animal resources, although it differs from the Paleoindian period largely in the greater diversity of species that were used. The Archaic period has traditionally been divided into the Early (8500–4800 B.C.), Middle (4800–1500 B.C.), and Late (1500 B.C.–A.D. 1) subperiods (Huckell 1984b:136–142, 1995:16). Some alternatives to this scheme have been proposed, particularly as archaeologists have come to recognize that agriculture is considerably older in the southern Southwest than once thought. Most notably, Huckell (1995:16) has argued that the label “Early Agricultural period” should be used to designate the period between the initial appearance of maize agriculture in southeastern Arizona, at around 1500 B.C., and the widespread appearance of pottery, at roughly A.D. 200. This period encompasses the San Pedro Cochise, Basketmaker II, and En Medio Oshara and is equivalent to the Late Archaic period. Whittlesey (2003:52) pointed out that it is inappropriate to define the Archaic period in terms of subsistence, particularly because there are several large, permanent Late Archaic period sites in this region that have yielded no evidence of maize. In this study, we use the term “Archaic” to refer to the preceramic groups of southern Arizona following the Paleoindian period.

The Early Archaic period is poorly known in southern Arizona and is especially underrepresented in the material record. Many areas have yielded no direct evidence for an Early Archaic period occupation (Huckell 1984b:137). At present, the Early Archaic period is known primarily from sites along Whitewater Draw in Sulphur Springs Valley. These Early Archaic period deposits are characterized by abundant milling equipment and flaked stone tools.

In contrast to the Early Archaic period, the Middle Archaic period is relatively well known in southeastern Arizona (see Gregory 1999; Sayles and Antevs 1941; Waters 1986; Windmiller 1973). The basic pattern during the Middle Archaic period can be described as one concerned with the exploitation of a number of environmental zones. Small base camps and limited resource-procurement and resource-processing sites are common in upland and *bajada* environments (Whittlesey 2003:54). Diagnostic projectile points from this period include Pinto and Gypsum Cave points (Huckell 1984a:196).

The beginning of the Late Archaic period was marked by what appears to have been an intensification of human occupation in southern Arizona. During this period, settlements became larger and relatively more permanent than in preceding periods, and substantial evidence of maize agriculture, in the form of ubiquitous, carbonized maize, noticeably entered the archaeological record for the first time (Mabry 2005a). Because of recent archaeological discoveries in the Santa Cruz River floodplain (Ezzo and Deaver 1998; Gregory, ed. 2001; Halbirt and Henderson 1993; Mabry 1998), Cienega Valley (Huckell 1995; Stevens 2001), and the Borderlands of southeastern Arizona (Wegener et al. 2009), we now know substantially more about this period of time. In general, the Late Archaic period was a time of decreasing residential mobility and increasing incorporation of agricultural subsistence strategies, although the degree to which either was practiced most likely varied between groups (Mabry 2005a). Agricultural technologies were expanded to include water-control features, such as canals and ditches, but exploitation of seasonal resources in upland areas continued to be an important component of the overall subsistence and settlement pattern, as well (Whittlesey 2003:56). Numerous seasonally occupied, special-use camps that were utilized during the fall and winter months for gathering wild resources have been recorded in the upper *bajadas* of southern Arizona (Fish et al. 1992; Huckell et al. 1987; Roth 1996). These camps most likely complemented the habitation settlements located in lowland settings of southern Arizona, such as the intensively focused settlements in the Santa Cruz River floodplain (Mabry 1998) and the smaller habitation sites in Cienega Valley (Huckell 1995). In the Borderlands region, groups utilized *cienegas* and other high-water-table features for cultivating maize, and possibly domesticated cotton, during this time (Wegener et al. 2009).

A number of archaeological features have been documented at Late Archaic period sites, including small, round or oval structures; bell-shaped and straight-sided storage and cooking pits; extended burials; and the aforementioned water-control features, including ditches (Ezzo and Deaver 1998), canals (Mabry 1998), and wells (Gregory, ed. 2001). Typically, structures contained at least one intramural storage pit each. Additionally, large, circular structures have been recorded at several Late Archaic period sites (Halbirt et al. 1993; Mabry 1994) and have been interpreted as serving a ceremonial function (Whittlesey 2003:58). Artifacts recovered from these sites include San Pedro, Empire, and Cienega projectile points (Stevens and Sliva 2002); fired-clay beads and anthropomorphic figurines (Halbirt et al. 1993:100; Huckell et al. 1995); and marine-shell ornaments (Huckell 1995). In addition, incipient plain ware ceramics have been recovered from dated contexts at the Coffee Camp (Halbirt et al. 1993:66–67), La Cuenca del Sedimento (Henderson 1989:100), and Los Pozos (Heidke and Ferg 2001) sites, indicating that an early ceramic industry was in place by the end of this period.

The Formative Period

The Formative period (A.D. 1–1450) in southern Arizona spanned the time between the appearance of technologically sophisticated pottery (Whittlesey 2003) and the first Spanish expeditions. We employ the term “Formative” in the sense in which it was used by Willey and Phillips (1958:146)—to describe agrarian cultures that utilize ceramic containers for cooking and storage and that include living in sedentary villages for much of the year. Although many of these characteristics emerged during the Late Archaic period, Formative period groups displayed a higher level of social complexity and technological sophistication, as is evident in the emergence of diverse cultural traditions, such as Hohokam and Mogollon, as well as numerous as-yet-unnamed groups. In fact, the Formative period is characterized by several major sociocultural changes, the timing of which was remarkably similar throughout the greater Southwest. These changes can be generalized across three subperiods: the Early (A.D. 1–750), Middle (A.D. 750–1150), and Late (A.D. 1150–1450) Formative periods.

The Early Formative period (A.D. 1–750) in southern Arizona is a regional expression of a pan-southwestern tradition that includes the addition of an established ceramic-container industry to a Late Archaic period lifestyle (Deaver and Ciolek-Torrello 1995; Whittlesey 2003). During this time, groups throughout southern Arizona exhibited a fairly homogeneous culture pattern that only began to differentiate toward the end of the period. Subsistence practices during this time relied increasingly on maize agriculture and other cultigens, and residential mobility decreased correspondingly. Initially, this period is marked by the appearance of sand-tempered, plain brown wares in the form of small, neckless jars and out-curved bowls (Deaver and Ciolek-Torrello 1995; Huckell 1987; Whittlesey 2003). This early horizon is characterized by an expedient flaked stone technology combined with remnants of the Archaic period biface technology; a Late Archaic period milling stone assemblage; bean-shaped structures; large, communal houses; semiflexed inhumations; and cremations (Deaver and Ciolek-Torrello 1995:484–485). Between A.D. 300 and 500, slipped and polished red wares were introduced into the ceramic assemblage. Vessel size increased, new forms were introduced during this time, and divergence in ceramic technology began to appear. Expedient reduction technology continued to dominate the flaked stone assemblage, although bifaces still occurred, and ground stone consisted of a generalized milling assemblage. Small, domestic pit structures and deep, communal houses continued to be built, and they increased in size and formality (Whittlesey and Ciolek-Torrello 1996:58). By A.D. 650, and possibly as early as A.D. 500 (Dean 1991), brown pottery painted in simple, red, broad-line patterns appeared throughout the region. Design styles were extremely similar during this time and reminiscent of Late Archaic period rock-art styles (Deaver and Ciolek-Torrello 1995:486). The broad-lined patterns became finer lined and more complex by the end of this short horizon, at which point major technological shifts in pottery production led to the development of multiple, recognizably different pottery traditions.

Clear differences in painted-ceramic styles were apparent by roughly A.D. 700, and these, combined with other salient changes in material culture and social organization, marked the beginning of the Middle Formative period (A.D. 750–1150). Unique configurations of architecture, mortuary practices, iconography, and other aspects of material culture and site structure appeared during this time, and these signaled the emergence of distinctive cultural traditions, such as the Hohokam, Mogollon, and Trincheras in southern Arizona. The differences among these and other cultures in the greater Southwest increased throughout this period, such that different regions have become immediately identifiable with specific groups. For instance, the archaeological record from the Phoenix Basin is characterized by the appearance and growth of the Hohokam culture for much of this period. In southeastern Arizona, distinctive Hohokam cultural traits, including buff ware pottery and Hohokam iconography, are concentrated in the Santa Cruz Valley. By the end of this period, these groups had developed large communities based on floodwater and irrigation farming, produced red-on-brown painted pottery, established a regional exchange and communication network associated with a ball-court complex, created a well-developed cremation-burial ritual, and forged trade relations with cultures to the south, including Trincheras groups in present-day northern Mexico. Likewise, hallmarks of the San Simon Branch of the Mogollon culture appeared throughout the San Simon Valley in southeastern Arizona during this time (Sayles 1945; Van West et al. 1997; Whittlesey et al. 1994). During the early and middle part of this period, these groups produced polished, brown plain ware pottery; red-slipped pottery; and red-on-brown painted pottery and constructed deep, bean-shaped or rectangular pit houses that had side entryways and were clustered in hamlets or small villages. Corrugated utility pottery was added to the repertoire toward the end of this period, and surface structures built in contiguous room blocks replaced the pit-house villages. Room blocks contained rectangular kivas, or ceremonial rooms, and were built around public spaces.

The Late Formative period (A.D. 1150–1450) was marked by widespread changes throughout the greater Southwest, including sociopolitical and economic reorganization, population movement, and changes in architectural styles and iconography (Adler 1996; Clark 2001; Clark et al. 2006; Hill et al. 2004; Lyons 2003; Nelson 1999; Spielmann 1998). The timing and nature of these changes varied throughout the region and affected the various populations differently. In the Santa Cruz Valley, a distinctive Tucson Hohokam regional system developed in place of the declining and contracting Salt-Gila network. Platform mounds replaced ball courts as the primary form of communal architecture, and pit houses were replaced, first by adobe-lined, semisubterranean pit rooms and later by adobe surface structures organized into room blocks. Ceramic assemblages from this area were dominated by Tanque Verde Red-on-brown pottery in the early part of this period, and polychrome styles were abundant during the later part. Further east, the Salado phenomenon emerged, as indicated by the clustering of large sites, the appearance of specific iconography, and the production of distinctive, widely traded, painted ceramics (Crown 1994; Dean 2000). Many sites in the lower San Pedro Valley have exhibited characteristics attributed to this phenomenon, including cobble-and-adobe-masonry architecture, single-story room blocks organized around a central plaza, and abundant Salado ceramics. In addition, evidence for the influx of northern groups from the Kayenta/Tusayan region during this time has been recorded at a number of these lower San Pedro Valley sites, as well as at sites in the Safford area (Clark et al. 2006; Di Peso 1958; Lindsay 1987; Lyons 2003; Woodson 1999). In contrast, sites in the middle and upper San Pedro Valley have displayed characteristics suggesting that, during the second part of this period, these groups participated in or were influenced by the expansive Casas Grandes interaction sphere to the south and east (Van West et al 1997). Ceramic assemblages from this time were dominated by the micaceous, locally produced Babocomari Plain and Chihuahuan-inspired Babocomari Polychrome wares. Rectangular surface structures were constructed from puddled adobe or adobe-and-cobble masonry and arranged around courtyards or plazas.

The Protohistoric Period and Spanish Colonial Era

Our understanding of the indigenous populations of southern Arizona after the fifteenth century is limited and primarily comes from European historical documents. European explorers first ventured into southern Arizona in the sixteenth century, and early accounts indicate that the prehistoric period populations of southern Arizona were replaced by Upper Piman peoples. These groups established large settlements in the Santa Cruz and San Pedro River valleys and farmed the productive floodplains (Ravesloot and Whittlesey 1987; Seymour 1989). At some point during this time, bands of Chiricahua Apache expanded into this area, and Western Apache bands routinely traveled the region. These groups were highly effective raiders who viewed the agrarian populations of southern Arizona as important subsistence resources (Basso 1983), and by the end of the 1600s, Apache raids were common in this area.

Spanish colonization of the region began toward the end of the seventeenth century with excursions by explorers and missionaries, such as Father Eusebio Francisco Kino, down the Santa Cruz and San Pedro Rivers. By the first decade of the eighteenth century, several missions and numerous *visitas* had been established throughout the region. With the death of Kino in 1711, the Spanish military began to assume more power, and perhaps not unexpectedly, unrest developed among the Piman groups, leading to the Pima Indian Revolt of 1751 (Whittlesey 2003). In the 1770s, Apache raiding increased to the point that Piman and Spanish groups abandoned the San Pedro River valley and relocated to the settlements along the Santa Cruz River (Van West et al. 1997). Aggressive military action by the Spanish eventually reduced the Apache threat, and a relatively peaceful period lasted from roughly 1787 to 1821.

Methods and Data

A variety of chronometric- and archaeological-dating techniques were used to assess the ages of investigated features and to develop the locus and synthetic site chronologies. The chronometric effort emphasized AM dating (see Appendix 2.A), although several radiocarbon dates were obtained for specific contexts, as well (see Appendix 2.B). Dendrochronology was attempted by submitting 12 tree-ring samples to the University of Arizona Tree-Ring Laboratory, but none could be dated against the existing chronologies. This study also utilized temporal information from contextual stratigraphy, ceramic cross-dating, and projectile point typologies to place different archaeological contexts in time. Detailed analytical information for the latter two sets of data are provided in Chapters 3 and 4, respectively, of this volume, and descriptive information on feature stratigraphy is presented in the individual feature descriptions and associated tables in Volume 1.

The extent to which each technique contributed to the age estimate for a specific feature depended in large part on the total suite of available temporal data. Each of the employed techniques differed, in the resolution that could be achieved, the type of material(s) that could be dated, and the confidence with which the event dated through the technique (i.e., dated event) could be related to the age of the feature (i.e., target event). In general, both chronometric techniques (AM and radiocarbon) are superior in resolution and relevance to the target event, but the application of these techniques is limited to specific contexts, such as thermal features. Ceramic data, on the other hand, typically provide less-precise date ranges; therefore, the relevance of these date ranges to the ages of specific features was more difficult to ascertain. But ceramic artifacts were available for a wider range of features and, in many cases, provided the only temporal information. Likewise, stratigraphic relationships often provided the only means of dating features, but in these cases, the dated event could be related easily to the target event, although the resolution of dates estimated through this technique was very low because the dates reflect only the earliest or latest possible age of a feature. Finally, projectile points primarily provided confirmation of age estimates arrived at through other techniques. Both the temporal resolution and the contextual relevance of diagnostic projectile points were very low, and tentative age estimates were provided only for features from which no other temporal information was recovered.

Through these combined sources of temporal information, the ages of 252 investigated features could be estimated (see Appendix 2.C). In determining the age estimates, preference was given to chronometric data, when available. For features with multiple AM-dating options, ceramic and/or stratigraphic data were used to determine the most likely options. In the absence of chronometric data, the archaeological data were assessed, and the most informative combinations were employed. For some contexts, the painted-ceramic collection provided the best age estimate for a feature. Others could be dated based on their stratigraphic positions between chronometrically dated features. Still others were dated through a combination of stratigraphy and ceramic collections. In every case, all possible combinations of temporal information were considered before an age estimate was assigned.

AM Dating

This project emphasized AM dating because of its ability to inform on the potential contemporaneity of features as well as to provide calibrated chronometric information. Efforts were made to collect an AM sample from every structure encountered at the site and from most excavated extramural thermal features. To this end, many structures were probed or stripped in an effort to locate hearths for sampling. In total, 107 samples were recovered from 88 features across the three loci. As discussed in Appendix 2.A, 94 of these samples were measured and analyzed, and 79 produced reliable AM data.

The principles of AM dating and its use in the Southwest have been well documented (DuBois 1975; Eighmy et al. 1980; Sternberg 1990; Sternberg and McGuire 1990a) (see also Appendix 2.A) and need not be elaborated here, although this discussion benefits from a review of some of the unique benefits and problems associated with the technique. There are three fundamental advantages to utilizing AM dating over other dating methods available to archaeologists. First, the dated event—the time of magnetic acquisition—is almost always directly related to an event of archaeological interest, such as the last use of a feature. Second, the technique allows the archaeologist to directly date an archaeological feature, rather than associated artifacts, and so the randomizing effects of many postdepositional formation processes have less of an impact. Finally, dates accurate to within 50 years are possible for features that date to the well-dated and robust segments of the established Southwest secular variation curve (Sternberg and McGuire 1990b:127).

There also are limitations to AM dating that must be taken into consideration. The most pervasive of these relates to the sinusoidal nature of geomagnetic secular variation. The path of secular variation, or positional changes in the geomagnetic north pole through time, is fairly random and often reverses direction. This is evident in the loops and kinks of secular variation curve SWCV2000 (Lengyel and Eighmy 2002), which provides the most recent depiction of geomagnetic secular variation in the U.S. Southwest over the past 2 millennia. By chance, two of the directional shifts in secular variation occurred during important cultural transitions in the Southwest. The first took place between approximately A.D. 700 and 900, immediately following the transition between the Pioneer and Colonial periods of the Hohokam chronology. The second took place between A.D. 1050 and 1200 and encompassed the transition between the Middle and Late Formative periods. During these periods, the magnetic data recovered from an AM sample may intercept the secular variation curve at several places and produce multiple date-range options. In these cases, supplemental contextual data, such as ceramic associations and stratigraphic relationships must be used to select the most likely option(s). As discussed below, this quirk of secular variation holds implications for high-resolution contemporaneity studies, as well.

Calendrical Dating

AM calendrical dating involves a process of comparing the AM-pole position calculated for a sampled feature with a master reconstruction of the ancient pattern of regional secular variation. The Mescal Wash data were statistically dated against Southwest dating curve SWCV595 (LaBelle and Eighmy 1997). This curve was used instead of the more recently developed SWCV2000 because it is compatible with the statistical-dating method developed by Sternberg (Sternberg 1982:104–105; Sternberg and McGuire 1990b:125–129). SWCV2000 is a modification of SWCV595 that provides a better visual depiction of Southwest secular variation, but it lacks the statistical parameters necessary to be used for statistical dating at this time. For this reason, SWCV595 was used to date archaeological features from this project, but AM data are presented visually against SWCV2000.

Seventy-one of the 79 acceptably precise (α_{95} of less than 9°) AM samples produced one or more date ranges against SWCV595. All date-range options are reported (see Appendix 2.A), but only the options that best fit the archaeological data (e.g., associated ceramic collections) were included in the chronological analysis (see Appendix 2.C). Furthermore, one of the datable samples (SRI 2393) produced a suspiciously late date range, and it is likely that the sampled feature predated the early end of the curve. For this reason, the AM date range was excluded from further analyses, reducing the total number of datable samples to 70.

The remaining eight acceptable, but undated, samples fell into two categories. Two of the samples produced VGP locations that are consistent with a pre-curve age, and it is likely that they were magnetized prior to A.D. 585, the earliest extent of the dating curve. The remaining six samples produced data that were consistent with a suggested revision to the Southwest curve (Lengyel and Eighmy 2002). These data were located near, but were statistically different from, segments of the A.D. 700–900 loop in SWCV595, and it was hypothesized that these samples were magnetized at some point during this time range (see Appendix 2.A). Additional archaeological evidence from the sampled contexts supported this hypothesis, and the tentative AM dates (e.g., near A.D. 850) were included as minor components in the respective age estimations.

The 70 dated samples were collected from 60 features: 7 in Locus A, 12 in Locus C, and 41 in Locus D. Multiple AM-dating samples were collected and measured from 3 structures in Locus A (Features 200, 2157, and 2160), 3 structures in Locus C (Features 6098, 6129, and 6153), and 5 structures in Locus D (Features 438, 1575, 3679, 4682, and 4768). The data collected from each structure were compared using the statistical tests of McFadden and Lowes (1981) to determine whether they represented the same archaeological event. If this was found to be the case, the data were combined, and a composite mean was calculated for the structure. The composite mean was then dated against SWCV595, and the best dating option was used to estimate the age of the feature. If, on the other hand, the sample data were found to be statistically different, they were not combined, because it was possible that they reflected temporally different events. Differences in directions also can be due to some unknown mechanical displacement (e.g., bioturbation of floors or settling and shifting of walls) of one or more of the samples. In these cases, the integrity of each sample and its likeliness to reflect the target event (e.g., abandonment of the structure) were assessed, and the data from the best sample were used in subsequent analyses.

Contemporaneity Studies

When AM data from sets of features are compared directly to each other, it is possible to ascertain the sequence and potential contemporaneity of these features. The assumption underlying this approach is that archaeological materials magnetized parallel to the same field (i.e., contemporary features) will exhibit the same AM directions, whereas materials magnetized parallel to different fields (i.e., noncontemporary features) will exhibit different AM directions. The technique used to assess this relationship is the same one used to compare a sample virtual geomagnetic pole (VGP) with the AM-dating curve to obtain a calendar date (Sternberg and McGuire 1990b). It involves a series of statistical tests (McFadden and Lowes 1981) used to evaluate the similarity between two archaeomagnetically determined VGPs. These pairwise calculations test the null hypothesis that, all things being equal, two sample VGPs share a common true mean VGP and were therefore magnetized parallel to the same field. By convention, this test is run at the 5 percent significance level, meaning that if the probability of the F-statistic, F(*p*), is calculated to be less than 0.05, the null hypothesis is rejected, and it is concluded that the VGPs are different. Pairs of VGPs for which F(*p*) is less than 0.05 are said to be statistically different.

It is important to note that, because the F-test is run under the assumption that the two VGPs are the same, the calculated F(*p*) value is simply the probability that the value of the F-statistic, or the measured difference between the two VGPs, is due to chance. It is not the probability that the two VGPs are the same (i.e., the probability that H_o is correct), nor is it the probability that the two VGPs are different (i.e., the probability that H_a is correct). But common sense dictates that, as F(*p*) approaches the critical value—that is, as the probability that the measured difference is due to chance decreases—the likelihood that two VGPs are the same and, therefore, that they were magnetized parallel to the same field diminishes, as well. In practice, then, we assume that archaeological features that produce statistically different VGPs were magnetized at different times and, therefore, were not contemporary. On the other hand, archaeological features that produce statistically indistinct VGPs with respect to the critical value (i.e., $F(p) \geq 0.05$) *may* have been magnetized at the same time and, therefore, *may* have been contemporary. The reality of this relationship cannot be determined statistically, because it is assumed, a priori, that the features were contemporary. Again, common sense dictates that, in most cases, as F(*p*) approaches 1, the likelihood that the two features were, in fact, contemporary increases, because the measured difference between the associated VGPs, as indicated by the F-statistic, decreases. Obviously, this likelihood is stronger for pairs of VGPs with small error limits, as indicated by high precision values and low α_{95} values.

It should be noted that the cyclical nature of secular variation makes it possible for two temporally discrete samples to have statistically indistinct VGP locations. Therefore, it is necessary to use other lines of archaeological data to determine whether a contemporaneity test between two VGPs is appropriate. For instance, an AM direction acquired around A.D. 1025 will be statistically indistinguishable from an AM direction acquired at roughly A.D. 1250, but the two events will have occurred at measurably different times. One way to avoid this is to treat the unique location of the A.D. 1100 minimum as a pivot point with which to divide the data set into pre- and post-A.D. 1100 subsets. Because this minimum coincides roughly with the transition between the Middle and Late Formative periods, archaeological data, such as associated ceramic collections, can be used to place these features within the correct subsets.

Conversely, the rapid rate of secular variation and the poor temporal resolution of certain segments of the curve (e.g., A.D. 900–1050) create the situation in which two VGPs with similar AM calendar dates may have statistically different locations. In this case, contemporaneity tests can be used to temporally order events at a finer resolution than can be achieved through calendar dating. Relative sequencing can be achieved because the direction of secular variation is known for these periods. For instance, there is a westerly flow of secular variation between A.D. 900 and 1100, so younger sample VGPs will have a more westerly location during this time.

Contemporaneity studies were undertaken for each of the three loci investigated and for the project as a whole. Essentially, this involved calculating the F(*p*) value for each pair of VGPs in the study and then using a hierarchical clustering analysis to identify possible groups of similarly aged features. This analysis is based on the assumption that the F(*p*) value serves as a proxy indicator of the similarity between two VGP locations and their associated precisions. Theoretically, a group of similarly aged features will produce similarly located VGPs, and these VGPs will produce relatively high F(*p*) values when compared to each other. Ideally, then, scrutiny of the pattern of F(*p*) values within a large data set should reveal internally consistent and mutually exclusive groups. In reality, though, this does not always occur. Sometimes, the paradoxical situation arises in which A and B are similar, B and C are similar, but A and C are statistically different. Usually, the F(*p*) value for one of these pairings will be higher than the other, and comparison with a larger data set will reveal a more robust pattern of similarity among a group of VGPs. In addition, archaeological information, such as stratigraphy, may help to eliminate one of the paradoxical pairings. In the end, though, the resulting clusters may contain one or more pairs of statistically distinct VGPs, and pairs of statistically similar VGPs may be split between separate clusters. Ultimately, the membership of individual features within specific clusters must be evaluated through other archaeological information.

For all three loci, only data with α_{95} values of less than 5.0° were included in the study. A series of pairwise statistical comparisons were conducted on the relevant data set, and the results were organized into a two-dimensional matrix of F(*p*) values (see Appendix 2.D). Because a VGP compared with itself will have no measurable difference, all F(*p*) values along the main diagonal of the matrix equal 1. On the other hand, statistically different pairs of VGPs had F(*p*) values of between 0 and 0.05; for ease of analysis, these relationships were converted to 0. The resulting matrix was imported into SYSTAT 7.0 as a similarity matrix for cluster analysis. Because the F(*p*) values serve as a standardized proxy measure of the spatial distance between pairs of VGPs, Euclidean distances were calculated from these values and used to group VGPs via the single-linkage clustering algorithm. Intuitively, this was the most appropriate algorithm because it groups data based on their measured proximity. The validity of resulting clusters was evaluated through archaeological and stratigraphic data. Finally, the relative locations of the clusters within a given data set were compared to the known direction of secular variation for the respective time periods, in order to ascertain the sequence of events represented by the clustered VGPs. In this way, the probable sequence of abandonment events could be discerned for each locus.

Radiocarbon Dating

Eleven macrobotanical samples recovered from 10 features in Locus D of the Mescal Wash site were submitted to Beta Analytic, Inc. (Beta), for radiocarbon dating (see

Appendix 2.B:Table 2.B.1). In all cases, the accelerator mass spectrometry (AMS) method of analysis was used. In addition to the measured and corrected radiocarbon ages, Beta supplied calibrated radiocarbon ages for each sample. These results were calibrated to calendar years via the Pretoria Calibration Procedure (Talma and Vogel 1993) and using the Intcal98 (Stuiver et al. 1998) calibration data set. The two-sigma calibrated results reported by Beta were used in this study. Subsequent data manipulations, including calculation of combined radiocarbon dates, were conducted via OxCal 3.10 (Bronk Ramsey 1995, 2001) using the Intcal04 (Reimer et al. 2004) calibration data set.

Radiocarbon dating is one of the most widely employed chronometric techniques, and the principles of this method (Taylor 1987) generally are well understood by archaeologists. Furthermore, most researchers recognize that the event dated through the radiocarbon method is the death of the sampled organism and that this event may or may not relate directly to the archaeological event of interest. Wood charcoal, for instance, has the potential to produce dates that significantly predate the archaeological event (Schiffer 1982). There are a variety of reasons for this. First, only outer rings of most woody species are alive, and so radiocarbon assessment of the inner rings of long-lived species can significantly predate the death of the tree. Second, dead wood preserves well in arid environments, such as the Sonoran Desert, and may have served as a source of fuel woods for past groups. In such cases, the death of the tree could significantly predate the use of the wood in prehistory. Similarly, architectural wood scavenged for fuel wood would introduce a lag between the death of the tree and the final introduction of the wood into the archaeological record. These problems are exacerbated if the samples are drawn from fill contexts, which generally postdate the use of a feature by an indeterminate amount of time.

These problems usually can be mitigated through judicious sample selection. For instance, the problems associated with the use of old wood can be alleviated by obtaining radiocarbon measurements on short-lived organisms. In this study, we made an effort to select only annual-plant remains, such as seeds and nut shells, for dating. Furthermore, rigorous attention to the contextual integrity of the selected materials can help to increase the likeliness that the dated event and the target event were coeval. To this end, we preferentially selected datable materials recovered from sealed contexts and floor fill. In the event that no such context was available for specific feature classes that we wished to date, samples were selected from the features that displayed the least amount of postabandonment mixing, as indicated by trash fill. Finally, the question of how many samples to date from any given context is a thorny issue that most recently has been addressed through the Bayesian statistical framework (Bayliss and Bronk Ramsey 2004; Buck and Christen 1998). Researchers have suggested employing a risk-analysis approach, to balance monetary cost against potential information gain when determining the optimal number of samples to submit from a particular context, but given our limited budget for radiocarbon dating, our desire to date primarily annual-plant remains, and the variety of features we wished to date, we decided to submit only one sample for AMS measurement from each context. An exception was made for a particularly good bell-shaped pit (Feature 3983) that exhibited excellent contextual integrity and produced a large amount of charred walnut shells; two samples were submitted from this context.

The specific features that we chose to date through the radiocarbon method fell into three general categories, based on different goals for the project. First, we targeted features that were mostly likely to be Late Archaic or Early Formative period in age because this method offered the best means of obtaining chronometric data for these contexts. Specifically, we targeted extramural bell-shaped pits because they are associated primarily with these periods and because they had potential to inform on the local food economy during this time. Second, we chose to date a few of the bell-shaped and rock-lined roasting pits that had produced ambiguous AM results. The AM data from this set of features were relatively imprecise, and it was unknown whether the Middle Formative period AM dates obtained for these features were accurate or the features actually predated the Southwest curve. Radiocarbon samples were submitted from three of these features (Features 3668, 4871, and 7827) to address these problems. Finally, we chose to date at least one of the presumably Late Formative period adobe structures encountered at the site, in order to verify this assessment and narrow the age estimate for these features. AM data recovered from these features indicated that they more likely were abandoned sometime during the latter half of the period, but the Southwest curve is fairly imprecise for this time, and only large date ranges are possible. In contrast, the radiocarbon calibration curve (Reimer et al. 2004; Stuiver et al. 1998) is fairly steep between A.D. 1200 and 1500, and calibrated date ranges of 80–150 years are possible. So, a sample was submitted from one of the adobe structures (Feature 4729).

Stratigraphic Dating

Typically, stratigraphic relationships are fairly straightforward, and the sequence of construction events indicated by these relationships can form the backbone of the chronology. In some cases, it was difficult to ascertain which of two features was intrusive to the other. Given the law-like status of superpositioning, it is crucial that field assessments of stratigraphic relationships are accurate; therefore, ambiguous relationships were excluded from this study.

A total of 245 direct stratigraphic relationships were recorded across the site. The majority of these (71 percent) were present in Locus D, which exhibited the most complex occupational history of the investigated loci.

These relationships were used in conjunction with AM and radiocarbon dating to help refine the temporal relationship between sets of features. In many cases, a feature could be dated only through its stratigraphic positioning with respect to one or more features dated through other means. A conservative approach was used, and these features were given a maximum and/or minimum age limit, based on their relationships to other dated features. For instance, a pit located beneath a structure with an estimated age of A.D. 900–1100 would be assigned the minimum, or most recent, age of A.D. 1100. This is because the pit had to have been abandoned by the latest possible age of the overlying structure. Conversely, the earliest that a pit could have intruded the abandoned structure was A.D. 900, and in the absence of other temporal information, this would be assigned as the maximum, or oldest, age of the pit.

In the case of stratified sets of archaeomagnetically dated features, stratigraphy was used to identify the best dating option. These relationships also helped to structure the contemporaneity study in Locus D, because superimposed structures had to be noncontemporaneous, regardless of the calculated F(*p*) value. Furthermore, for early Middle Formative period pairs of stratified features (A.D. 700–900), the directional trend between the VGPs of superimposed features could be used to determine whether one of the features predated or postdated the A.D. 825 latitudinal minimum of the AM curve. As with the A.D. 1150 latitudinal minimum discussed above, the A.D. 825 latitudinal minimum can be treated as a pivot point within the A.D. 700–900 loop in the dating curve. If stratified VGPs from this time period trend away from the rotation axis, the earlier of the features would have predated this minimum. Likewise, when stratified VGPs trend toward the rotation axis, the younger feature must have postdated the minimum. These rules allowed statistically indistinct VGPs to be segregated into temporally different subsets.

Ceramics

Ceramic cross-dating is widely used in the Desert Southwest to obtain temporal estimates for specific contexts or general occupations. This technique uses well-dated ceramic types, typically tree-ring-dated painted wares from the Colorado Plateau, as index fossils to estimate when specific features or portions of sites were in use. Although cross-dating can provide broad chronological control, the disconnect between the ceramic date and the target event (e.g., the use of the feature) can prove problematic. Ceramic styles are temporally sensitive only in that they are manufactured within a particular social environment during a particular period of time. The style in question is encoded with information that is socially meaningful within that environment. What we date is the time during which that information had a social meaning, or the time that a particular style was in vogue. How and when an artifact bearing that style ended up within a particular depositional context are questions that need to be addressed through other archaeological information. It cannot be assumed, although it often is, that the artifact in question was used and deposited during the time associated with its style. Many behavioral and natural processes can lead to redepositional episodes, such as recycling of projectile points or ceramic sherds or erosion and transport of deposits to new areas. The inference that a group of sherds, for instance, originated in a localized pot bust is strengthened when a large number of sherds of the same type are recovered from a single locale, but the temporal relationship between the manufacture of the pot and its breakage and deposition in the recovery locale is unknown. Realistically, a given artifact could have been deposited at any point after it was created. The associated production dates are offered as guidelines and hypotheses about when activities may have taken place at a given locale.

Ceramic artifacts were used in this study to estimate the ages of individual features and to identify periods of more-intensive use for each locus. Whenever possible, the painted-ceramic collections recovered from individual features were used in conjunction with other chronological data to estimate the ages of individual features. The extent to which ceramics contributed to these estimates depended in large part on the composition and context of the recovered collection, as well as the availability of chronometric data. When chronometric data were available for a given feature, the ceramic collection was used to verify the contextual integrity of the chronometric data, particularly for radiocarbon dates, or to identify the most likely of multiple dating options, as with AM dates. In the absence of chronometric data, the production date range(s) for whole or partially reconstructible painted vessels, particularly those recovered from structural-floor contexts, provided the best age estimate for a feature. But only 27 painted vessels were recovered from a total of 15 features across the site (excluding burials), and only 15 of these vessels were recovered from relatively strong contexts. So, the ages for many features were estimated, at least partially, from the production date ranges associated with the respective painted collections. Whenever possible, emphasis was placed on the portion of the collection recovered from strong contexts, such as de facto floor deposits in structures, but the majority of ceramic dates were based on fill collections. Given the problems of associating fill artifacts with feature use, collections were placed within one of four broad temporal periods, based on the production dates for the majority of the associated painted sherds. These ceramic periods coincided with the first and second halves of the Middle and Late Formative periods: A.D. 750–950, A.D. 950–1150, A.D. 1150–1350, and A.D. 1350–1500. When no clear majority could be discerned, the total production date range was used to estimate the age of a feature. Approximately 109 features were at least partially dated in this way, and

30 of these were dated solely through the painted-ceramic portion of the total recovered collection.

In the absence of other temporal information, the recovery of plain ware, red ware, or indeterminate painted-ceramic artifacts provided a conservative estimate of the feature's maximum, or earliest, age. In all cases, an assigned date was based on estimates of the earliest appearance of the respective ceramic type. For instance, Deaver and Ciolek-Torrello (1995) placed the appearance of ceramic-container technology in southern Arizona at around A.D. 1. This agrees with the early end of the 95 percent probability range (A.D. 4–569) that Lindeman and Wallace (2004:Table 2) calculated for the Plain Ware horizon. Only ceramic-container plain ware artifacts, as opposed to "incipient" plain ware artifacts (see Heidke 1999; Heidke and Ferg 2001), were recovered from Mescal Wash contexts. Therefore, a conservative estimate for the age of features from which only plain ware ceramics were recovered is post-A.D. 1. This estimate is stronger for features that contained larger ceramic sherds (i.e., greater than 5 cm^2), because smaller sherds are more likely to indicate heavily transformed deposits (Beck 2006). Likewise, red ware ceramics are thought to have been introduced into assemblages in southeastern Arizona by as early as A.D. 300 (Dean 1991:79; LeBlanc 1982), and this estimate was applied to contexts from which red ware ceramics were recovered. Finally, an early estimate of A.D. 500 (Deaver and Ciolek-Torrello 1995) was applied to contexts from which indeterminate painted-ceramic sherds were recovered. Typically, these painted sherds were too small to be identified beyond a general type (e.g., red-on-brown or buff ware); therefore, more-refined temporal estimates could not be obtained. In total, 55 features were assigned early age estimates in this way. It is likely that the ages of most, if not all, of these features postdate these maxima, but this cannot be confirmed without additional information.

Projectile Points

As with ceramics, regional sequences of flaked stone tools have long been used for chronology building (Flenniken and Wilke 1989). These regional sequences tend to be better developed in other areas of the U.S. (see Justice 1987) but still can provide useful temporal information for sites in the Southwest. Typically, projectile point styles changed slowly and had long periods of production and use. As a consequence, they primarily were used in this study to identify activities that took place within fairly broad cultural periods, namely the Middle Archaic, Late Archaic, and Formative periods. Furthermore, the common recovery of Late Archaic period projectile points from Middle or Late Formative period structures and other features at Mescal Wash indicated that these later groups often scavenged and recycled points manufactured by much earlier individuals. Because of this tendency, less emphasis was placed on diagnostic projectile points when assessing the probable age of a feature.

The extent to which diagnostic projectile points contributed to the age assessment of a feature depended in large part on the availability of other temporal information for that feature. Late Archaic period points, such as San Pedro or Cortaro dart points, provided a maximum age of feature use. When these points were recovered in conjunction with younger temporal information, such as painted ceramics, later projectile points, or chronometric data, they were assumed to reflect recycling behaviors. When they occurred in conjunction with similarly aged chronometric data, such as radiocarbon dates, they provided independent validation of the contextual association of the dated materials (e.g., botanicals). For features from which no other diagnostic artifacts were recovered, Late Archaic period points provided tentative information about the age of a feature.

Middle Formative period points, such as Rincon or Hohokam serrated arrow points, provide a better temporal estimate for the ages of features because there is a shorter time for these points to have been recycled and redeposited by later individuals. Although these points do not provide a conclusive age estimate by themselves, they do provide secondary support for other sets of temporal data.

Locus Chronologies

Of the three fully investigated loci, only Locus A appeared to represent a discrete archaeological locality. Loci C and D most likely connected prior to modern road construction. These areas were excavated as separate localities, and many of the analyses were structured within these areas. Therefore, it seemed appropriate to develop individual locus chronologies that could be combined into a synthetic site-level chronology.

Each locus chronology is summarized visually by a weighted probability curve that is generated through a modified version of the pooled probability method developed by Eighmy and LaBelle (1996). Although this method was developed as a means of calculating pooled, calibrated age ranges for groups of radiocarbon dates, it can be extended to examine the temporal distribution of dated features in a given locale. In essence, the curve depicts the proportion of dated features that could have been in use at any given point during the use life of that locale. It is assumed that peaks in the curve correlate with more-likely periods of occupation, as indicated by a greater potential number of features in use. The method used here treated the date ranges for the individual features as flat, uniform probability curves. So, there is an equal probability that the feature could have been abandoned during any single year within its date range, and this probability is 1 divided by the total interval. The composite probability curve was generated for a locale by summing the individual probabilities of all datable features and was standardized to 1 by dividing the total value for each year by the total area under the curve. This approach has the advantage that imprecisely dated features contribute less to the composite probability curve. It should be noted that only features with discrete date ranges were included in these curve calculations; therefore, most features dated through stratigraphy or the presence of plain ware ceramics were excluded.

In developing these chronologies, the key issues of persistent place and cultural composition were considered. From a temporal perspective, a persistent place on the cultural landscape would exhibit few, if any, hiatuses in activity over extended periods of time. Brief occupational hiatuses dictated by normal cultural movement (e.g., seasonal or annual rounds) would not be discernable at the resolution of the available chronometric methods, particularly during less-well-dated time periods (e.g., the Late Archaic or Early Formative period), and such behavior would not contradict the interpretation of a persistent place, although longer spans, on the order of multiple generations, should be identifiable, and an extensive pattern of long breaks between periods of activity might indicate that the locale did not represent a persistent place.

The nature of group membership can be addressed by ascertaining whether synchronic cultural deposits contain artifact signatures from different cultural groups. The following locus chronologies provide the framework necessary for identifying these signatures. Furthermore, the AM contemporaneity studies undertaken for each locus were uniquely suited for assessing the temporal relationships among the different styles of domestic architecture encountered at Mescal Wash, which, in turn, can inform on the cultural composition of the population at specific points in time. This is because domestic architecture has been shown to be subject to isochrestic variation and therefore serves as a good indicator of cultural affiliation (Clark 2001; Stark et al. 1998). Of particular interest is the potential contemporaneity of traditional Hohokam-style houses-in-pits with the unique recessed-hearth-style (RHS) pit structures found at the site. RHS pit structures have been documented at Gleeson near the Dragoon Mountains (Fulton and Tuthill 1940) and at Tres Alamos in the lower San Pedro Valley (Tuthill 1947:Figure 3, No. 40), and they appeared to reflect the presence of non-Hohokam-affiliated individuals at Mescal Wash. These structures each contained a large, circular or D-shaped, recessed area located inside the house, in front of the entryway, and each structure's hearth was constructed in the center of the recessed area. In one part of the site, these unique structures were replaced by more-traditional Hohokam-style houses-in-pits (see the Locus C discussion, below), suggesting that a sequential, rather than coeval, relationship occurred.

Locus A

Locus A was an isolated farmstead in the northeast portion of the Mescal Wash site. Eight structures, including 3 with recessed-hearth areas (Features 200, 2160, and 2192), and 38 extramural pits located within the confines of this locus were excavated (see Figure 6, this volume). Eleven AM samples were recovered from the 8 excavated structures, and AM date ranges were obtained for all but 1 of these (Feature 2192) (Table 4). In addition, 5 tree-ring

Table 4. Archaeomagnetic Dates for Features in Locus A

Feature No.[a]	Sample No.[b]	α_{95}	k	Date Ranges (years A.D.)
200	SRI 4000—avg (SRI 2361 and SRI 2362)	1.7	320.86	935–1040, 1185–1315
207	SRI 2366	3.7	149.60	935–1390
290	SRI 2364	2.9	285.57	1010–1290
1189	SRI 2365	4.2	133.08	935–1040, 1210–1565, 1635–1690
2160	SRI 4002—avg (SRI 2368 and SRI 2405)	2.7	135.43	935–1040, 1185–1390
2157	SRI 4001—avg (SRI 2369 and SRI 2404)	1.9	339.72	935–1040, 1185–1215, 1235–1315
2192	SRI 2403	11.7	16.13	no date
2195	SRI 2367	3.5	191.80	585–740, 860–915, 935–990, 1535–1565

[a] All pit structures.

[b] The designation "avg" indicates a composite sample; the combined sample numbers are listed in parentheses.

samples were collected from Feature 200 and submitted for dendrochronology, but they could not be dated against the existing tree-ring chronologies. No other chronometric samples were recovered from this locus.

There was a noticeable lack of stratigraphy among the structures in this locus (see Figure 6, this volume), suggesting that this part of the site was occupied fairly briefly in comparison to other areas of the site. In fact, only two of the structures (Features 2157 and 2192) were superimposed with other features, and in each case, the structure was intruded by a later extramural feature. Two other structures (Features 200 and 207) were remodeled significantly, suggesting that they may have had longer use lives than the other structures in this locus. The remodeling of Feature 200 was particularly interesting because it resulted in the transformation of one of the few RHS houses to a more-traditional Hohokam house-in-pit.

Four temporally diagnostic projectile points were recovered from the fill of two structures in this locus (Features 2157 and 2192). Three of these were whole or broken Hohokam serrated points, and the fourth was a Cienega dart point. A complete Hohokam serrated point was recovered from the structural debris of each of these structures and, most likely, was deposited shortly after each structure was abandoned. The Cienega point, on the other hand, was recovered from the upper fill of Feature 2192 and most likely washed in with other mixed trash from the site. Given the extensive Late Archaic period occupations located at other portions of the site, it is not surprising to find trash from this period mixed in with later deposits.

The painted ceramics recovered from this locus helped to define the temporal constraints for the use of this area. The majority (93 percent) of temporally sensitive painted-ceramic artifacts recovered from all contexts in this locus had a combined production date range of A.D. 950–1150. Only 4 of the recovered ceramic artifacts predated A.D. 950, and an additional 27 ceramic artifacts may have been produced between A.D. 850 and 1150. No ceramic artifacts postdating A.D. 1150 were encountered in the locus. These data suggest that this area was utilized primarily, if not exclusively, during the latter half of the Middle Formative period (ca. A.D. 950–1150). The rest of the Locus A chronology was constructed within these constraints.

AM data were used to place the individual structures in calibrated time and to test their apparent contemporaneity. All but the sample from Feature 2192 produced good AM data that could be dated against SWCV595. Multiple samples were collected from Features 200, 2157, and 2160, and composite dates were calculated for each of these structures. The AM date ranges of the seven dated structures overlapped and, working within the temporal constraints set by the ceramic data, placed the main occupation of this locus between roughly A.D. 935 and 1040.

AM Contemporaneity Study

Although the date ranges from these structures overlapped, the AM data from Feature 2195 indicated that this pit structure may have fallen out of use somewhat earlier than the rest of the structures. This observation is supported by the pairwise contemporaneity tests performed on the Locus A AM data set. These tests indicated that the sample recovered from Feature 2195 had a statistically different AM direction from those of every other structure in Locus A. When the sample VGPs were plotted against SWCV2000 (Figure 9), it was apparent that the VGP from Feature 2195 was acquired before those from the other Locus A structures. We can conclude, then, that Feature 2195 was abandoned prior to the others. It should be noted that this structure exhibited a different orientation from that of the rest of the structures in this locus (i.e., oriented northeast, rather than north or south), and it was located in the center of three north-south-oriented pit structures with recessed-hearth areas. Although it is possible that this structure's use life overlapped those of other structures in the locus to some extent, its location in the center of the cluster of recessed-hearth structures suggested that it was abandoned before these structures were constructed.

The data from all other structures in this locus were statistically indistinct from each other, suggesting that the structures were abandoned within a short time of each other. These data indicated that the RHS pit structures were coeval with the more-traditional Hohokam-style pit structures in Locus A. If, as has been suggested, these two architectural styles are indicative of different cultural groups, then it appears that at least some coresidence occurred within this part of the site. Furthermore, the similarity of the AM data and the uniformity of the material culture recovered from this area suggest that this area served as residential space for only a brief time during the site's long history.

Summary

The temporal data collected from Locus A supported the idea that this was a discrete Middle Formative period farmstead. The time range represented by material culture recovered from this locus spanned the period between A.D. 750 and 1150, but the majority of dated features fell within the A.D. 950–1150 period. Visually, this can be seen in the weighted probability curve generated for this locus (Figure 10). The peak in the curve between A.D. 925 and 1050 is due to the high precision of the archaeomagnetically dated structures.

Locus C

Locus C had a longer and more-complex occupational history than Locus A. Chronometric and artifact data indicated

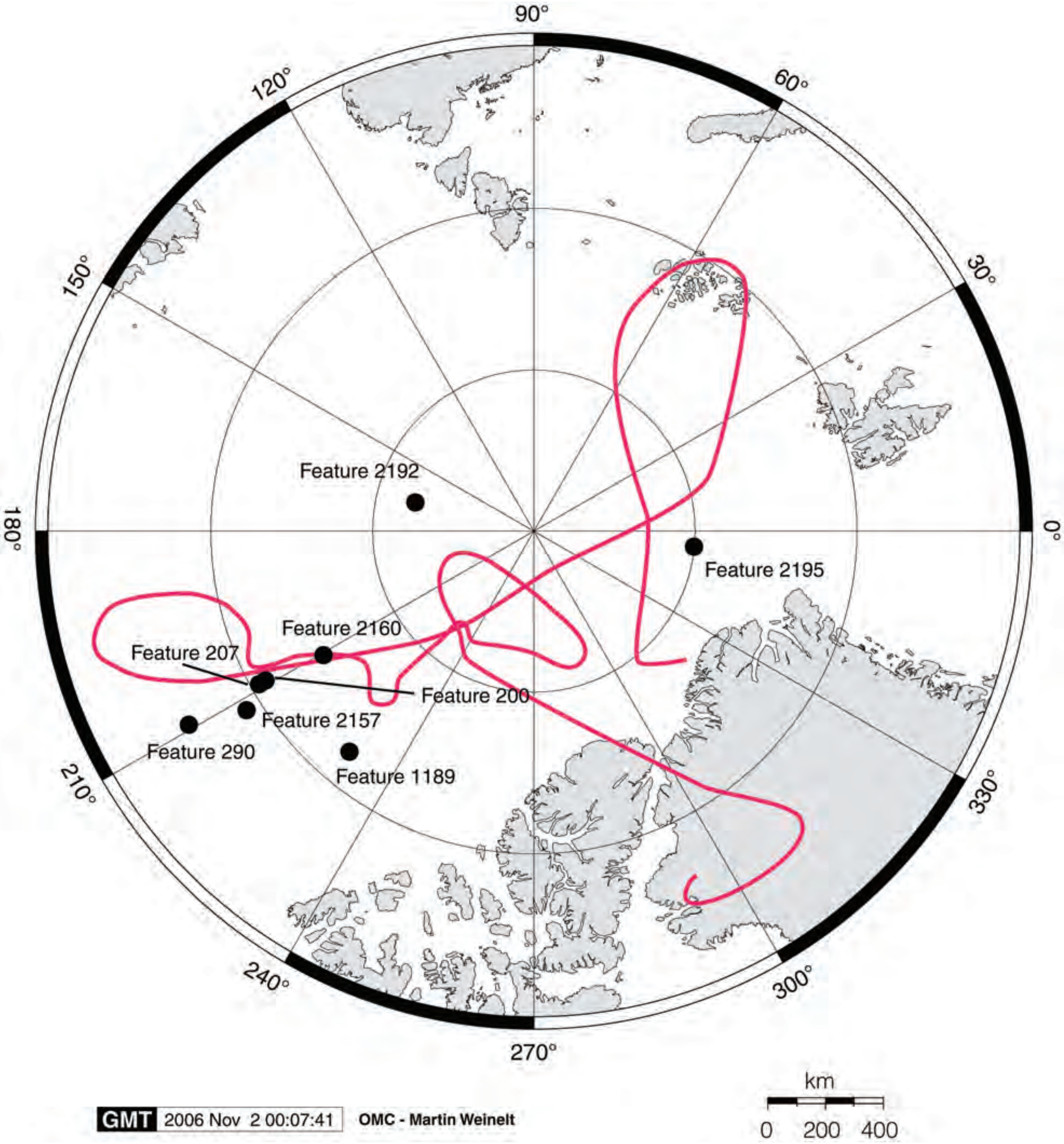


Figure 9. Locations of all archaeomagnetic poles from Locus A, depicted against SWCV2000.

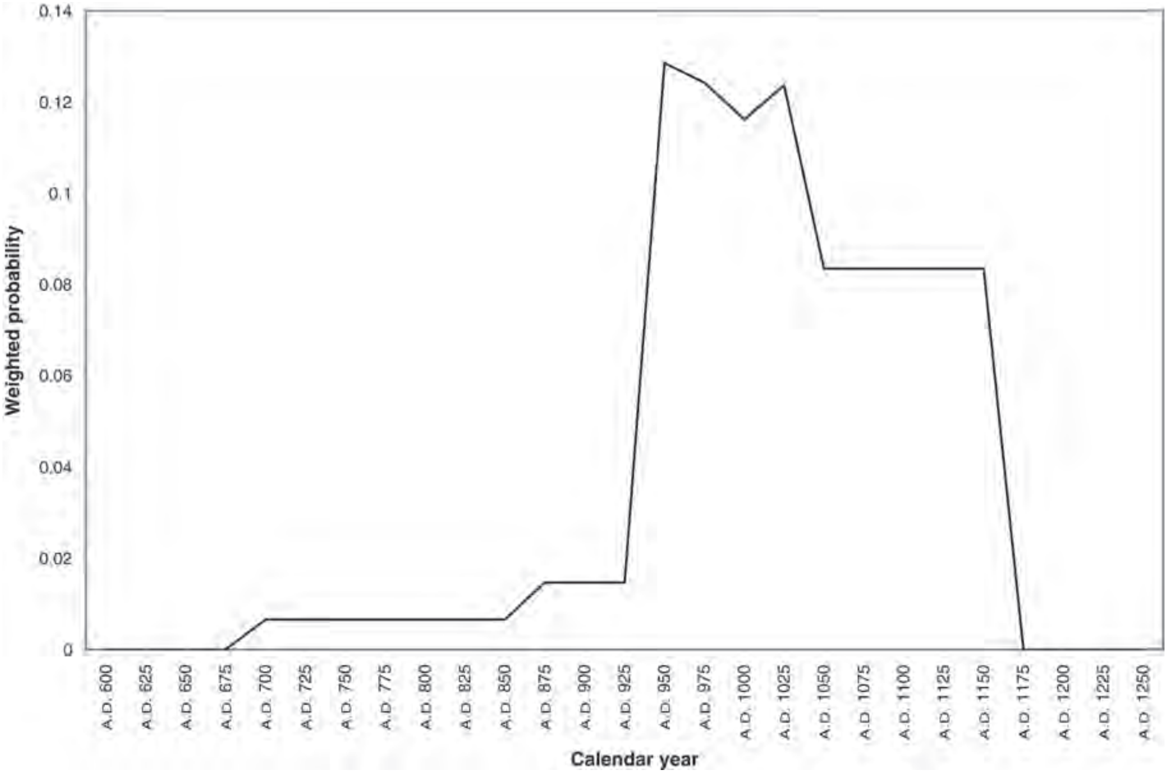


Figure 10. Weighted probability curve of dated features from Locus A. This curve graphically depicts the temporal distribution of dated features over the total use life of the locus.

that this area was utilized, in one form or other, throughout the Formative period and possibly during the Late Archaic period, as well. Fifteen structures, including 3 with recessed-hearth areas (Features 379, 995, and 6098), and 65 extramural pits were at least partially excavated. AM samples were recovered and measured from 13 of the excavated structures and 1 extramural thermal feature. AM date ranges were obtained for all of the structures except Features 276 and 995 and for the thermal pit (Feature 7153) (Table 5). In addition, 4 tree-ring samples from structure Feature 379 were submitted for dendrochronology. Unfortunately, none of these samples could be dated against existing tree-ring chronologies. No other chronometric samples were recovered from this locus.

Many of the houses and extramural features in this locus were stratigraphically superimposed with each other (see Figure 7, this volume). Most notably, four pairs of superimposed structures were identified and excavated in the main portion of this locus. Two of these pairs consisted of an RHS house superimposed by a Hohokam-style pit structure (Feature 995 with Feature 6129 and Feature 6098 with Feature 7461), reminiscent of the remodeling noted in Feature 200 of Locus A. In the third pair, Feature 379, another RHS house and the only structure facing east in this locus, was superimposed by a surface structure (Feature 235). The fourth pair consisted of two Hohokam-style pit structures (Features 6139 and 6153), the lower of which was excavated only partially. Finally, 8 of the 15 excavated structures were intruded by later extramural features, indicating that this area continued to be utilized.

Thirteen whole or fractured projectile points were recovered from contexts in Locus C. Four, including 2 Archaic period dart points, a Sinagua side-notched point, and a Rincon point, were recovered from the surface or from exploratory test pits. The rest were recovered from the fill of six features. Two Archaic period dart points, a Hohokam serrated point, and a Classic Side-notched point were recovered from the fill of Feature 379, a large, east-facing structure with a recessed-hearth area and parallel floor grooves that may have supported a raised floor. Two San Pedro dart points (ca. 1200–800 B.C.) were recovered from the fill of Features 6098 and 6139, although they undoubtedly reflected recycling behaviors. A Rincon point was recovered from an extramural thermal pit (Feature 6146), and a second one was recovered from an undefined extramural pit (Feature 6148). Finally, the base of an Empire point (ca. 1200–800 B.C.) was recovered from the fill of a bell-shaped pit (Feature 6171), although the recovery of more than 150 sherds from this pit suggested that the dart-point fragment was redeposited. Together, this collection

Table 5. Archaeomagnetic Dates for Features in Locus C

Feature No.	Sample ID[a]	α_{95}	k	Date Ranges (years A.D.)
235[b]	SRI 2370	5.0	125.26	935–1090, 1160–1690
276[b]	SRI 2441	10.4	34.85	no date
376[b]	SRI 2425	7.4	107.64	585–740, 835–1015, 1310–1815
379[b]	SRI 2424	1.7	665.05	1010–1140, 1160–1265
995[b]	SRI 2432	9.3	43.15	no date
6095[b]	SRI 2426	3.5	252.95	935–1040, 1185–1590, 1635–1690
6098[b]	SRI 2428	2.2	389.93	935–1015, 1235–1415, 1535–1590
6098[b]	SRI 2429	2.7	288.03	1010–1190
6129[b]	SRI 3965—avg (SRI 2396 and SRI 2397)	2.4	174.53	635–665, 935–1015, 1535–1590, 1760–1815
6138[b]	SRI 2395	2.4	316.66	935–1315
6153[b]	SRI 3966—avg (SRI 2398 and SRI 2399)	1.7	493.98	1010–1040, 1185–1215, 1235–1315
6154[b]	SRI 2427	4.2	204.14	935–1015, 1310–1690
7153[c]	SRI 2440	1.5	699.33	985–1040, 1185–1315
7201[b]	SRI 2402	2.9	318.06	935–1015, 1310–1690
7461[b]	SRI 2430	2.2	399.70	935–1040, 1160–1315

[a] The designation “avg” indicates a composite sample; the combined sample numbers are listed in parentheses.

[b] Pit structure.

[c] Roasting pit.

indicated that this portion of the site was utilized intermittently for nearly 2,000 years, which is not surprising, given the extensive Late Archaic period activities documented in neighboring Locus D (see below).

The majority (83 percent) of the painted-ceramic-artifact collection from this locus had a combined production date range of A.D. 900–1150, although the full collection spanned most of the Middle and Late Formative periods. The earliest painted-ceramic artifact recovered from this locus was a Dragoon broad red-on-brown sherd (A.D. 650–750) recovered from the fill of Feature 276, one of two structures located in the western end of the locus. This was the only painted-ceramic artifact recovered from this structure. An additional 17 of the 310 painted-ceramic artifacts (6 percent) had production date ranges that predated A.D. 950, and most of these were recovered from near the surface during stripping or from midden excavations. Only 1 of these early sherds was recovered from the floor of a structure (Feature 6129). Likewise, a handful of sherds had production date ranges that postdated A.D. 1150, and all were recovered from the fill of structures. In addition, an unusual, partially reconstructible vessel was recovered from the floor of one structure (Feature 6098) and was painted in the style of a Tanque Verde Red-on-brown pot but had a Rincon-style vessel form. Given the other chronometric data from that structure (see below), it seems likely that the vessel was manufactured and discarded well before the accepted production date range for this style (A.D. 1150–1350). This is not disconcerting, given the site’s location in a transition zone; variation from the norm and experimentation is to be expected in these areas.

Fifteen AM samples from 11 pit structures and 1 roasting pit produced magnetic directions that could be dated against SWCV595. Multiple samples were collected and dated from Features 6098, 6129, and 6153, and composite dates were calculated for Feature 6129 and for Feature 6153. The data collected from the hearth in Feature 6098 were used to date that structure. The AM data indicated that these structures were occupied and abandoned between roughly A.D. 585 and 1690, although this wide span can be reduced to about A.D. 835–1400 through other lines of evidence (e.g., ceramics). Furthermore, the majority of these structures most likely were abandoned between A.D. 935 and 1040.

AM Contemporaneity Study

A more refined chronology for the use and abandonment of these structures was developed by combining the stratigraphic data with a contemporaneity study of the AM data. It is known from stratigraphy that Feature 235 postdated Feature 379, Feature 7461 postdated Feature 6098, Feature 6129 postdated Feature 995, and

Feature 6153 postdated Feature 6139. It should be noted that Features 379, 6098, and 995, the lower structures in three of these pairs, contained recessed-hearth areas. This information was used to structure the contemporaneity study and to assign structures to abandonment groups. From this, four different groups of similarly aged features were identified, and the relative ages of these groups were established (Table 6).

The earliest AM group (Group 1) consisted of a single structure, Features 6129. The data from this structure were different from those of every structure but Feature 6154; however, the two structures were not grouped because the AM data from Feature 6154 more closely resembled those of a later group of features. Furthermore, while Feature 6129 appears to reflect the earliest feature included in the contemporaneity study, its superposition with Feature 995 indicates that it was not the first structure abandoned at the site.

The second AM group (Group 2) consisted of Features 6095, 6098, 6154, and 7201. These features were archaeomagnetically contemporary with each other and statistically different from the majority of other structures in the locus. Furthermore, this group did not conflict with the stratigraphic relationships identified in this locus. The location of the VGPs in this group, with respect to that of Group 1, indicated that these structures were abandoned at some point after Group 1. Feature 6095 was tentatively included with this group because its direction was most similar to the directions of the other features in this group. It should be noted that this structure was archaeomagnetically contemporary with all but the Group 1 feature, and it is possible that its abandonment coincided with those of features in later groups.

Group 3 consisted of Features 7153 (a thermal pit) and 7461 (a pit structure). The data from these two features were very similar to each other, but the location of their VGPs near the A.D. 1000/1250 curve intersection introduced the possibility that they were separated by several centuries. The artifact collection and architectural style of Feature 7461 indicated that this structure was occupied and abandoned during the Middle Formative period. Likewise, the few temporally sensitive ceramics recovered from the fill of Feature 7153 suggested that this thermal pit was abandoned during the Middle Formative period; it is assumed, therefore, that these two features were coeval.

Finally, the youngest group (Group 4) consisted of Features 379, 6138, and 6153. Again, the data from these three features were very similar to each other and statistically different from virtually all other structures in the locus. As with Group 3, it is possible that these structures differed by as much as a century, given the location of their VGPs near the cusp of the A.D. 1150 loop of the curve, but the architectural style and ceramics recovered from each suggested that all three were occupied and abandoned during the late Middle Formative period. Given this, and the strong similarity of their AM directions, it is likely that these structures were occupied concurrently and were abandoned at roughly the same time.

Table 6. Locus C Archaeomagnetic (AM) Groups

AM Group	Feature Numbers
1 (oldest)	6129
2	6095, 6098, 6154, 7201
3	7153, 7461
4 (youngest)	379, 6138, 6153

The contemporaneity study combined with other chronological information has generated a fairly precise abandonment sequence for most of the structures in this locus (Figure 11), but AM data typically are related to the last use of a feature and, therefore, do not inform on the construction or duration of that feature. It is likely that there was at least some overlap in the use of features assigned to separate AM groups. The relatively short time span represented by these structures suggests that if one or more occupational hiatuses did occur in this area, they would have been brief and archaeologically invisible. Therefore, it is posited that, at the scale of this research, this portion of the site was utilized continuously during the tenth and eleventh centuries.

Finally, it should be noted that a comparison of the data from the RHS structures (Features 379, 995, and 6098) and their subsequent counterparts (Features 235, 6129, and 7461, respectively) indicated that the two styles were coeval across the pairs. Originally, we expected to find that the RHS structures clustered together archaeomagnetically and that the Hohokam-style replacements formed a later, cohesive unit. Instead, it was found that Feature 6129, and consequently Feature 995, was abandoned earlier than any of the other four structures and that Feature 379, and consequently Feature 235, fell out of use after the other four structures. The paired Features 6098 and 7461 were abandoned sometime between these two events. It is possible that RHS Feature 6098 was coeval with Feature 6129 and that Feature 7461 was coeval with RHS Feature 379. If RHS Feature 379 had an unusually long use life, it may have been coeval with RHS Feature 6098, as well. Overall, it appears that the three RHS structures were constructed sequentially rather than simultaneously and that this sequence overlapped with that of the replacement structures, such that a replacement structure in one pair was at least partially coeval with an RHS structure in a different pair.

Summary

The total material culture collection recovered from this locus indicated that the area was utilized intermittently for nearly 2,000 years, although the dated features spanned

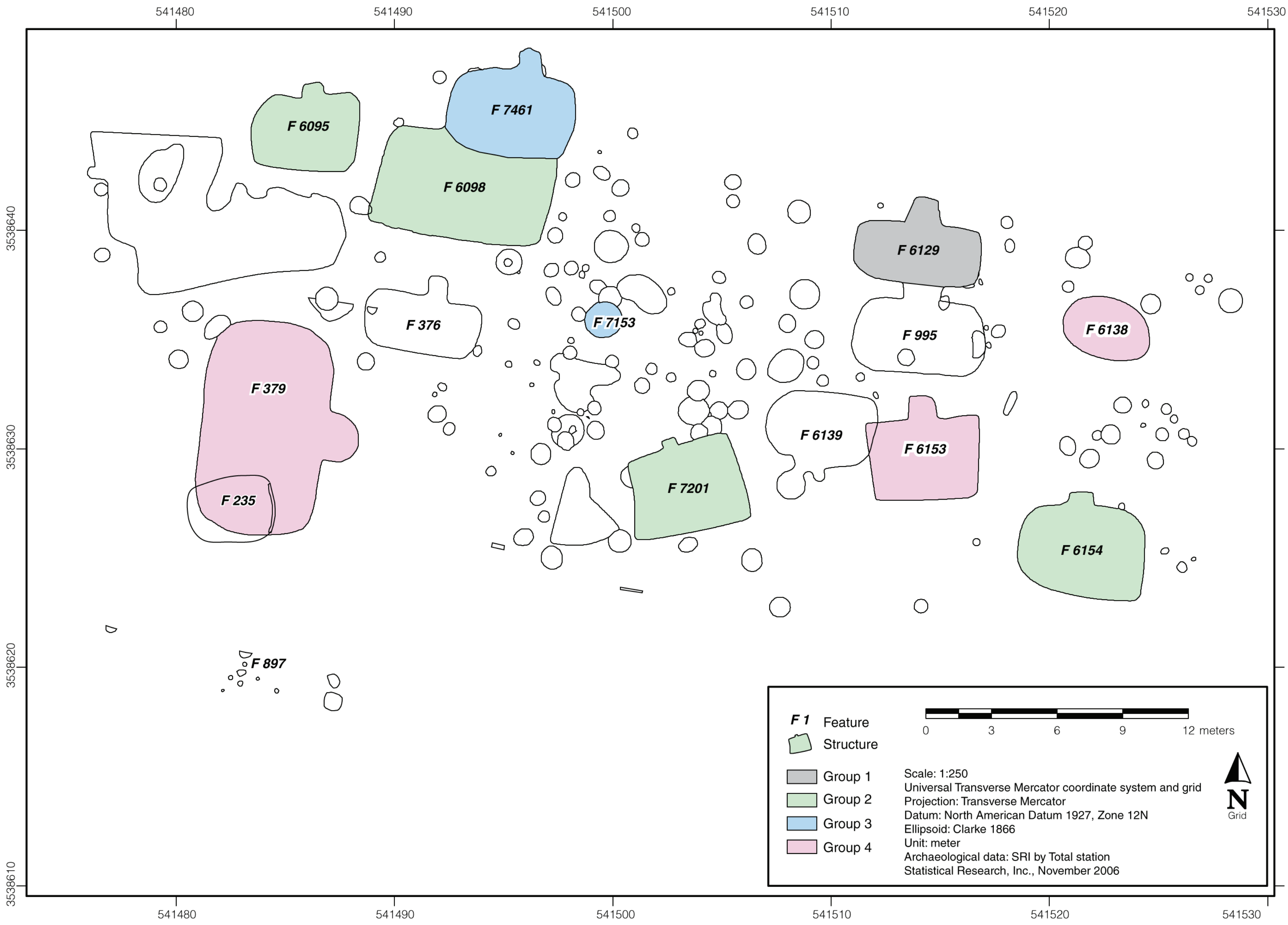


Figure 11. Locations of archaeomagnetically contemporary sets of features from Locus C, organized by group.

the interval between A.D. 650 and 1690. As in Locus A, the bulk of these features dated to the second half of the Middle Formative period, as indicated by the peak in the probability curve between A.D. 925 and 1175 (Figure 12). Again, the narrow peak between A.D. 925 and 1050 is due to the high precision of the archaeomagnetically dated features from this time. The extension of the curve toward A.D. 1600 reflects the presence of Late Formative period features and material culture in this area. This longer use interval, combined with moderate superpositioning and the identification of at least five abandonment episodes, indicated that this area was utilized repeatedly during the Middle and Late Formative periods and was not the product of a single, discrete occupational episode. If this locus really was a continuation of the main activity area encompassed by Locus D, the evidence for overlapping episodes of use and abandonment may be part of a larger pattern of shifting site use during the Formative period.

Locus D

Locus D had the most complex occupational history of the three investigated loci. Chronometric and artifact data indicated that this area of the site was utilized fairly continuously from the Late Archaic period to the Late Formative period. The repeated use and reuse of this area was evident in the numerous complexes of stratigraphically superimposed structures and extramural features. Seventy-four structures, including 2 with recessed-hearth areas (Features 3869 and 10781), and 164 extramural features, excluding 37 features that were probed only, were excavated within this locus (see Figure 8, this volume). Seventy-four AM samples were recovered from 48 of the excavated structures and from 14 extramural thermal pits. AM date ranges were obtained for 41 of these features (Table 7). Other chronometric data were obtained from 11 botanical samples submitted to Beta for AMS radiocarbon dating (Table 8; see Appendix 2.B). Seven of the AMS samples were recovered from 6 bell-shaped pits (Features 411, 3557, 3976, 3983, 4849, and 5505), 2 from 2 bell-shaped thermal pits (Features 4871 and 7827), 1 from a rock-filled thermal pit (Feature 3668), and 1 from the hearth of an adobe surface structure (Feature 4729). All submitted samples consisted of charred annual plants except for the sample from Feature 4871, which consisted of a *Prosopis* twig fragment. In addition, 3 tree-ring samples, 1 each from structure Features 3545, 4768, and 5994, were submitted for dendrochronology, but none could be dated against existing tree-ring chronologies.

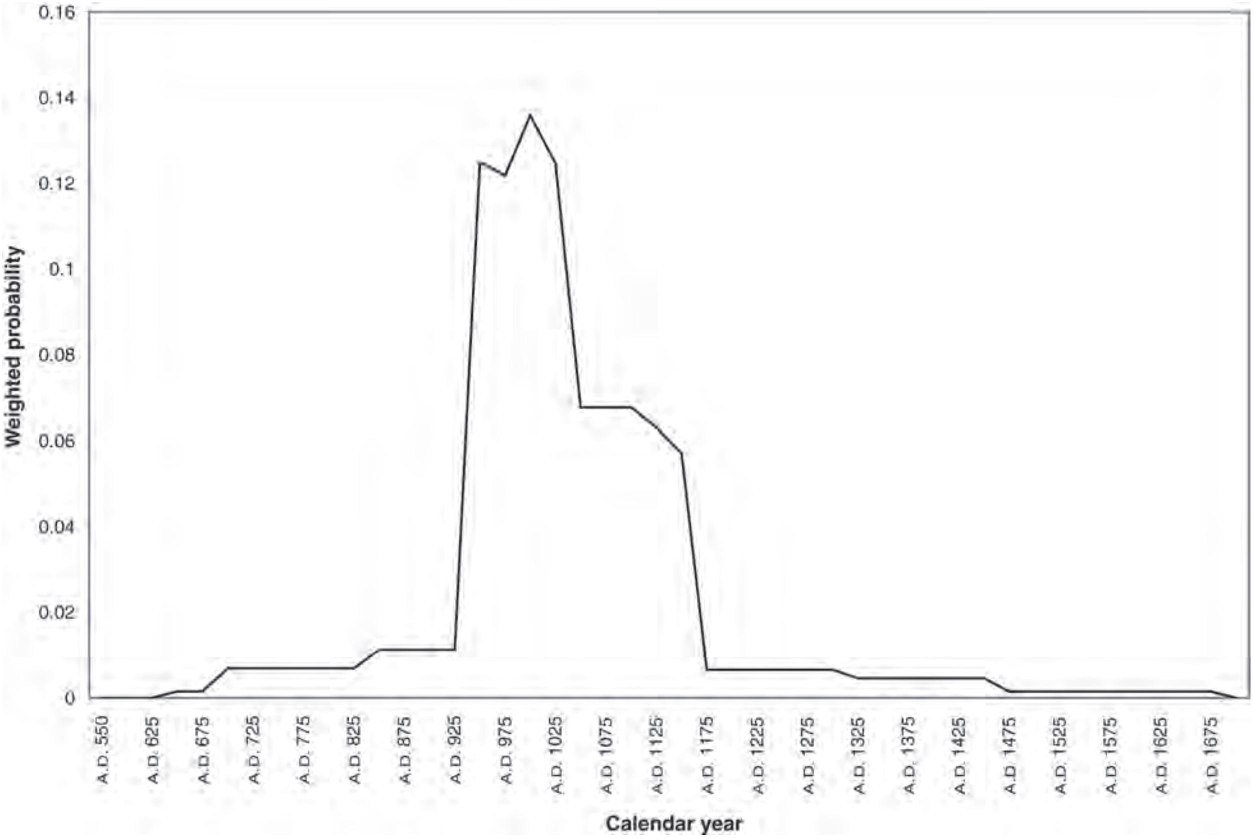


Figure 12. Weighted probability curve of dated features from Locus C. This curve graphically depicts the temporal distribution of dated features over the total use life of the locus.

Table 7. Archaeomagnetic Dates for Features in Locus D

Feature No.	Sample ID[a]	α_{95}	k	Date Ranges (years A.D.)
438[b]	SRI 3989—avg (SRI 2387 and SRI 2455)	3.40	95.60	735–865, 935–990
492[b]	SRI 2454	3.60	144.58	735–840
565[b]	SRI 2442	1.40	899.18	735–840
834[b]	SRI 2437	5.90	88.80	685–915, 935–990
1571[b]	SRI 2406	11.59	14.98	no date
1575[c]	SRI 3990—avg (SRI 2418 and SRI 2419)	4.00	64.63	585–740, 910–1015, 1385–1690
3545[b]	SRI 2377	4.70	137.20	585–740, 860–1015, 1535–1615, 1760–1815
3569[b]	SRI 2373	2.50	474.17	635–665, 935–1015, 1385–1615, 1635–1690
3569[b]	SRI 2445	9.06	23.92	no date
3641[b]	SRI 2446	2.50	477.94	585–690, 1760–1815[d]
3663[b]	SRI 2447	3.10	194.90	935–1040, 1160–1415
3668[e]	SRI 2457	5.30	83.50	835–915
3670[b]	SRI 2463	4.40	123.37	685–790, 835–990
3677[b]	SRI 2448	28.61	3.27	no date
3679[b]	SRI 3991—avg (SRI 2375 and SRI 2376)	1.70	322.47	835–865
3696[f]	SRI 2389	3.20	209.18	835–915
3710[b]	SRI 2390	4.00	130.42	685–790, 835–915
3756[f]	SRI 2374	2.10	463.24	685–740, 860–915
3817[b]	SRI 2382	23.80	6.35	no date
3818[f]	SRI 2458	4.60	112.79	935–1015, 1210–1690
3869[b]	SRI 2464	11.90	14.27	no date
3879[b]	SRI 2378	11.57	15.03	no date
4069[g]	SRI 2400	5.90	68.22	no date[d]
4221[g]	SRI 2401	7.70	52.55	585–790, 835–1015, 1385–1815
4333[b]	SRI 2391	5.40	90.40	685–790, 835–1015, 1535–1615
4516[b]	SRI 2379	12.55	12.92	no date
4642[b]	SRI 2453	8.68	25.97	585–740, 835–915, 1535–1590, 1760–1890
4682[b]	SRI 3992—avg (SRI 2410 and SRI 2411)	4.20	77.00	no date, near 900
4683[c]	SRI 2383	3.00	231.19	635–690, 910–1015, 1385–1690
4684[c]	SRI 2384	8.90	30.56	585–1015, 1310–1690
4702[f]	SRI 2461	2.10	847.93	no date, near 850
4729[c]	SRI 2385	2.70	255.03	935–1015, 1310–1690
4768[b]	SRI 3993—avg (SRI 2434 and SRI 2450)	1.20	626.34	1010–1040, 1060–1090, 1160–1190, 1235–1265
4871[f]	SRI 2392	4.40	187.35	no date, near 850
4902[f]	SRI 2393	4.20	148.37	1835–1890[d]
4931[f]	SRI 2394	2.10	521.63	985–1040, 1060–1090, 1160–1315
5781[b]	SRI 2414	6.12	46.85	660–940
5794[b]	SRI 2415	6.54	45.01	585–690, 910–1015, 1335–1890
5795[b]	SRI 2416	11.98	14.08	no date
5994[b]	SRI 2409	11.47	15.29	no date
7558[b]	SRI 2371	1.90	594.91	710–740, 835–915

continued on next page

Feature No.	Sample ID[a]	α_{95}	k	Date Ranges (years A.D.)
7559[b]	SRI 2372	3.10	270.52	785–840
7880[b]	SRI 2407	2.90	358.04	735–865
7942[b]	SRI 2449	1.30	1,036.78	no date, near 700 and 900
8607[b]	SRI 2417	9.31	22.72	no date
8643[b]	SRI 2412	18.33	6.57	no date
8644[b]	SRI 2413	5.62	60.52	685–915
8655[b]	SRI 2452	1.40	957.17	no date, near 850
8798[f]	SRI 2436	6.00	164.93	no date[d]
8841[b]	SRI 2422	8.64	26.18	835–865
8842[b]	SRI 2435	2.40	476.03	735–840
9867[b]	SRI 2451	2.50	299.34	760–840
10507[f]	SRI 2462	3.90	238.27	no date, near 700 and 900
10560[b]	SRI 2443	3.50	150.52	735–840
10561[b]	SRI 2467	3.90	242.66	685–765, 835–990, 1535–1590
10729[b]	SRI 2466	2.00	494.98	935–1015, 1310–1690
10781[b]	SRI 2465	4.00	169.35	585–690, 935–1015, 1535–1590, 1760–1815
10782[b]	SRI 2444	2.70	258.25	935–1015, 1335–1390
11342[b]	SRI 2380	3.70	136.43	760–840

[a] The designation “avg” indicates a composite sample; the combined sample numbers are listed in parentheses.
[b] Pit structure.
[c] Adobe structure.
[d] Probably predates curve.
[e] Horno
[f] Roasting pit.
[g] Crematorium.

Table 8. Radiocarbon Dates for Features in Locus D

Feature No.	Sample No.	Calibrated Age (2σ)
411	Beta 206388	1100–900 cal B.C.
3557	Beta 206386	1060–880 cal B.C.
3668	Beta 206381	cal A.D. 770–980
3976	Beta 206382	1280–1010 cal B.C.
3983	Beta 206378	1140–920 cal B.C.
3983	Beta 206379	1040–850 cal B.C.
3983[a]	combined	1070–900 cal B.C.
4729	Beta 206385	cal A.D. 1270–1320, 1340–1390
4849	Beta 206383	820–760, 620–590 cal B.C.
4871	Beta 206384	cal A.D. 990–1160
5505	Beta 206380	1110–900 cal B.C.
7827	Beta 206387	cal A.D. 660–790

[a] A combined radiocarbon date was calculated for Feature 3983 from the results for the two samples analyzed from the feature.

Stratigraphy contributed greatly to the chronology for Locus D, and 175 pairs of stratigraphically related features were recorded. Thirty-eight of these features could be dated only through their stratigraphic relationships to better-dated features. Furthermore, 18 complexes of multiple superimposed features were encountered within this locus, indicating intensive reuse of some portions of this locus. For example, Superfeature 3544 consisted of 5 structures superimposed with at least 18 extramural features. Additionally, 6 sets of reused house pits were discovered, among which at least 2 different structures could be identified. It could not be determined whether these represented significant remodeling episodes by the original occupants or discrete construction events; so, each structure identified within a house pit was treated separately.

A total of 160 whole or fractured projectile points were recovered from contexts in Locus D. Thirteen, including 10 dart points, were recovered from the surface or from exploratory test pits. The rest were recovered from 28 structures, 15 thermal and nonthermal pits, 1 inhumation, 2 feature complexes, and an erosional depression. Of the 76 dart points recovered from the locus, over half (n = 39) came from structures, but only 1 of these dart points was recovered from a probable Late Archaic or Early Formative period structure (Feature 1815), suggesting that the rest were recycled and redeposited during later periods. Likewise, 20 of the 32 points recovered from extramural pits were Archaic period dart points. Furthermore, 6 of these dart points were recovered from 3 bell-shaped pits (Features 3976, 3983, and 5505) that were radiocarbon dated to the early part of the Late Archaic period (see below). It is likely that these points were deposited shortly after the abandonment of the features. A seventh dart point was recovered from a bell-shaped pit (Feature 4312) for which no other temporal data were available. It is likely that this pit was used and abandoned during the Late Archaic period, as well. Finally, 3 dart points were recovered from a fifth bell-shaped pit (Feature 5508) that yielded 3 small sherds, as well. No other temporal information was obtained for this feature, and it was assumed that it was used during the end of the Late Archaic period or the beginning of the Early Formative period.

Unlike other areas of the site, more than half (65 percent) of the painted-ceramic-artifact collection from this locus had a combined production date range of A.D. 650–950. Furthermore, less than a quarter of the collection (24 percent) had production date ranges that extended into the latter half of the Middle Formative period, and only 10 percent of these had a combined production date range of A.D. 900–1150. So, the composition of the total painted collection from this locus suggested that this area was utilized more heavily during the first part of the Middle Formative period than in succeeding periods. This finding is supported by the AM data, as well (see below). The full painted collection spanned the Middle and Late Formative periods, although there appeared to be a brief ceramic hiatus between roughly A.D. 1300 and 1320. A total of 41 partially reconstructible vessels were recovered from this locus, 7 of which were painted. One Tonto Polychrome, 2 Gila Polychrome, and 1 Rincon Red-on-brown vessel were recovered from the floors of four structures (Features 1575, 4684, 4729, and 4768, respectively).

The radiocarbon dates obtained for this locus confirmed that this portion of the site was utilized during the Late Archaic period. The samples recovered from six bell-shaped pits returned calibrated ages within the Late Archaic period. Two of these samples were recovered from Feature 3983, and a combined calibrated age of 1070–900 cal B.C. was calculated for the feature. The walnut shells that constituted the two samples were most likely from the same harvest, and it is possible that members of each sample were from the same nuts; therefore, they were treated as a single, split sample, and the conventional ages were combined prior to calibration. Ward and Wilson's (1978) chi-square test for similarity was calculated for the corrected dates from the six Late Archaic period pit features, and the results indicated that all but Feature 4849 were similar at the 95 percent confidence level. A Bayesian model was constructed in OxCal to test this agreement and to calculate the combined age for the features. This involved calculating a combined probability distribution for the group of samples and then comparing the probability distributions for each sample to it. An agreement index that indicated how well the individual probability distribution matched the combined distribution was calculated for each sample, and an overall agreement index was calculated for the model. The agreement index indicates the amount of overlap between the final probability distribution (e.g., the combined sample distribution) and the original probability distribution (e.g., the distribution for each sample). When the final distribution overlaps with only the highest part of the original distribution (i.e., it is narrower than the original), the index will be greater than 100 percent. An index of less than 60 percent indicates that there is a problem with the model (Bayliss and Bronk Ramsey 2004:34; Bronk Ramsey 2005). It was found that the dates from Features 411, 3557, 3983, and 5505 agreed extremely well with each other and with the combined distribution, and the date from Feature 3976 had a very low probability (likelihood index of 5.1 percent) of belonging to the group. When Feature 3976 was removed, the model returned an overall agreement index of 159.4 percent (An = 35.4 percent) and a combined date range of 1020–920 cal B.C. These results indicated that at least three different Late Archaic period occupations were represented in the recovered data.

The four remaining radiocarbon dates from this locus appeared to represent temporally distinct activities during the Middle and Late Formative periods. The distribution of these dates suggested that this part of the site was utilized fairly continuously during the Middle Formative period and into the Late Formative period. AM dates were obtained for two of these features (Features 4729 and 3668), and they agreed with the respective radiocarbon dates, which supported the contextual association between the dated botanical samples and the features.

Forty-five AM samples from 34 structures and 7 thermal features produced magnetic directions that could be dated against SWCV595. An additional 8 samples were well magnetized but produced directions that were not close enough to the curve to be dated. These directions were included in the contemporaneity study, when appropriate. Multiple samples were collected and dated from Features 438, 1575, 3679, 4682, and 4768, and composite dates were calculated for each feature. Altogether, the AM data indicated that this locus was utilized throughout the Formative period, although it was utilized more intensively during the early part of the Middle Formative period. The majority of the structures dated through this technique returned date ranges of roughly A.D. 700–900. This was particularly apparent when the mean VGPs were plotted against SWCV2000 (Figure 13).

AM Contemporaneity Study

In addition to limiting data to those with α_{95} values of less than 5°, obvious outliers, such as the sample from Feature 4871, were removed from the analytical data set. Stratigraphic relationships between sampled features provided additional information for 11 of the features in the filtered data set (Table 9). The F(*p*) value was set to 0 for pairs of stratigraphically related features, and these features were assigned to different groups of similarly aged structures.

Furthermore, the analysis was structured to minimize the potential errors introduced by the sinusoidal nature of secular variation. Although the geomagnetic pole cannot occur in two different locations at the same time, it often has occurred in the same place at two or more different times. This has resulted in loops and crossovers in the path of secular variation over the past 2 millennia (Figure 14), most notably between A.D. 600 and 925 and between A.D. 1000 and 1300. Therefore, features with very different ages can yield similar AM directions. To mitigate the effects of this quirk in secular variation, care was taken to divide the data set into unidirectional analytical groups. For instance, the period between roughly A.D. 825 and 1100 was characterized by a westerly drift of the magnetic pole, whereas the pole drifted eastward between A.D. 600 and 825 and again between A.D. 1100 and 1450. Coincidentally, the A.D. 1100 minimum of the later loop in secular variation coincides with well-documented changes in material culture that mark the transition between the Middle and Late Formative periods. Therefore, it was possible to use material culture as well as architectural style (adobe walls) to identify the Late Formative period features in the data set (Features 1575, 4683, and 4729), and the AM data from these features formed the first analytical group. It was found that these features yielded similarly located VGPs, suggesting that they may have represented a fairly discrete occupation. A radiocarbon date obtained from Feature 4729 indicated that this group of structures most likely was abandoned between cal A.D. 1270 and 1320 or between cal A.D. 1340 and 1390.

Two additional features (Features 3641 and 4902) were judged to be Early Formative period in age. The data from these features were compared to each other, and it was found that each was statistically different from the others. This indicated that these features were abandoned, and probably used, at different times during the site's occupational history. Because these data predated the existing Southwest curve, their relative order could not be determined.

The majority of the Locus D data set were recovered from Middle Formative period features. This period encompassed the A.D. 700–900 loop in secular variation, and there were no clear changes in material culture that could be used to distinguish unequivocally between features that predated or postdated the loop's A.D. 825 latitudinal minimum. In some cases, it was possible to use the directional trend between VGPs of superimposed features to determine whether one or both predated or postdated this minimum. For instance, Features 10561 and 10562 were stratigraphically superimposed structures with statistically different VGPs. The direction between these VGPs trended toward the rotation axis, indicating that Feature 10561, the younger structure, postdated the A.D. 825 minimum. Likewise, the directional trend between the VGPs of a second set of superimposed structures (Features 7558 and 7559) indicated that the older structure (Feature 7558) predated A.D. 825. Furthermore, because Feature 7558 superimposed Feature 3756, this roasting pit must have predated A.D. 825, as well.

Sometimes a feature's age with respect to the A.D. 825 minimum cannot be determined, making it impossible to verify its affinity to a specific AM cluster. This was the case for Feature 7942, which produced a VGP that was nearly identical to one from Feature 3756. The location of these VGPs near the juncture of the A.D. 700 and A.D. 900 segments of the curve meant that the respective features could have had very different ages. It was known from stratigraphy that Feature 3756 predated the A.D. 825 minimum, but the same could not be determined for Feature 7942. Therefore, the internal consistency of this cluster could not be verified, and the pairing was not considered further in this analysis. Other features that produced ambiguous VGPs located in the area of the A.D. 700–900 loop were removed from this analysis, as well, including Features 3670, 3710, 4702, and 10507.

In the end, 25 Middle Formative period features were included in this study, and they were assigned to seven temporally distinct AM groups (Table 10; Figure 15). The earliest two groups (Groups 1 and 2) were composed of

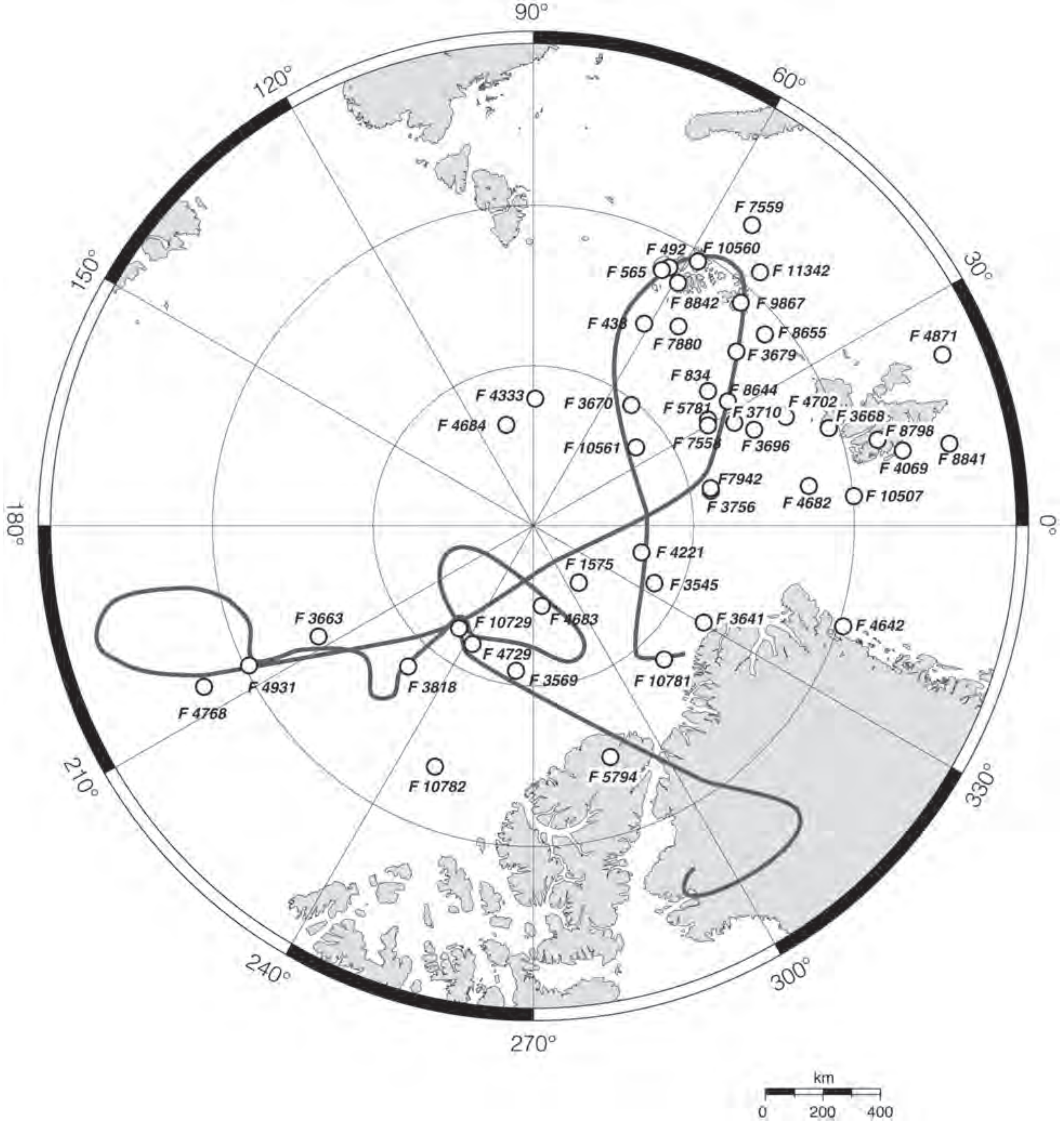


Figure 13. Locations of the dated archaeomagnetic poles from Locus D, depicted against SWCV2000.

Table 9. Stratigraphic Relationships among Pairs of Locus D Archaeomagnetic-Sampled Features

Early Feature	Late Feature
3756	7558
3756	7559
4702	3679
7558	7559
8655	4768
10560	10561
10781	10782

Table 10. Locus D Middle Formative Period Archaeomagnetic (AM) Groups

AM Group	Feature Numbers
1 (oldest)	3756
2	7558
3	438, 492, 565, 3679, 7559, 7880, 8655, 8842, 9867, 10560, 11342
4	3696, 4682, 10561
5	3545, 10781
6	3569, 3818, 10729, 10782
7 (youngest)	3663, 4768, 4931

Figure 14. Secular variation curve SWCV2000 provides the most recent depiction of geomagnetic secular variation in the U.S. Southwest over the past 2 millennia.

Features 3756 and 7558, respectively. It was known from stratigraphy that Feature 3756 was older than Feature 7558, and as discussed above, each of these features predated the A.D. 825 minimum. The only other features with similarly located AM poles postdated this minimum and, therefore, were younger than these features.

Group 3 consisted of 11 features (Features 438, 492, 565, 3679, 7559, 7880, 8655, 8842, 9867, 10560, and 11342), all of which yielded AM poles located near the A.D. 825 minimum. This was the largest group in this study, and the inability to distinguish between pre- and post-A.D. 825 features increased the likelihood that temporally distinct samples were grouped together. In fact, three subgroups were evident within the larger group, but there was not enough evidence to support the additional subdivisions. Therefore, the final Group 3 included several unavoidable pairings of statistically distinct features, such as Features 7559 and 438. In this case, the relative locations of the respective VGPs suggested that Feature 7559 was younger than Feature 438, but their position at the apex of

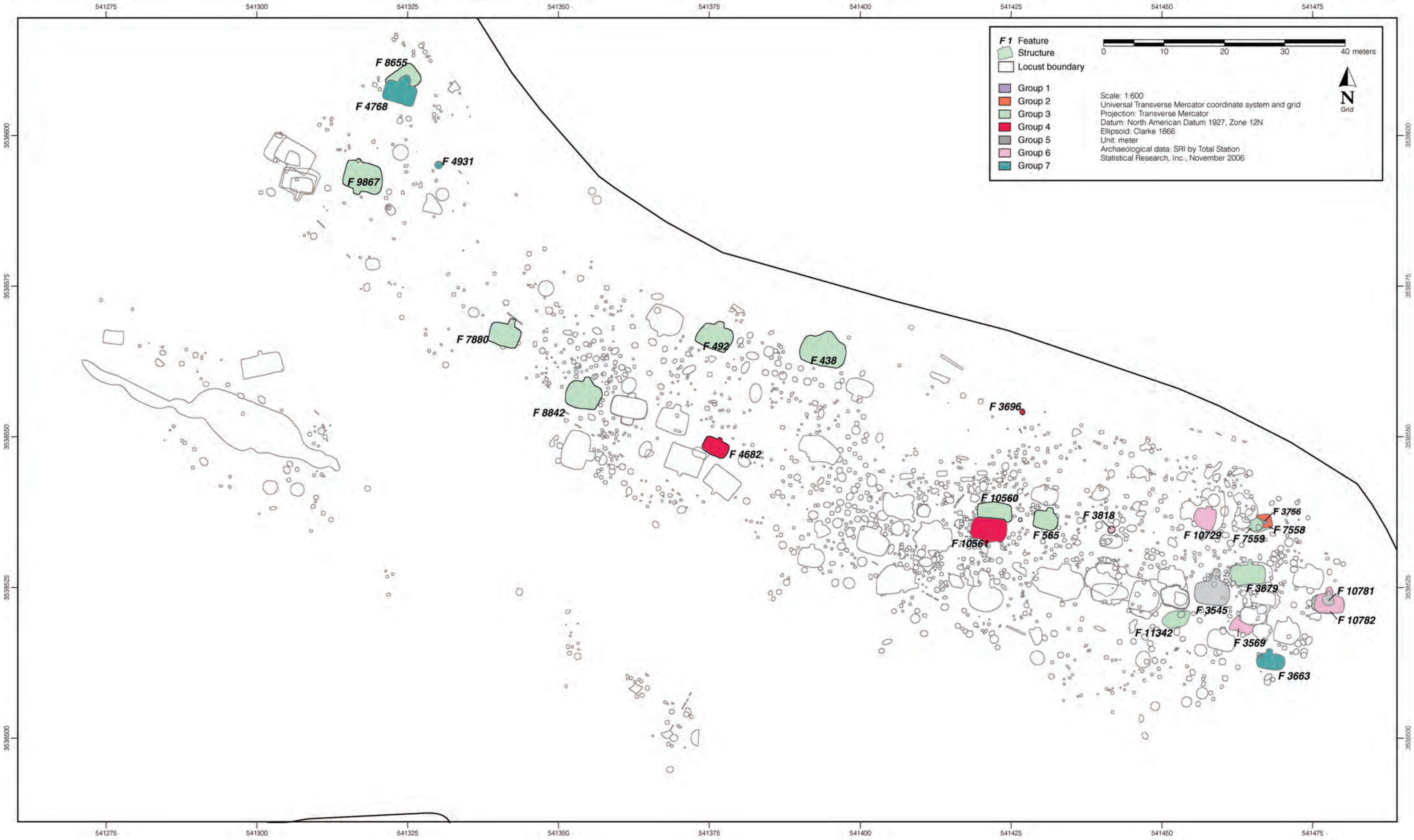


Figure 15. Locations of archaeomagnetically contemporary sets of features from Locus D, organized by group.

the loop made it unwise to accept this observation without additional archaeological evidence.

Group 4 consisted of two structures (Features 4682 and 10561) and a roasting pit (Feature 3696) and produced AM poles located along the post-A.D. 825 arm of the A.D. 700–900 loop. In general, this was not a very strong cluster, although the poles from Features 4682 and 3696 had fairly similar locations and all three pole locations were statistically indistinct. The inclusion of additional poles, such as the ambiguous VGPs from Features 3670, 3710, 4702, and 10507, would strengthen this cluster, but the validity of this grouping cannot be assessed through the available data.

Group 5 consisted of two structures (Features 3545 and 10781). The VGPs from these two features were located near the A.D. 700 and A.D. 900 juncture, as well, and in fact, they fell on the A.D. 600–700 segment of the curve, although the ceramics recovered from Feature 3545 indicated that this structure probably fell out of use sometime during the latter half of the Middle Formative period. It is likely that Feature 10781 also dated to this time, because the structure's house pit and floor and many of its subfeatures were reused in a later structure (Feature 10782) that clearly dated to this time. It is doubtful that the use of these two superimposed structures (Features 10781 and 10782) was separated by centuries. It should be noted, as well, that Feature 10781 was one of two RHS structures encountered in this locus.

Three structures (Features 3569, 10729, and 10782) and a thermal pit (Feature 3818) formed Group 6. Interestingly, Features 3569 and 10782 were both structures that superimposed earlier RHS houses (Features 3869 and 10781, respectively). Overall, this group of AM poles did not cluster as tightly as did many of the other groups from this period, and in fact, the poles from Features 10729 and 10782 were statistically different from each other. Their similarity to the other poles in the group and their difference from virtually all other poles in the study set prompted their inclusion in this group. Regardless of these discrepancies, it is likely that all four features fell out of use within a fairly short period of time.

The youngest Middle Formative period AM group (Group 7) contained two structures (Features 3663 and 4768) and a roasting pit (Feature 4931). The AM poles from these three features formed a fairly discrete cluster, in that they were similar to each other and different from almost all other poles in the study set. Because this cluster was located near the A.D. 1025–1250 loop in secular variation, it is possible that these three features had very different ages. Archaeological evidence, including the recovery of a partially reconstructible Rincon Red-on-brown vessel from the floor of Feature 4768, indicated that the structures were Middle Formative period in age, but no independent evidence was available for discerning the age of the roasting pit with respect to the A.D. 1150 minimum, and the pole from this feature was included in both the Middle

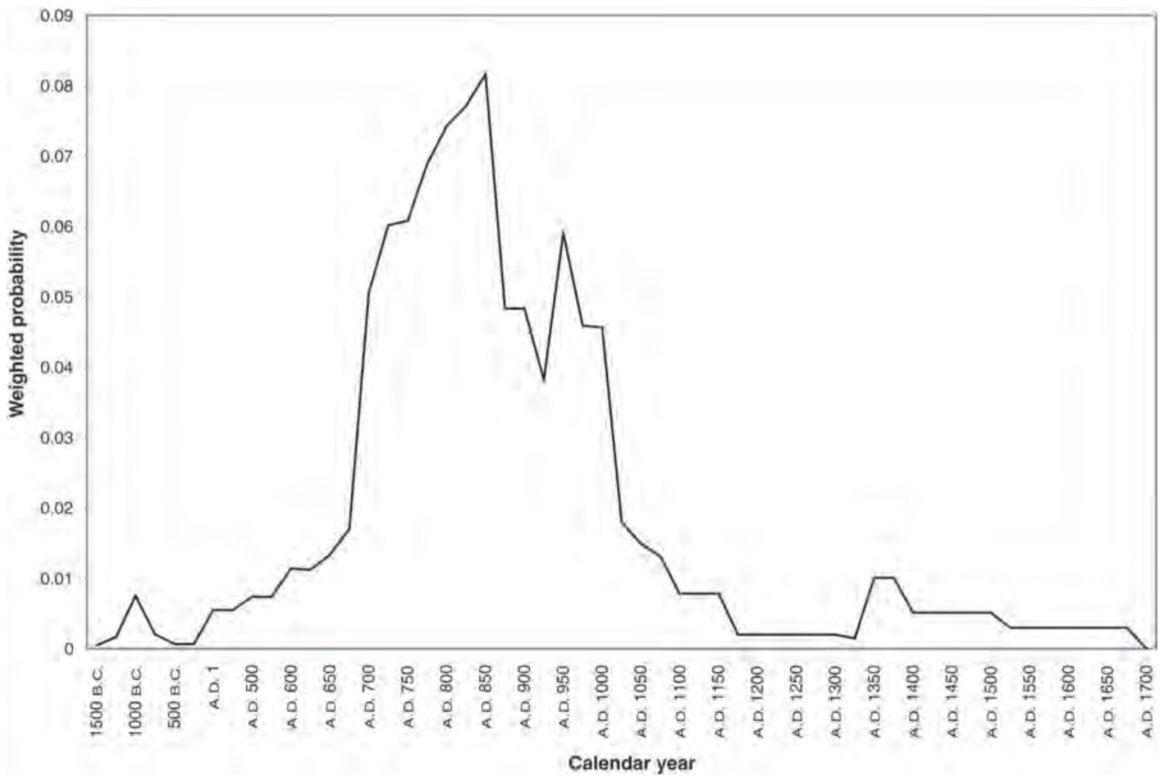


Figure 16. Weighted probability curve of dated features from Locus D. This curve graphically depicts the temporal distribution of dated features over the total use life of the locus.

and the Late Formative period study sets. If Feature 4931 was Middle Formative period in age, then it most likely fell out of use at the same time as did Features 3663 and 4768. The feature's AM pole was different from those of the three known Late Formative period features in the study set (adobe structures Features 1575, 4683, and 4729), and it must have predated these structures.

Summary

Locus D encompassed the most extensively utilized area of the excavated portion of the site. The total dated collection recovered from this locus indicated that the area was utilized fairly continuously over a period of nearly 3,000 years (Figure 16), with chronometric data spanning much of the period between 1280 B.C and A.D. 1690. Although some gaps in the chronometric data undoubtedly were due to the sampling strategies employed and to methodological limitations, particularly in regard to the Late Archaic period, others probably reflected decreased levels of activity in this area. Most notably, there were significantly fewer numbers of features dated between A.D. 900 and 1150 and virtually no features dated between A.D. 1150 and 1350, compared to the preceding and succeeding periods. Together, these data indicated that this portion of the site was utilized extensively during the first portion of the Middle Formative period, particularly for habitation activities, but that the intensity of use diminished through the period, to the point that few, if any, individuals were living in this area by A.D. 1150/1200. Occupation of the area clearly resumed at some point in the thirteenth century, as evidenced by the mid-fourteenth-century abandonment dates for four adobe surface structures representing the final known occupation of the locus. Therefore, the intensity and nature of activities in this area fluctuated through time.

Synthetic Contemporaneity Study

A contemporaneity study was undertaken for the site as a whole, in order to clarify the shifting patterns of site use indicated by the combined temporal data. As with the individual locus studies, the data were divided into Early, Middle, and Late Formative period subsets, and these groups were analyzed separately. Both the Late Archaic/ Early Formative period and the Late Formative period subsets are the same as those included in the Locus D study, and they will not be discussed further here. The Middle Formative period subset, on the other hand, combined data from all three loci. All of the data included in the Loci A and C studies are included in this subset; however, Locus D Features 3756 and 7558 were excluded from this data set because no other Middle Formative period features were thought to predate the A.D. 825 minimum. Altogether, the final Middle Formative period data set included data from 40 features.

The distribution of these 40 Middle Formative period AM poles was remarkably similar to the known path of secular variation (Figure 17), suggesting a fairly continuous level of site use during this time. From the results of the contemporaneity study, they were divided into six groups of similarly aged features (Table 11). Overall, the formulation of these groups was consistent with the results from the individual locus studies, with only moderate shuffling of previously paired features. In fact, the oldest group (Group 1) of the synthetic study was identical to its counterpart in the Locus D study. Furthermore, many of the original locus groups that were redistributed in the synthetic study were fairly weak to begin with, and it is not surprising that the addition of new data would indicate different configurations for these features. Only the formation of the youngest two groups (Groups 5 and 6) resulted in notable restructuring of the AM groups, primarily concerning the distribution of features from Locus A.

When the later Middle Formative period features were compared, it was found that the previously concordant group of Locus A features fit better with the rest of the AM data from the site when they were split into two groups. The majority of these fit best with features in the youngest groups from Locus C and D, and these features were combined to form the youngest synthetic group for the site (Group 6). Features 1189 and 2160 from Locus A corresponded best with a slightly older group of Locus C structures. In fact, archaeomagnetically, they fit better with these structures than they did with the rest of the Locus A structures. Because of the nature of the statistical tests, it is unknown whether these relationships reflect true differences in the ages of the Locus A structures or are due to the vagaries of the AM data. The best solution to this quandary would be to combine both groups into a single group of potentially contemporaneous features, but because one of the slightly older Locus C structures (Feature 6098) was superimposed by one of the structures included in synthetic Group 6 (Feature 7461), the two groups could not be combined without violating the law of stratigraphy. To satisfy these constraints, a separate and potentially older group of features (Group 5) was formed. This alternate configuration of features has ramifications for larger interpretations of site use, and the validity of this hypothesis must be evaluated alongside those proffered for the individual loci. Most notably, these competing hypotheses of contemporaneity affect the interpretation of Locus A as primarily a single occupational episode. Regardless of which is correct, there undoubtedly would have been some temporal overlap among most of the features assigned to the two groups. The extent of this overlap cannot be determined at the available resolution.

Finally, of the eight RHS structures excavated across the site, five were included in this study (Features 200, 379,

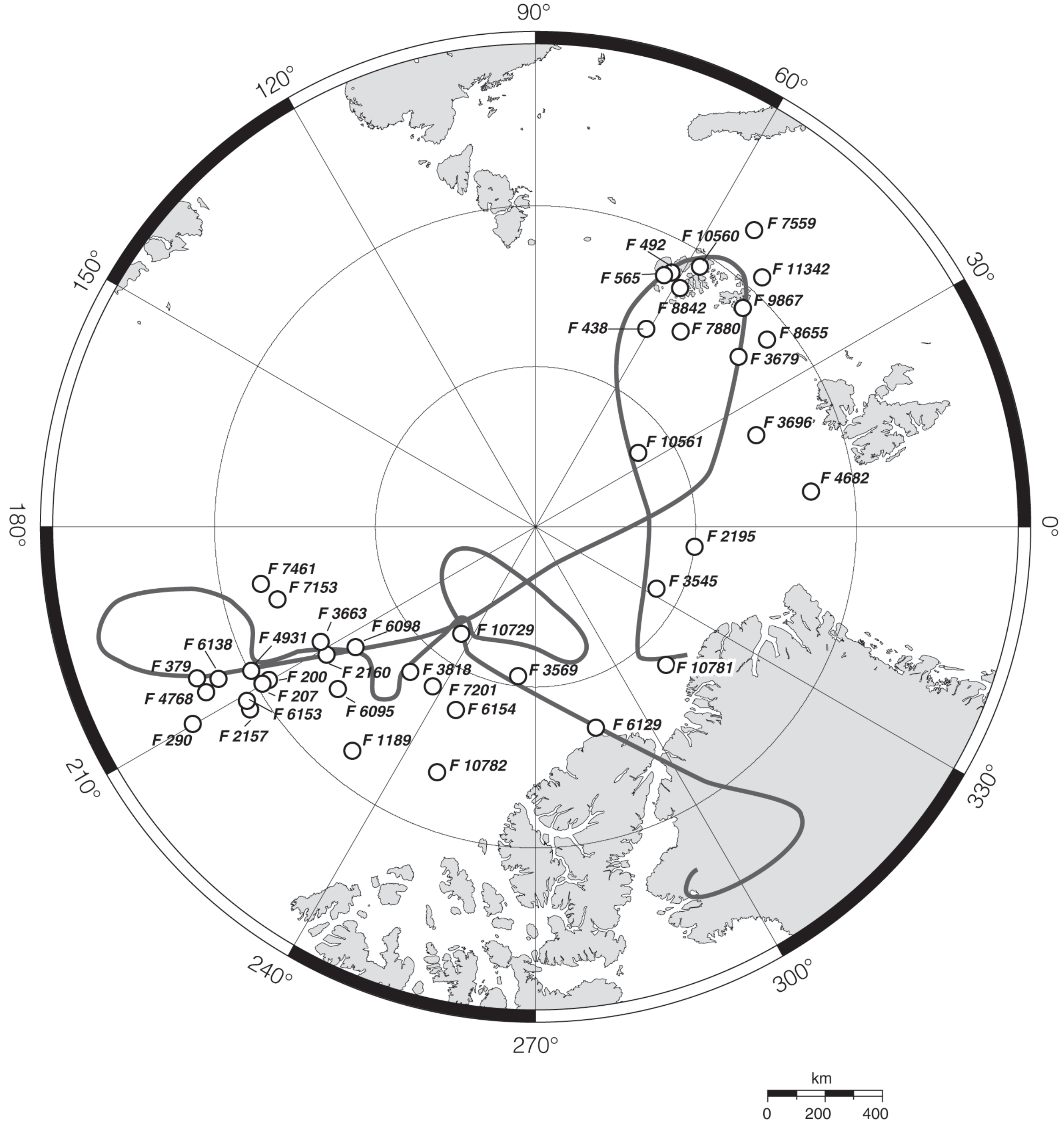


Figure 17. Locations of all archaeomagnetic poles from Middle Formative period features at the site, depicted against SWCV2000.

Table 11. Synthetic Middle Formative Period Archaeomagnetic (AM) Groups

AM Group	Feature Numbers
1 (oldest)	438, 492, 565, 3679, 7559, 7880, 8655, 8842, 9867, 10560, 11342
2	3696, 4682
3	2195, 6129, 3545, 10781, 10561
4	3569, 3818, 10729, 10782, 6154, 7201
5	1189, 2160, 3663, 6095, 6098
6	200, 207, 290, 379, 2157, 4768, 4931, 6138, 6153, 7461, 7153

2160, 6098, and 10781), and a sixth (Feature 995) was represented by a superimposing structure (Feature 6129). These structures were divided among Middle Formative period Groups 3, 5, and 6, suggesting that this construction style was utilized through much of the latter half of the period. The results of the pairwise comparisons conducted among the RHS structures indicated that they varied in age. Features 6129 and 10781 were similar to each other, but they clearly predated the other four RHS structures in this subgroup. By extension, Feature 995 must have predated the same four structures, and it may or may not have predated Feature 10781. At the other end, Feature 379 was similar only to Feature 200 and was younger than the other structures. Features 2160 and 6098 were similar to each other and to Feature 200, but their placement in Middle Formative period Group 5 indicated that they may have predated Feature 200. Interestingly, all but Feature 2160 were replaced by or remodeled into Hohokam-style structures, and the AM data from these later structures corroborated the temporal dispersion of the recessed-hearth construction style.

Summary and Discussion

When the data from all three loci were combined, a fairly continuous pattern of site use emerged (Figure 18). Over time, the focus of various activities shifted spatially (Figure 19), and gross temporal trends in site use can be identified. Within the excavated part of the site, early activities, particularly residential, were restricted to Locus D, and possibly Locus C, with no recognizable evidence for activities on the upper terraces, farther north and west, prior to A.D. 750. Most, if not all, inhabitants of the investigated area continued to live in the slightly lower portions of the site until around roughly A.D. 900. Between A.D. 900 and 1000, residential, and possibly other, activities expanded out from Locus D, with new settlements established to the west, in Loci A and C. The overall intensity of activity within the investigated area peaked between A.D. 900 and 1150, as indicated by the large number of structures dated to this period, and then dropped to almost nothing over the next 2 centuries. Finally, a small Late Formative period group resided in Locus D between roughly A.D. 1300 and 1450, representing the last recognizable prehistoric period settlement within the investigated area.

Interpretive discussions of the different communities identified in this study and the relationships among these communities must wait until all analyses discussed in the subsequent chapters of this volume can be synthesized in Volume 3, but the contemporaneity studies undertaken have provided a means for framing these discussions. The synthetic study indicated that there were coeval households within all three investigated loci by as early as A.D. 850–900, if not earlier. Given their proximity, residents of these areas almost certainly interacted with each other, and the nature and level of these interactions will need to be addressed through other analyses. Furthermore, this study revealed that the local, recessed-hearth architectural style was not a “flash in the pan” that occurred simultaneously across the site, but rather a longer-lived variation that had a minor presence through much of the Middle Formative period. The co-occurrence of this style with more-traditional Hohokam-style structures may indicate some level of ethnic coresidence, and this possibility will need to be explored through other lines of evidence.

In some cases, the temporal data employed in dating the use and abandonment of features provided temporal information about other aspects of the prehistoric period community, as well. For instance, many of the materials used to radiocarbon date specific features also provided temporal information on aspects of subsistence activities, because the AMS samples invariably consisted of charred plant materials that, in many cases, related to subsistence practices. A notable example is the date range of 1060–880 cal B.C. obtained for charred maize cupules recovered from a bell-shaped nonthermal pit in Locus D (Feature 3557), as well as the date ranges of 1280–1010 cal B.C. and 1110–900 cal B.C. obtained for mixed annual samples, including maize, from two other bell-shaped nonthermal pits (Features 3976 and 5505, respectively). These samples not only confirmed that individuals utilized this site almost 3,000 years ago but indicated that these individuals utilized maize agriculture to some degree. This finding is not surprising, given the evidence for early maize agriculture in other areas of the Cienega Creek valley (Huckell 1995), but it provides a starting point from which to explore the subsistence strategies employed by Mescal Wash groups, specifically during the Late Archaic period.

Although this study provides a synthetic temporal framework from which to address the project’s research themes, it inevitably incorporates several sampling and methodological biases. Most notably, the disproportionately low representation of Late Archaic period features within the dated portion of the data set likely was due to sampling strategies, available chronometric methods, and the allocation of chronometric resources. Given the apparent trend of occupation, moving from the west to the east and north, unknown quantities of Late Archaic period features likely are present in the unexcavated western portion of Locus D, closer to Cienega Creek. Importantly, the emphasis placed on AM dating biased the project toward dating Middle and Late Formative period features and dating thermal features, such as structure hearths. This, combined with the increased visibility and temporal resolution of material culture from this time period, predisposed this study toward identifying a greater number of Middle and Late Formative period features than features from earlier periods. These biases increased the difficulties of making demographic comparisons between Late Archaic and Formative period populations at the site. Furthermore, because the study was biased toward dating Middle and Late Formative period activities, the extremely low level of temporal data for the period between A.D. 1150 and 1300 likely reflected a true dip in activity within the excavated area. This finding has implications for demographics and site use that will need to be addressed further in the synthetic analyses presented in Volume 3.

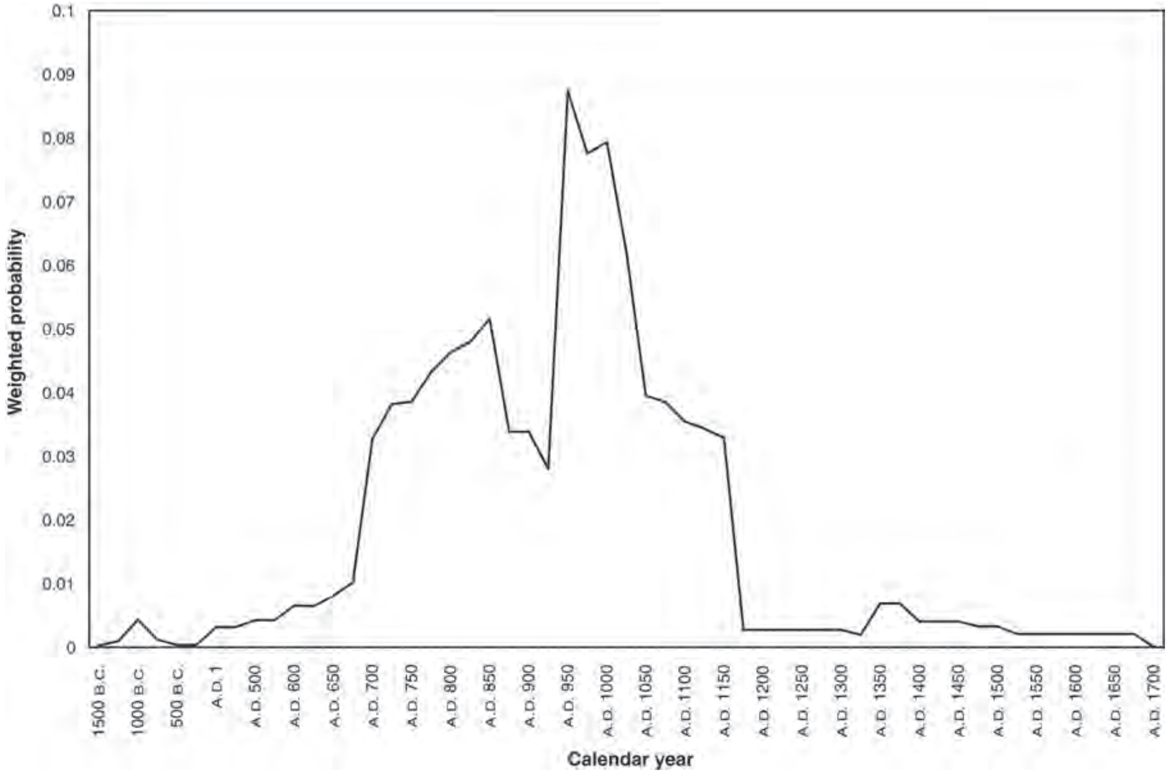


Figure 18. Weighted probability curve of all dated features from Mescal Wash. This curve graphically depicts the temporal distribution of all dated features over the total use life of the site.

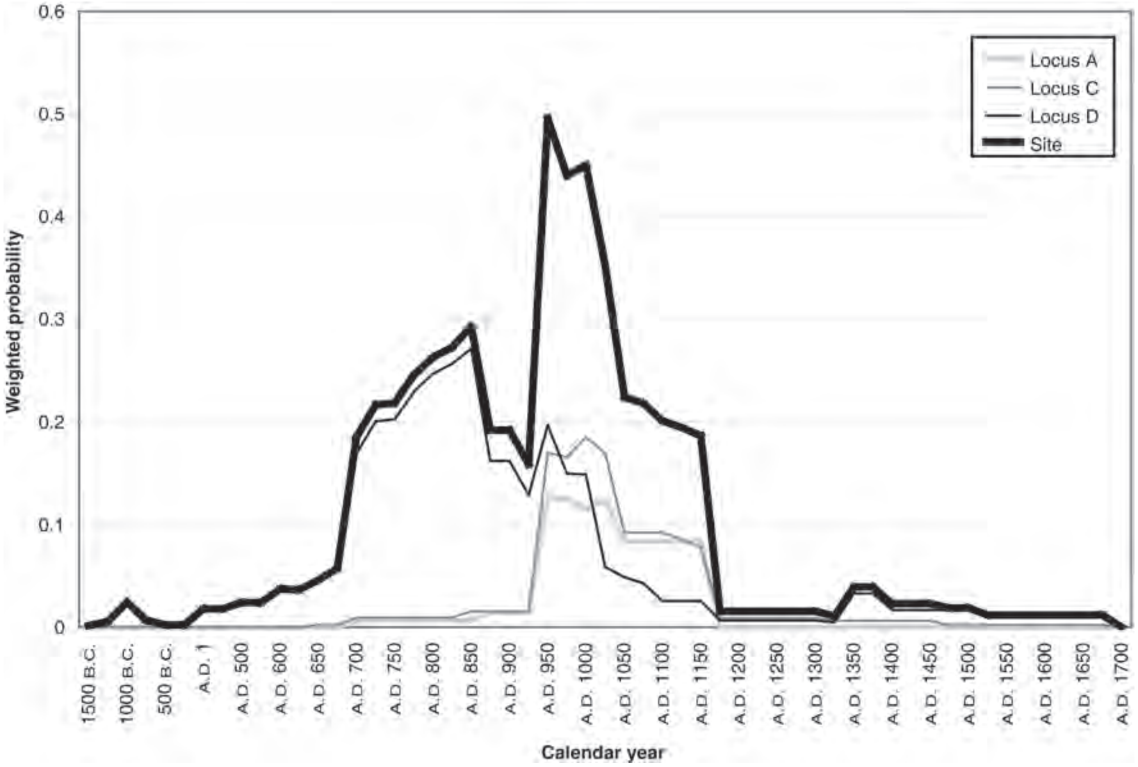


Figure 19. Weighted probability curve for each locus, calculated over the total use life of the site.

CHAPTER 3

Ceramic Artifacts

Christopher P. Garraty and Robert A. Heckman

SRI archaeologists recovered a total of 54,076 ceramic artifacts during Phase 2 archaeological investigations at the Mescal Wash site. This chapter presents a descriptive summary and interpretative discussion of these artifacts. Ceramic artifacts collected during Phase 1 (n = 2,442) primarily were collected from nonfeature surface contexts and are not part of the present study. Rather, the Phase 1 ceramics were analyzed to help characterize the site and infer period assignments in advance of the Phase 2 work (Vanderpot and Altschul 2000:Table 3). The Phase 1 analyses are summarized in Appendix 3.A. The present study does include data obtained from ceramics (primarily vessels) recovered with human burials during both phases of the project; the burial ceramics are separately described in Appendix 3.B but are not included in the present study. All burial artifacts were described and illustrated in the field but were repatriated immediately and, therefore, were not entered into the project database.

During the Phase 2 data recovery, SRI mechanically stripped 3.3 acres of land cover to expose roughly 2,000 subsurface features, several hundred of which were partially or completely excavated, including structures, extramural thermal and nonthermal pits, middens, human burials, and other low-frequency feature classes (Vanderpot 2001, see Appendix 1.A). The dates associated with these features encompass the Late Archaic through Late Formative periods (first millennium B.C. through ca. A.D. 1450), although the majority of features dated to the Middle Formative period (ca. A.D. 750–1150) (Vanderpot and Altschul 2007:56–61; see Chapter 2, this volume), and virtually all of the ceramic remains were recovered from Middle and Late Formative period contexts.

Based on the Phase 1 results, SRI organized the site into eight loci (Loci A–H), but Phase 2 data recovery focused primarily on Loci A, C, and D, with minor work done in Locus B. Locus D encompassed roughly three-quarters of the excavated structures and two-thirds of the extramural features. This locus was consistently used from Late Archaic through Late Formative period times, with a hiatus during the Late Formative A period (ca. A.D. 1150–1300) (Altschul et al. 2000; Vanderpot and Altschul 2007; see Chapter 2, this volume). Occupation peaked during the Middle Formative A period (ca. A.D. 750–950), and many of the Locus D features were superimposed over preexisting features, indicating frequent repeat occupation and reuse of house locations. The prehistoric inhabitants clearly viewed Locus D as an appealing settlement location and maintained a presence there over several millennia (see Altschul et al. 2000:8–9; Vanderpot and Altschul 2007). In contrast, Loci A and C were mainly occupied during the Middle Formative B period (ca. A.D. 950–1150), with little or no superimposition of features (Vanderpot 2001; Vanderpot and Altschul 2007:57–61).

Roughly three-quarters of the Phase 2 ceramic artifacts were recovered from Locus D (41,082 specimens, or 76 percent), which matches the percentage of features excavated in Locus D relative to other loci. Loci A and C accounted for 10 percent (5,363 specimens) and 14 percent (7,561 specimens) of ceramic artifacts, respectively. A very small number of ceramic artifacts were recovered during excavations in Locus B (n = 70); given the small sherd collections from this locus, we focused the analyses primarily on Loci A, C, and D. The ceramic artifacts from Locus B are only briefly described. Table 12 lists the ceramic counts and site information for the present study.

The majority of ceramic artifacts were vessel sherds (53,998 specimens, or 99.8 percent), roughly half of which were fragments from unpainted and painted vessels (28,085 specimens, or 52 percent). Unfortunately, nearly as many sherds were too small for the analysts to unambiguously distinguish painted or unpainted surfaces (25,903 specimens, or 48 percent); consequently, nearly half of the collection could not be subjected to ware or typological studies and are excluded from most of the

Table 12. Ceramic Artifacts, by Locus

Locus	Description	Painted Sherds		Unpainted Sherds		Painted Vessels		Unpainted Vessels		Modeled Artifacts		Indeterminate Sherds[a]		Total
		Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	Count	Row %	
A	Middle Formative period farmstead	1,465	27.3	2,296	42.8	11	0.20	9	0.20	3	0.10	1,579	29.4	5,363
B	activity area	1	1.4	38	54.3							31	44.3	70
C	Middle Formative period farmstead	1,373	18.2	3,112	41.2	10	0.10	3	0.04	4	0.10	3,059	40.5	7,561
D	multicomponent residential area	3,163	7.7	16,637	40.5	8	0.02	33	0.10	7	0.02	21,234	51.7	41,082
Total		6,002	11.1	22,083	40.8	29	0.10	45	0.10	14	0.03	25,903	47.9	54,076

[a] Too small to determine surface-treatment category (painted or unpainted).

interpretive discussions below. We concentrate mainly on the 28,173 ceramic artifacts that the analysts were able to classify according to ware and type, although we explore, below, the possible formation processes responsible for the proliferation of the very-small sherds (see Beck 2006; Schiffer 1987). A considerably smaller portion of the collection was composed of whole or reconstructible vessels (74 specimens, or 0.14 percent). Although few in number, the whole and reconstructible vessels provided an invaluable source of information concerning vessel function and subsistence practices. The remainder of the collection was composed of low-frequency modeled artifacts (14 specimens, or 0.03 percent), principally figurines and clay bells.

This chapter begins with a brief background discussion of the principal research questions and contexts for this study. We outline the major research questions for this chapter and how they relate to the broader goals of the project, as outlined by Altschul et al. (2000). The second section outlines the methods and data-recording procedures, including an overview of the basic form and ware categories used to code the ceramic artifacts. In the third section, we discuss the results of the analyses, presented separately for each locus. The subsequent section includes a variety of analyses and discussions focusing on the key research questions. The final section presents a conclusion and a summary of our analytical results.

Research Background and Analytical Context

We designed the ceramic analyses to address two major research themes: (1) regional interaction, identity, and exchange and (2) site function and subsistence practices. The first theme concerns the changing cultural affiliation and identity of the Mescal Wash inhabitants within the broader-regional social, ideological, and economic landscape of southern Arizona, building on the ideas and hypotheses expressed by Vanderpot and Altschul (2007). This is an especially important question, considering that prehistoric period sites in southeastern Arizona typically exhibit an amalgam of cultural traits and practices (Altschul et al. 2000:7–9; Vanderpot and Altschul 2007). The people living in this area incorporated cultural traits from a variety of neighboring culture areas, including the Hohokam and Mogollon traditions (Whittlesey and Heckman 2000). Our second theme relates to site function and activities and how they changed during the Middle and Late Formative periods (ca. A.D. 750–1450). Both themes relate to SRI's broader goal of explaining the long-term social, cultural, and land-use history of the Mescal Wash site during its long span of habitation (Altschul et al. 2000:10–14).

Regional Interaction, Identity, and Exchange

Interaction and Cultural Diversity

Unlike other regions of the U.S. Southwest, prehistoric period southeastern Arizona was not marked by a single dominant material cultural tradition but, rather, incorporated a culturally heterogeneous mix of material culture traits. In the data recovery plan for the Marsh Station project, Altschul et al. (2000:13) argued that southeastern Arizona is best described as a "borderland," or cultural frontier, that intersected with various larger "regional communities" (Altschul et al. 2000:13), or culture groups with relatively distinct and homogeneous material culture traits, including Hohokam, Salado, Mimbres Mogollon, and Chihuahuan groups. Southeastern Arizona was (and still is) also an ecotone between the Sonoran Desert to the west and north and the Chihuahuan grassland to the south and southeast. In addition, the area is traversed by the south-flowing San Pedro River, which, in prehistoric period times, functioned as a transportation artery between the desert and grasslands and probably also facilitated the transmission of people, ideas, and material culture. Moreover, as Vanderpot and Altschul (2007:67) explained, Mescal Wash was situated along the most logistically practical transportation route between the San Pedro Valley in the east and the Santa Cruz Valley and Tucson Basin to the west.

One of the chief objectives of the present project is to better understand how various regional communities intersected in this area and how local inhabitants forged their identities and sociocultural affiliations within a culturally diverse landscape (Altschul et al. 2000:13–14). The crystallization of ethnic identities is an interactive and social process: social groups do not construct and perpetuate their ethnic identities in a vacuum but, rather, in relation to other groups (see Barth 1969). As Duff (2002:xiii) explained: "Understanding how individuals perceived their own identity in relation to others is critical for the reconstruction of local and regional social organization." At the highland central-Mexican city of Teotihuacan, for example, ethnic enclaves of peoples from Oaxaca and the Gulf lowlands highlighted and sustained certain material culture traits from their homelands as a means of emphasizing their ethnic identities relative to the city's indigenous population, even after those traits had become anachronistic and passé in their native homelands (Spence 1992, 1996). The inhabitants of Mescal Wash also may have expressed their identities and affiliations through material culture, as a result of frequent contact with socially or culturally distant individuals.

This is an especially important question for southeastern Arizona, where local peoples in the region probably came into frequent contact with individuals from different ethnic and cultural backgrounds throughout the Formative period (A.D. 1–1450). As anticipated, based on the results of the Phase 1 research (Vanderpot and Altschul 2000), the areas of Mescal Wash investigated during Phase 2 mostly dated to the Middle Formative period (A.D. 750–1150); the Late Formative period component in the project area was relatively modest. SRI archaeologists found evidence of variability in burial practices and architectural styles among contemporary pit houses (Vanderpot 2001:12, 15–16), which may indicate varying cultural influences or styles. In addition, the painted-pottery sherds recovered during the excavation indicate the possibility of substantial social and economic connections to the larger "regional communities" (Altschul et al. 2000:13) in the southern deserts (see Vanderpot 2001:17; Vanderpot and Altschul 2007). The decorated-pottery collection included types associated with regional communities in the Tucson Basin (Hohokam), the Phoenix Basin (Hohokam), the Dragoon area, the Mimbres region (Mogollon), the San Simon area (Mogollon), and the Trincheras tradition (see Heckman et al. 2000) (Figure 20), with the bulk of the painted-pottery types related to the Tucson Basin Hohokam, Phoenix Basin Hohokam, and Dragoon traditions.

The fundamental question concerns the origins and character of this diversity. Does it indicate intensive interaction and exchange between local and nonlocal populations? Or does it reflect physical movement of peoples from surrounding regions into the Mescal Wash area? A third possibility is that local pottery manufacturers emulated the decorative styles of potters in the other regional communities. These hypotheses somewhat resemble Vanderpot and Altschul's (2007:65–69) three competing hypotheses for the diverse material culture record at Mescal Wash: (1) sequential occupation by culturally different groups, (2) cohabitation by culturally different groups, and (3) selective borrowing of nonlocal material culture traits by local native inhabitants. All of these scenarios may have been true, to some extent, although Vanderpot and Altschul (2007:68–69) posited that the site functioned as a longstanding and widely acknowledged "free zone" where groups and seasonal migrants from different areas and cultural backgrounds could interact and pursue resource acquisition without fear of conflict or competing claims of use rights regarding land and resources.

The ceramic data are well suited for exploring the broader processes and social changes. Material culture is one of the principal media through which ethnic groups express identity, but individuals or groups may variably express or emphasize certain material culture traits, depending on the frequency and duration of interaction with different cultural or ethnic groups. Consequently, material expressions of identity and affiliation may be more pronounced and competitive during periods of social change and economic disruption.

Variability in pottery types among features or areas of the site cannot be used to conclusively distinguish among these possibilities. The presence of some types might indicate economic and social relationships between local and external groups, whereas others might reflect movement into the region of peoples that made pottery using the traditional methods and techniques of their homelands (see Hegmon et al. 2000). We are therefore unable to unequivocally discriminate among the three hypotheses based on ceramic data alone, but we are able to offer some tentative interpretations and observations in the concluding section. Based solely on the available ceramic evidence, we tentatively argue, below, that the inhabitants of Mescal Wash used painted pottery as emblems of identity or social affiliation, whether by immigrants or by local peoples who expressed connections with nonlocal traditions. Moreover, rapid changes in proportions of various regional painted traditions during the Middle Formative period, we suggest, indicate possible social disruption or instability in interaction networks, as well as reorientations of social relationships, possibly related to the development of the large-scale ball-court-village network (Wilcox and Sternberg 1983) throughout the Hohokam region from about A.D. 950 to 1150. Lengyel's (see Chapter 2, this volume) fine-grained chronology and occupational episodes were a vital component of our interpretations of social change.

Pottery Provisioning and Exchange

We investigated the issue of social interaction and exchange from various perspectives and using several analytical techniques. First, we analyzed changes in the distributions of decorated types with known cultural affiliations. Second, we compared pottery-type percentages among features and loci to explore the extent to which households participated in a common provisioning system for pottery vessels. For example, how similar or different are pottery collections among structures or groups of structures? Similar collections (e.g., with similar proportions of painted or undecorated types) suggest the possibility of a common provisioning source among households. This comparative framework helps to reconstruct the scale and direction of interaction and provisioning networks. For example, did each household independently establish provisioning relationships with other areas, resulting in an eclectic mix of styles and types among contemporary sites? Or were exchange relationships relatively uniform, perhaps as a result of common participation in a broader exchange system or provisioning network (see Garraty et al. 2010)?

We inferred patterns of exchange and provisioning by inspecting the counts and proportions of nonlocal painted wares in the feature collections and how they changed over time. This is a viable approach for Mescal Wash, because a large proportion of the sherds and vessels recovered from the site were painted wares. Excluding the sherds that were too small to identify by type (see above), roughly one-fifth of the collection was composed of painted types

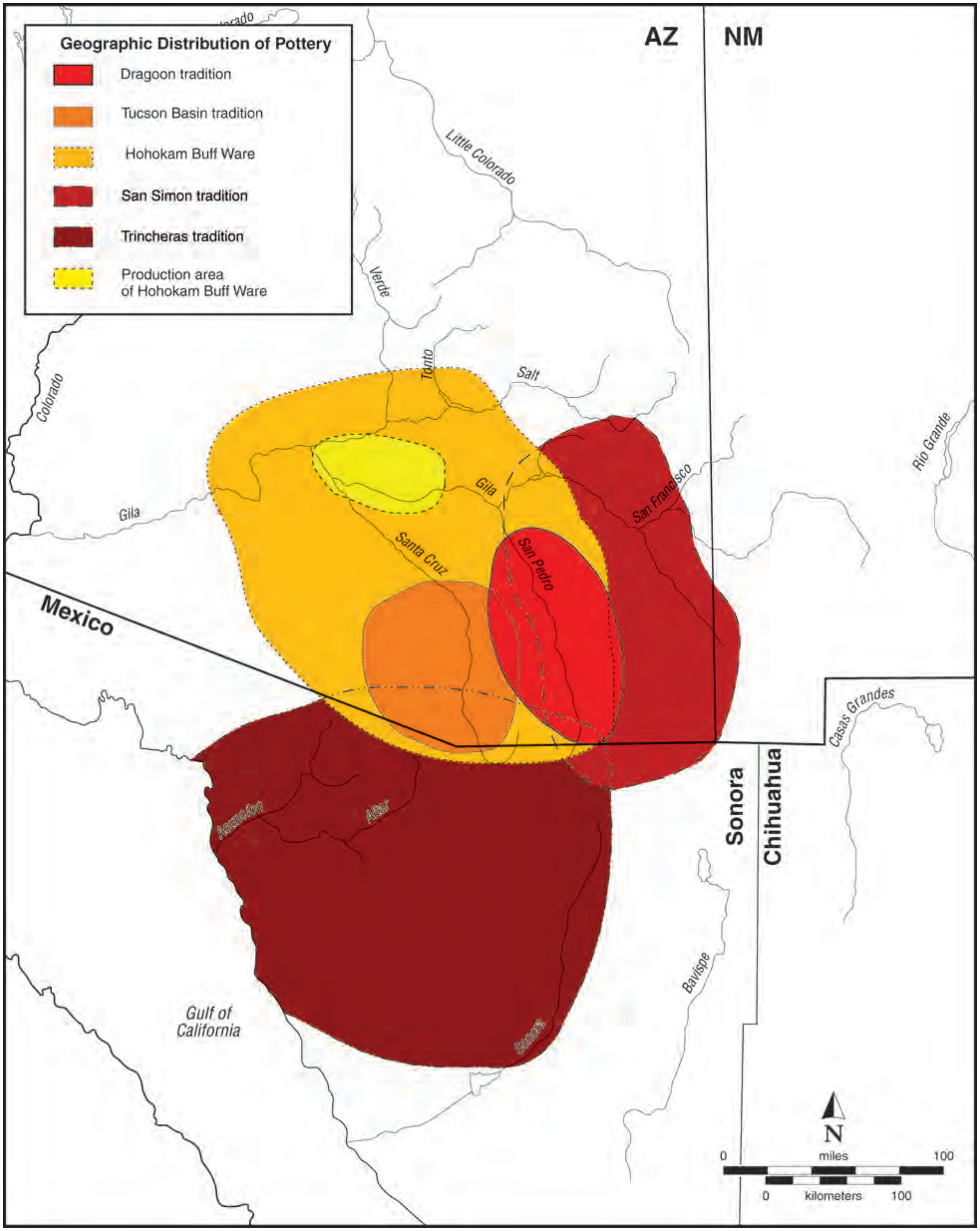


Figure 20. Approximate boundaries of the culture areas and painted-pottery traditions discussed in the text.

(21 percent, or 6,031 of 28,176 specimens). Nearly two-thirds of the painted types (66 percent, or 3,171 specimens) could be identified with a specific regional painted-ware tradition (Heckman et al. 2000), although many could not be identified as a specific type. These counts and proportions indicate a robust data set for detailed analyses of spatial distributions of regionally diagnostic painted types, which can shed light on patterns of interaction and provisioning among households at the site.

Site Function and Subsistence Practices

A second objective of this chapter is to complement other material, architectural, and landscape evidence in inferring site function and activities. Inferences of vessel forms have often been used to help interpret site function in southern and central Arizona (see Doyel and Elson 1985; Whittlesey 1994). The range of vessel forms and functions (e.g., storage, cooking, and serving wares) present at a specific site, feature, or other provenience sheds light on the human activities that occurred at that location. For example, the sizes and diversity of form classes are instructive as to the range of activities that occurred within a site or subarea of a site.

Ideally, such interpretations require detailed form and function information. SRI analysts were able to approximate vessel volume (see below) for only 23 whole and reconstructible vessels, which is too small a sample to infer broad patterns concerning function. Rather, we employed a program developed by Heckman (2002) and based on Braun's (1980, 1983) functional categories to make detailed assessments of vessel function and size (e.g., serving/processing, storage, cooking, etc.). As Braun (1980) has pointed out, a great deal of information about vessel function and use can be gleaned from analyses of formal variation in rim sherds; generally, with some exceptions, less information can be extracted from formal analyses of vessel parts below the rim. Rim sherds provide information about the vessel orifice and therefore contain "encoded" information about how the vessel contents were extracted; they provide empirical grounds for inferring types of contents (wet versus dry materials), the mechanics of content removal (e.g., pouring versus scooping), and the frequency of content removal. In turn, these inferences provide valuable clues to the vessels' probable functions as cooking, serving, or storage containers.

In addition, Braun (1980:177–181) defined six form categories based on rim and upper-wall morphology. He defined four categories of jars (jars with necks, neckless jars, jars with recurvate necks, and miscellaneous/other jar forms) and two categories of bowls (simple hemispherical bowls and shallow bowls/plates) and determined that each of these form classes corresponded with specific functions, including serving/processing of food, transfer or carrying, wet or dry storage, and cooking. He also defined seven orifice-diameter ranges, or size classes, based on the means (i.e., pouring or scooping) by which pottery users accessed vessel contents and the inferred frequency of access, as determined from ethnographic observations of vessel use. He combined his six form categories with his seven size classes to infer a broad range of intended functions, resulting in the 42 detailed functional categories (see below). Braun combined these attributes to infer the sizes of vessels used for various intended functions, including serving/processing vessels, transfer/carrying vessels, storage vessels, cooking vessels, and combinations of these.

Using this method, we were able to assess a detailed form and functional class for 581 large rims and whole/reconstructible vessels, which constituted roughly 1 percent of the collection—2 percent, if the very-small sherds are excluded. Distributional patterns for these detailed forms and functions will help shed light on site and feature function. Below, we report differences in the compositions of functional classes for the Middle and Late Formative periods, which may suggest different site functions and activities during these occupations.

In order make use of a more robust portion of the collection, we also employed less-precise lines of evidence, such as proportions and ratios of broad formal categories. Most of the rims identified by form were from bowls or jars, although plates and scoops also were present in low frequencies. Bowls were frequently used for processing and serving food and drink; conversely, many jars likely functioned as storage and cooking containers. One salient pattern in the Mescal Wash data was a proliferation of painted bowls and jars relative to unpainted vessels during the Middle Formative period, which might suggest an increased focus on the processing and serving of comestibles for feasts or communal gatherings. We link this pattern to the development of the interregional interaction network in the southern deserts during the A.D. 900s and 1000s, which was partially articulated by an extensive system of villages with ball courts (Wilcox and Sternberg 1983) (see below). Increased interregional interaction and exchange may have fostered greater emphases on feasting activities and communal ritual or ceremonial events.

Methods

Data-Recording Procedures

Most of the ceramic artifacts analyzed for the present study were collected from Loci A, C, and D; a very small collection was recovered from Locus B, which we do not report in detail. All ceramics recovered during each phase of the project were collected for coding and analysis. The Phase 1 ceramics were analyzed by Robert Heckman and are reported in Appendix 3.A. Kristen Hagenbuckle, Robert Heckman, and Elizabeth Hora recorded attribute data for the Phase 2 ceramic collection.

Not all ceramic materials received the same level of analytical detail. The analysts employed a multistage approach to data recording, with each stage focused on recording a different set of ceramic attributes (listed in Table 13). Appendix 3.C provides brief descriptions of the ceramic attributes and coding categories employed for this project.

During the initial sort, the analysts recorded a limited number of attributes, based on analyses of all ceramic artifacts collected during the Phase 2 excavations. All sherds were counted and coded by provenience, ceramic ware and type (if inferable), and vessel part (rim, body, handle, etc.). The ceramic typologies employed for the study are described below. Attribute records for all worked sherds and low-frequency artifacts (e.g., clay bells and figurines) also were recorded as part of the initial sort. Other attributes, such as the presence of incising and surface sooting, were recorded only if these attributes were evident. The initial sort was mainly intended to provide a general characterization of the ceramic collection and provided a baseline for determining the attribute-recording procedures employed for subsequent stages of recording. As explained above, nearly half of the recovered ceramic remains were too small to code by type or ware class. These pieces were recorded as “too small” and excluded from further analysis.

One of the goals of this project is to infer site functions and subsistence practices (Altschul et al. 2000:18–19) (see above). Therefore, the second stage of analysis focused on an expanded set of morphological attributes, based on analyses of rim sherds and whole or reconstructible vessels. Recorded attributes for this stage included general form class (e.g., bowl, jar, or scoop), the shape of the upper vessel wall and rim (outcurving, straight, etc.), and various metric attributes, such as orifice diameter. In all, the analysts recorded an expanded set of morphological attributes for all rims and whole/reconstructible vessels in the collection (n = 1,905). A subset consisting only of large rims and whole/reconstructible vessels (n = 581) was included in the detailed functional classification, as explained above.

An additional stage of analysis focused exclusively on the whole and reconstructible vessels (defined as those that were at least 15 percent complete or that exhibited a complete vessel profile). During this stage of analysis, the analysts made various detailed form measurements (such as counter metrics) (see below), which were used for more-detailed assessments of vessel form and size. Unfortunately, whole/reconstructible vessels generally were recovered in insufficient quantities for robust and statistically sound analyses on a per-feature or, in some cases, a per-locus basis (especially when the data were placed into subsets by age or occupational episode). Regardless of these limitations, important information can be gleaned from the whole/reconstructible vessels, and they provided a sound baseline for inferring the range of morphological variation exhibited in the rim collection.

Type and Ware Classification (Initial Sort)

The type and ware coding procedures were based on a hierarchical classification system. Sherds and vessels were initially coded into one of three broad ware classes: plain wares, red wares, and painted wares. Within these broad classes, more-detailed type classifications were defined based on selected attributes, as explained below. Painted wares were assigned to type categories based on paint colors and diagnostic design motifs and patterns. Plain wares and red wares were assigned to type categories based on macroscopic paste inclusions and surface-treatment attributes.

Painted Wares

Excluding the very-small sherds for which type distinctions were not possible, sherds and vessels with visible or inferred painted decoration composed 21 percent of the project collection (6,031 specimens) (Table 14). Many of the specimens coded as painted pottery actually lacked visible evidence of surface paint but likely derived from painted vessels. These specimens likely came from unpainted portions of painted vessels or from portions from which the surface paint had eroded. For example, the majority of buff wares were coded as “indeterminate buff wares,” which do not possess visible surface paint, per se, but very likely derived from painted red-on-buff vessels. Table 14summarizes the painted-pottery ware and type categories used for the Mescal Wash collection.

On a broad level, the painted sherds were classified according to various prehistoric period painted-pottery traditions in southern and central Arizona. Here, “pottery tradition” refers to a characteristic manner, method, or style of manufacturing pottery that persisted through time and was restricted in geographic space (see Heckman et al. 2000); this is the pottery equivalent of the concept of a “regional community,” as defined above. Whittlesey and Heckman (2000) have employed the concept of “tradition” to provide a framework for classifying the diverse array of decorated sherds recovered from sites in southeastern Arizona. Distinguishing pottery traditions is especially pertinent to this study, given that Mescal Wash was likely located in a culturally diverse “boundary zone” or “free zone” (see Vanderpot and Altschul 2007) bordering on a number of

Table 13. Summary of Recorded Variables

Recorded Variable	Variable Type	Limited Attribute Recording	Expanded Attribute Recording	Whole/Reconstructible Vessels	Comments
Tracking information	categorical	X			provenience and catalog information
Ceramic unit	categorical	X			
General type	categorical	X			plain ware, red ware, or painted qare
Painted-ware type	categorical	X			painted and buff wares only
Type X description	categorical	X			see Table 14 for details
Ware description	categorical	X			see Table 14 for details
Item count	integer	X			
Slip	presence/absence	X			
Evidence of repair	presence/absence	X			
Recycled	presence/absence		X		reused, with postbreakage modification
Exterior incision	categorical		X		
Exterior corrugation	categorical		X		
Vessel class	categorical		X		restricted or unrestricted vessel
Vessel form	categorical		X		general classes (bowl, jar, etc.)
Rim form	categorical		X		e.g., outcurved, straight, etc.
Orifice diameter	metric (cm)		X		
Orifice percent	percent estimate		X		percentage estimate
Aperture diameter	metric (cm)		X		large rims only
Aperture percent	percent estimate				percentage estimate
Completeness of vessel	percent estimate			X	percentage estimate
Shoulder form	categorical			X	based on shape typology
Minimum vessel height	metric (cm)			X	
Maximum vessel height	metric (cm)			X	
Rim-wall angle	metric (cm)			X	

Table 14. Painted-Pottery Wares, Types, and Date Ranges

Regional Tradition	Type or Ware Category	Date Range	Total
Tucson Basin Hohokam	indeterminate Pioneer or Colonial Red-on-brown	A.D. 550–850	2
	Snaketown-style red-on-brown	A.D. 700–800	3
	Cañada del Oro Red-on-brown	A.D. 750–850	34
	Cañada del Oro or Rillito Red-on-brown	A.D. 750–950	161
	Rillito Red-on-brown	A.D. 850–950	119
	Rillito or Rincon Red-on-brown	A.D. 850–1150	135
	Rincon Red-on-brown	A.D. 950–1150	441
	Rincon Polychrome	A.D. 1000–1100	10
	Rincon Black-on-brown	A.D. 950–1150	42
	Rincon or Tanque Verde Red-on-brown	A.D. 950–1300	3
	Tanque Verde Red-on-brown	A.D. 1150–1300	19
	indeterminate Tucson Basin red-on-brown	indeterminate	1,335
	indeterminate Tucson Basin black-on-brown	indeterminate	14
	indeterminate Tucson Basin polychrome	indeterminate	3
Subtotal			2,321
Phoenix Basin Hohokam	Sweetwater Red-on-gray	A.D. 700–800	2
	Sweetwater or Snaketown Red-on-gray	A.D. 700–800	3
	Snaketown Red-on-buff	A.D. 700–800	9
	Snaketown or Gila Butte Red-on-buff	A.D. 700–850	9
	Gila Butte Red-on-buff	A.D. 750–850	30
	Gila Butte or Santa Cruz Red-on-buff	A.D. 750–950	39
	Santa Cruz Red-on-buff	A.D. 850–950	86
	Santa Cruz or Sacaton Red-on-buff	A.D. 850–1100	28
	Sacaton Red-on-buff	A.D. 950–1150	40
	indeterminate buff ware	indeterminate	675
Subtotal			921
Dragoon	Dragoon Red-on-brown (broad line)	A.D. 650–750	17
	Dragoon Red-on-brown (fine line)	A.D. 700–950	50
	Dragoon Red-on-brown (elaborated)	A.D. 950–1100	182
	Dragoon Red-on-brown (indeterminate)	indeterminate	205
Subtotal			454
San Simon	Dos Cabezas Red-on-brown	A.D. 650–750	6
	Dos Cabezas or Pinaleno Red-on-brown	A.D. 700–800	3
	Pinaleno or Galiuro Red-on-brown	A.D. 700–800	1
	Galiuro Red-on-brown	A.D. 700–950	77
	Cerros Red-on-white	A.D. 950–1150	6
	Encinas Red-on-brown	A.D. 950–1150	3
	indeterminate San Simon red-on-brown	indeterminate	29
Subtotal			125
Roosevelt Red Ware	Gila Polychrome	A.D. 1320–1450	23
	Tonto Polychrome	A.D. 1350–1450	3
	Gila or Tonto Polychrome	A.D. 1320–1450	62
	indeterminate Roosevelt Red Ware	indeterminate	31
Subtotal			119

continued on next page

Regional Tradition	Type or Ware Category	Date Range	Total
Trincheras	Trincheras Purple-on-red (nonspecular)	A.D. 700–1150	2
	Trincheras Purple-on-red (specular)	A.D. 700–1150	13
	Nogales Polychrome	A.D. 950–1150	6
Subtotal			21
Low-frequency painted types	Mimbres Black-on-white	A.D. 900–1150	4
	Babocomari Bichrome (elaborated)	A.D. 950–1300	1
	San Carlos Red-on-brown	A.D. 1275–1400	2
	indeterminate Maverick Mountain or Tucson Polychrome	indeterminate	2
	black-on-red	indeterminate	1
Subtotal			10
Split categories	Snaketown Red-on-buff or Snaketown-style red-on-brown	A.D. 700–800	3
	Gila Butte Red-on-buff or Cañada del Oro Red-on-brown	A.D. 750–850	9
	Tucson Basin or Dragoon Red-on-brown (elaborated)	A.D. 950–1150	72
	Dragoon or San Simon Red-on-brown (elaborated)	A.D. 950–1150	1
	Dragoon or San Simon Red-on-brown (fine)	indeterminate	57
	Dragoon or San Simon Red-on-brown (indeterminate)	indeterminate	162
	Tucson Basin or Dragoon Red-on-brown (fine)	indeterminate	2
	Tucson Basin or Dragoon Red-on-brown (indeterminate)	indeterminate	266
Subtotal			572
Indeterminate categories	Red-on-brown (indeterminate)	indeterminate	1,413
	indeterminate red-on-buff or red-on-brown	indeterminate	75
Subtotal			1,488
Total			6,031

Note: Based on Heckman et al. (2000).

cultural and ethnic territories (see above). The sheer diversity of painted types highlights the site's "culturally intermediate position and occupations by, or connections with, peoples of diverse cultures" (Altschul et al. 2000:8).

The major painted-pottery traditions included the Tucson Basin Hohokam brown ware tradition (Deaver 1984; Heckman 2000e), the Phoenix Basin Hohokam buff ware tradition (Haury 1937a), the Dragoon brown ware tradition (Fulton and Tuthill 1940; Heckman 2000b), the San Simon brown ware tradition (Heckman 2000c; Sayles 1945), the Roosevelt Red Ware tradition (Crown 1994; Gladwin and Gladwin 1930), the Trincheras tradition (Heckman 2000d), the Mimbres tradition (Haury 1936), the Babocomari tradition (DiPeso 1951; Heckman 2000a), and the Safford/San Carlos tradition (Danson 1952; Lindsay 1992). Importantly, previous researchers have developed a temporal sequence for these traditions that facilitated our chronological evaluations of features and site components at Mescal Wash (see Table 14).

In some cases, we used ware-specific catchall categories to accommodate sherds that could be classified by ware but not assigned to specific type categories (e.g., "indeterminate red-on-buff" for Hohokam Buff Ware). We also devised "split categories" for cases in which the analysts were unable to distinguish between two possible ware traditions; examples include our "Dragoon or Tucson Basin elaborated" and "San Simon or Dragoon Fine-line" categories. Some types were subdivided into smaller categories, or "styles" (e.g. Mimbres Black-on-white and Rincon Red-on-brown). A large percentage of the painted sherds were classified into one of these split categories, which is largely attributable to the small sizes of most of the sherds.

Unpainted Wares

Excluding very-small sherds, unpainted plain ware and red ware sherds and vessels composed about 79 percent of the project collection (22,129 specimens). Of the unpainted sherds and vessels, the overwhelming majority were plain wares (97 percent, or 21,395 specimens); red wares composed only 3 percent of the unpainted sherds and vessels (734 specimens). Two additional plain ware sherds were classified as brown corrugated types with sand-sized inclusions. Similar brown corrugated plain wares were common at sites along the San Pedro River during the Late Formative period.

During the initial sorting process, we avoided imposing the existing typologies for coding the unpainted plain ware and red ware sherds and vessels. Instead, we developed a different classification system based on a suite of salient surface-treatment and paste attributes (summarized in Table 15). This typological system is a modification of a system developed by Deaver (1984) for analysis of prehistoric period ceramic collections from Hohokam sites in the Santa Rita Mountains, which Heckman (2001) has described in detail. With this system, all plain ware and red ware sherds were classified into one of four categories (Types I–IV). Types I and II are both characterized by a paste matrix composed of sand particles (typically quartz) with minor amounts of mica. These two types are distinguished on the basis of surface treatment: Type I ceramics are characterized by poor surface finish and hand-modeling, and Type II ceramics are well smoothed and lightly polished. Types III and IV tend to be well smoothed and lightly polished but are distinguished based on paste inclusions. Type III pastes contain abundant course, micaceous-schist and -rock inclusions. Type IV pastes contain large particles of foliated-rock inclusions, such as phyllite or micaceous materials.

Unfortunately, the rock and mineral inclusions were too broadly defined to infer production provenance or regional affiliation. Consequently, macroscopic identifications of rock types could not be used for estimations of clay provenance, as Abbott (2000) has done for ceramic artifacts in the Salt River Basin. Clays with sand and mica inclusions (Types I and II) are ubiquitous in alluvial deposits throughout the greater Southwest. Micaceous and schistose rock (Types III and IV, respectively) also are found in various loci in southern and central Arizona and cannot be tied to specific geological outcrops. Compositional analyses provide the best method of inferring clay provenance for the plain and red wares, but these analyses are costly and cannot typically be conducted on a very large sample.

Inferring Vessel Form (Expanded Attribute Analysis)

As discussed above, one of the goals of the project is to infer site function and the human activities that took place within the site or loci (Altschul et al. 2000:18–19). Detailed studies of ceramic attributes and forms can help archaeologists determine the range of human activities and subsistence practices.

Table 15. Type Definitions for Plain Wares and Red Wares

Type Category	Paste	Inclusions	Surface Finish
Type I and Red Type I	• dark brown to grayish brown	1. Quartz: • angular	Unfinished: • hand-modeled
Type II and Red Type II	• light brown to orange brown • dark gray and dark brown also common • soft and friable to medium hard • carbon core not typical	1. Sand: • quartz, feldspar, orthoclase, and horneblend common • abundant, spherical in shape 2. Mica: • phlogopite, probably from igneous or metamorphic parent materials	Variable: • hand-smoothed, uneven surface • tool-polished, uneven surface • occasional anvil marks on interior
Type III and Red Type III	• tan to dark gray	1. Micaceous schist: • abundant, angular in shape 2. Micaceous rock: • possibly gneiss 3. Sand: • secondary inclusion, not abundant	1. Jars: • exteriors well smoothed, lightly polished 2. Bowls: • both exterior and interiors well smoothed, lightly polished 3. Exterior striations: • jars: horizontal on necks • bowls: no consistent pattern
Type IV and Red Type IV	• no consistent pattern	1. Schistose rock: • large, coarse chunks • often micaceous • larger particles than in Type III, but similar material	no consistent pattern

Note: Based on Deaver (1984) and Heckman (2001).

As with the ware and type definitions, vessel classes were coded using a hierarchical classification system. At the broadest level, rims and vessels were classified into two general vessel-class categories: restricted (narrow orifice diameter relative to maximum vessel diameter) or unrestricted (orifice diameter matched or exceeded maximum vessel diameter below the rim) (see Sheppard 1976:229–230). The analysts also classified many rims and vessels into one of five general vessel-form categories: bowls, jars with necks, neckless jars, plates, and scoops. Many rims were too small or fragmented to infer vessel class or form. In all, 68 whole or reconstructible vessels and 1,837 large rims were classified according to vessel class and form.

At a more detailed level, a sample of 581 large rims and whole/reconstructible vessels were classified into one of the 42 detailed functional categories listed in Table 16, using Braun's (1980, 1983) detailed morphological criteria. As explained above, Braun (1980, 1983) outlined a method of inferring vessel function based on an assortment of metric and morphological attributes. His method was based on the assumption that potters' decisions regarding vessel formation and shape likely hinged on use-related behavioral criteria, such as the probable content of the containers (dry versus wet contents), the frequency with which pottery users needed to access those contents, and the manner by which those contents were removed from the containers (e.g., pouring versus scooping by hand). Braun was able to classify vessels into functional categories based on such metric attributes as vessel shape, size, and orifice diameter (for a summary discussion, see Heckman 2001, 2002). Heckman (2001, 2002) has developed a computer program that classifies rims and whole/reconstructible vessels into one of the 42 functional categories based on a series of ratios calculated from maximum-diameter measurements, orifice diameter, aperture diameter, maximum vessel diameter, rim angle, angle of the neck-wall juncture (for jars only), and vessel height. The results of the Braun analysis reported below derive from the classifications made using Heckman's program.

Inferring Vessel Modification

Where present, the analysts recorded evidence of vessel modifications on vessels and rims, such as using broken-pottery fragments as scraping, scooping, or smoothing tools. Most of the modified sherds in the Mescal Wash collection were classified as having been recycled. In our definition, recycling refers to sherds or vessel fragments that exhibited modifications resulting in a change in the original function of the container to an entirely new, non-container function. Recycled sherds typically exhibited extensive modification on broken edges of sherds, such as chipping or smoothing from use as scraping or smoothing tools on hard or soft surfaces. Also, many sherds were recycled as sherd disks with deliberately chipped or ground edges. Some recycled disks also included a drilled perforation in the middle. Other disks with perforations may have been used as spindle whorls for weaving cotton, maguey, or other fibers.

We also developed and applied additional vocabulary for classifying ceramic modification. *Repairing* refers to alterations to vessels in which the vessels retain their original functions, most commonly evidenced by the presence of repair holes. Holes were drilled into the vessels on either side of a crack to prevent further cracking or breaking of the vessel. *Refurbished* vessels are broken-vessel parts that have been subsequently reshaped or modified into another form of container tool. In contrast with our definition of recycling, refurbishing explicitly refers to a vessel that was modified for a different use after it was broken but continued to be used as a container. The most common example is a plate made from the base of a broken jar. In other words, unlike recycled sherds, refurbished sherds continued to be used as containers. For example, in some areas of the U.S. Southwest, sherds from large jars and bowls were reused as *comales*, or tortilla griddles (Beck 2001:203). Similarly, *reused* vessels are those that were broken and continued to be used as containers but, unlike refurbished vessels, without any postbreakage modification. *Use wear* refers to alteration of the vessel surface as a result of frequent use. In this analysis, the analysts recorded use wear in the form of pitting on the vessel or sherd surfaces.

Chronological Analyses

Ceramic data, especially painted wares, provide valuable information about chronology and site activities. Given the large number of painted sherds recovered from the Mescal Wash site, inspections of the counts and portions of temporally diagnostic painted types from a given locus or feature provided a useful means of estimating the period of occupation. Ideally, the diagnostic sherds from intact floor deposits should be used to infer approximate date ranges for features, but relatively few painted wares were recovered from floor deposits, necessitating a consideration of painted wares from the feature-fill deposits. The date ranges pertaining to the diagnostic painted types present in the Mescal Wash collection are listed in Table 14.

A more effective means of assigning chronology is through careful analysis of chronometric data. In Chapter 2 of this volume, Lengyel reports the results of a detailed chronometric analysis of the Mescal Wash site based on her inspections of radiocarbon dates, AM dates, and time-sensitive artifacts. Lengyel determined that the project area was occupied over a roughly 3,000-year span, from the Late Archaic period through the Late Formative period, peaking during the Middle Formative period. Ceramic artifacts did not appear to predate the Early Formative period.

Table 16. Braun Functional Categories

Braun Code	Shape Class	Orifice-Diameter Range	General Function	Specific Function[a]	Vessel Size
1	jar with neck	extremely narrow (0–2.9 cm)	storage	specialized liquid/canteen	individual
2	jar, indeterminate	extremely narrow (0–2.9 cm)	storage/transfer	short-term dry/liquid storage	individual
3	jar, recurvate	extremely narrow (0–2.9 cm)	storage/transfer	short-term dry/liquid storage	individual
4	jar, simple	extremely narrow (0–2.9 cm)	storage	specialized dry storage	
5	bowl, plain	extremely narrow (0–2.9 cm)		miniatures, specialized function	
6	plate/shallow bowl	extremely narrow (0–2.9 cm)		miniatures, specialized function	
7	jar with neck	very narrow (3–6.9 cm)	storage/transfer	short-term dry/liquid storage	individual
8	jar, indeterminate	very narrow (3–6.9 cm)	storage/transfer	short-term dry/liquid storage	individual
9	jar, recurvate	very narrow (3–6.9 cm)	storage/transfer	short-term dry/liquid storage	individual
10	jar, simple	very narrow (3–6.9 cm)	storage	specialized dry storage	
11	bowl, plain	very narrow (3–6.9 cm)		miniatures, specialized function	
12	plate/shallow bowl	very narrow (3–6.9 cm)		miniatures, specialized function	
13	jar with neck	narrow (7–12.9 cm)	storage/transfer	liquid storage/carrier	individual
14	jar, indeterminate	narrow (7–12.9 cm)	storage	liquid/dry storage	individual
15	jar, recurvate	narrow (7–12.9 cm)	storage	liquid/dry storage	individual
16	jar, simple	narrow (7–12.9 cm)	storage	specialized dry storage	
17	bowl, plain	narrow (7–12.9 cm)	processing/ serving	food processing without heat/ eating/serving	individual
18	plate/shallow bowl	narrow (7–12.9 cm)	processing/ serving	food processing with or without heat/eating/serving	individual/small
19	jar with neck	medium (13–25.9 cm)	storage/cooking	short-term liquid storage/ cooking	small
20	jar, indeterminate	medium (13–25.9 cm)	storage/cooking	short-term liquid or dry storage/ cooking	small
21	jar, recurvate	medium (13–25.9 cm)	storage/cooking	short-term liquid or dry storage/ cooking	small
22	jar, simple	medium (13–25.9 cm)	storage	short- or long-term dry storage	small
23	bowl, plain	medium (13–25.9 cm)	processing/serving	serving/food processing without heat	small
24	plate/shallow bowl	medium (13–25.9 cm)	processing/serving	food processing without heat/ dry cooking/serving/eating	small
25	jar with neck	wide (26–31.9 cm)	storage/cooking	short- or long-term liquid or dry storage/cooking	small/medium
26	jar, indeterminate	wide (26–31.9 cm)	storage/cooking	short- or long-term dry storage/ cooking	small/medium
27	jar, recurvate	wide (26–31.9 cm)	storage/cooking	short- or long-term dry storage/ cooking	small/medium
28	jar, simple	wide (26–31.9 cm)	storage	short- or long-term dry storage	small/medium
29	bowl, plain	wide (26–31.9 cm)	processing/serving	serving/food processing without heat	small/medium
30	plate/shallow bowl	wide (26–31.9 cm)	processing/serving	food processing without heat/ dry cooking/serving/eating	small/medium

continued on next page

Braun Code	Shape Class	Orifice-Diameter Range	General Function	Specific Function[a]	Vessel Size
31	jar with neck	very wide (32–38.9 cm)	storage	short- or long-term liquid storage	medium/large
32	jar, indeterminate	very wide (32–38.9 cm)	storage	short- or long-term liquid or dry storage	medium/large
33	jar, recurvate	very wide (32–38.9 cm)	storage	short- or long-term liquid or dry storage	medium/large
34	jar, simple	very wide (32–38.9 cm)	storage	long-term dry storage	medium/large
35	bowl, plain	very wide (32–38.9 cm)	processing/serving	serving/food processing without heat	medium/large
36	plate/shallow bowl	very wide (32–38.9 cm)	processing/serving	food processing without heat/ dry cooking/serving/eating	medium/large
37	jar with neck	extremely wide (>39 cm)	storage	short- or long-term liquid storage	large
38	jar, indeterminate	extremely wide (>39 cm)	storage	short- or long-term liquid or dry storage	large
39	jar, recurvate	extremely wide (>39 cm)	storage	short- or long-term liquid or dry storage	large
40	jar, simple	extremely wide (>39 cm)	storage	long-term dry storage	large
41	bowl, plain	extremely wide (>39 cm)	processing/serving	serving/food processing without heat	large
42	plate/shallow bowl	extremely wide (>39 cm)	processing/serving	food processing without heat/ dry cooking/serving/eating	large

Note: Based on Heckman (2001, 2001).

[a] Based on Braun (1980).

SRI archaeologists analyzed a combination of chronometric and relative dates (e.g., ceramic dates) to make age assignments for most of the excavated features. Because of variability in the quality of the chronological data, they developed more- and less-specific age assignments. In some cases, features were assigned to specific periods or phases within a period (noted here by an A and B designation), such as the Middle Formative A period, Late Formative B period, Early Formative period, and so on (see Chapters 1 and 2, this volume). The Middle Formative A period encompassed a time range from A.D. 750 to 950. The Middle Formation B period extended from A.D. 950 to 1150. The Late Formative B period refers to the later occupation, from about A.D. 1300 to 1450.

Less-specific age assignment included broader time ranges that are not subset into earlier and later time spans, such as "Middle Formative period." In some cases, the chronological data was insufficient to infer a single period designation, resulting in split designations (e.g., Early/Middle Formative period, Middle Formative/ Late Formative A period). In still other cases, the archaeologists were only able to infer a minimum or maximum date—for example, "post-A.D. 600" or "pre-A.D. 1000." These designations were generally inferred based on the presence of temporally sensitive painted-ceramic types and are less reliable than the age determinations based on chronometric data. Given their ambiguity, we rarely report these latter age designations in the tables.

For the Middle Formative period, Lengyel also evaluated the contemporaneity of selected features, based on statistical analyses of the AM data, stratigraphic relationships, and the presence of time-sensitive artifacts. She grouped the Middle Formative period features into "contemporaneity groups" on a site-wide and per-locus scale. She defined six contemporaneity groups for the entire project area, as well as more-specific groups for Loci A, C, and D. For Loci C and D, she defined four and seven groups, respectively. Locus A appeared to contain a temporally discrete occupation and was not subdivided into episodes. Lengyel's contemporaneity groups are discrete occupation episodes that offer a far-more-fine-grained basis for inferring diachronic changes than is possible using the broader period designations. Her analysis provided a detailed chronological framework for analyzing ceramic changes during the Middle Formative period.

Quantifying Data

Results and interpretations of the analyses may vary according to how the ceramic data are quantified. To quantify the data, we mostly calculated percentages per analytical unit (e.g., site, temporal component, or feature). Percentages were calculated as the numbers of types, form classes, artifact types, and so on (numerators), relative to the total counts per analytical unit (denominators). We also calculated simple ratios in some places, to report data patterns (e.g., ratios of bowls to jars or painted to unpainted ceramics). As mentioned above, nearly half of the project collection was composed of very-small sherds for which ware and type classes were not identifiable. We excluded the very-small sherds when calculating percentages of type or ware categories.

Ideally, estimates of the minimum number of vessels (MNV) would provide a more accurate means of quantifying the ceramic data, but we did not possess sufficient data or attribute information to calculate MNV values. The sherds from most collections were very small and not amenable to MNV estimates. Therefore, we generally assumed that each rim sherd represented a distinct vessel, for the purposes of estimating proportions and ratios, although we acknowledge that variability in vessel size and the degree of fragmentation could have affected the calculated results and comparisons among analytical units. Even so, we suspect that the broader trends and patterns in the data are largely reliable, especially as the very-small sherds have been excluded from analysis.

Although MNV estimates were not feasible for this study, the analytical team did attempt to refit and reconstruct sherd pieces into larger sherds or reconstructible vessels (see Heckman 2001), where possible. The entire collections from each feature (all proveniences, including subfeatures) and all nonfeature contexts were laid out. This allowed for the identification of refits within a given provenience. No exhaustive effort was made to identify all refits within and between proveniences. Each sherd or collection of refits was recorded individually. For example, if five sherds refit, they were recorded as a single observation with a count of one. This approach mitigated the potential of a single large vessel getting counted multiple times in the collection. Refits that composed approximately 15 percent of the original vessel were recategorized as reconstructible vessels.

Ceramics from Burial Features

As noted above, our analyses as discussed in this chapter did not include ceramic artifacts recovered in association with human burials. In accordance with the Burial Agreement, all artifacts recovered in association with human remains were recorded and illustrated during fieldwork and turned over for repatriation. Appendix 3.B includes descriptions and illustrations of the burial ceramics, most of which were vessels interred with the human remains as offerings or cremation urns.

In some cases, ceramics also were recovered from fill overlying the human remains. In consultation with the Tohono O’odham tribal observers, these ceramics were determined during fieldwork to have been unaffiliated with the human remains. That is, they did not appear to have been intentionally interred with the human remains or deposited as mortuary offerings. Many of these remains probably entered the feature fill as a result of postdepositional disturbances, such as bioturbation or later construction episodes (see Chapter 11, this volume). Others may have been accidentally and unintentionally included in the fill during the burial event. In still other cases, the burials intruded on earlier features, and some of the materials from the preexisting features likely were mixed in with the burial fill. For example, Feature 7170 in Locus C contained the remains of an infant skeleton that had been interred in a reused extramural nonthermal pit. The ceramic remains in the fill of Feature 7170 were probably related to the earlier, nonmortuary use of the pit.

The “unassociated” ceramic materials were included in our ceramic sample and factored into our analytical calculations (e.g., site-wide or locus-wide ware and type frequencies). We therefore report frequencies of these materials recovered from individual burial features in the tables and appendixes (Loci C and D only). *To be clear, these listings of feature counts include only the “unassociated” ceramic materials in the burial fill and not the ceramic remains believed to have been* intentionally *interred as burial goods or as offerings with the human remains.* Moreover, given their ambiguous depositional context, we did not include these materials in our analyses of ceramic variability among feature types.

Site-Wide Results and Patterns

Ceramic Artifacts

Table 17 summarizes the distribution of ceramic artifact types among the four Phase 2 loci, including the very-small sherds. Ninety-four percent of the ceramic collection consisted of body sherds. The remaining 6 percent consisted of rims, whole/reconstructible vessels, and various low-frequency categories, such as vessel handles (n = 12), figurines (n = 5), clay bells (n = 3), and indeterminate ceramic pieces (n = 6). Body sherds dominated the collection and accounted for between 90 and 97 percent of the individual locus collections (95 percent for the entire project ceramic collection). Rim sherds composed most of the remaining 3 to 9 percent; all other artifact categories accounted for less than 1 percent in the individual loci.

The percentage of rims recovered from Locus A (9.3 percent) was two to three times greater than the percentages recovered from Locus B (2.9 percent), Locus C (5.3 percent), and Locus D (4.8 percent). This may relate to the generally lower ceramic breakage rates and larger sherd

Table 17. Ceramic Artifact Types, by Locus

Locus	Body	Rim	Vessel	Clay Bell	Figurine	Handle	Indeterminate Artifact	Total
A	4,836	498	20	—	1	6	2	5,363
B	68	2	—	—	—	—	—	70
C	7,146	398	13	3	1	—	—	7,561
D	39,046	1,982	41	—	3	6	4	41,082
Total	51,096	2,880	74	3	5	12	6	54,076

sizes in Locus A relative to Loci C and D, as discussed below. Rims compose a relatively small portion of the overall surface areas of most pottery vessels (especially voluminous jars and large vessels); therefore, breakage of the vessels into smaller pieces reduces the likelihood that a given sherd will encompass the rim.

Depositional Contexts and Artifact Size

In this section, we inspect the distribution of whole/reconstructible vessels versus very-small sherds, to provide grounds for interpreting variability in site-formation processes and depositional contexts in the three principal loci (Loci A, C, and D). Proportions of large and small ceramic artifacts are informative about formation processes (Beck 2006). Generally, high ratios of small sherds suggest frequent trampling, dumping, or other cultural processes that promote ceramic breakage (Schiffer 1987:267–269). Postdepositional processes, such as root and animal activity, also may contribute to breakage. In contrast, larger pieces may accumulate in areas that are not habitually cleaned or swept or in quickly abandoned structures (Schiffer 1987:268).

Beck’s (2006) ethnoarchaeological study of ceramic middens in Dalupa, Philippines, has offered practical insights for interpreting depositional contexts based on inspections of sherd sizes. Most of the ceramic refuse in Dalupa included broken domestic vessels discarded in middens within a few meters of the locations of damage (typically, residences or water sources). The ceramic items tossed in the middens mostly included reconstructible vessels and large fragments; small sherds were typically swept up separately and deposited near the houses in expedient refuse areas, such as vegetated zones or terraces.

Within the middens, most large sherds quickly fragmented into smaller sherds, as a result of various cultural formation processes, including high-volume trampling from children playing in the middens, scavenging by domestic animals in the middens, and adults (who generally tended to avoid middens) occasionally retrieving discarded items from middens (Beck 2006:44). In some cases, breakage occurred as a result of extramural cleaning or from moving entire midden deposits to new locations (e.g., to clear the space for group activities) (Beck 2006:44–45). Beck found that sherd breakage was most prevalent in the more frequently used activity areas with high levels of pedestrian traffic.

Beck’s ethnoarchaeological study has shown that residential middens typically generate small-sherd deposits, unless the deposits have been shielded from trampling through burial or placement in areas removed from frequent pedestrian traffic. Her observations suggest that variability in proportions of small and large sherds reflects differences in the extent to which discard areas were subjected to trampling. A corollary inference is that breakage decreased with distance from activity areas with high levels of pedestrian traffic; trash dumps located in areas far removed from residences and other high-traffic areas presumably would have been less frequently subjected to trampling. As explained below, our analyses suggest that trash dumping, trampling, and other processes responsible for ceramic breakage were more prevalent in Locus D than in Locus A or Locus C.

Vessel Distributions

Drawing on Beck’s study, we suggest that variability in whole-/reconstructible-vessel frequencies among loci potentially indicates important differences in site-formation processes and depositional contexts (Table 18). For the site as a whole, the dearth of whole/reconstructible vessels argues against a rapid abandonment of the site or any of the loci. Most of the ceramic materials probably were deposited as a result of postabandonment dumping, and probably few or none of the ceramic materials were recovered as de facto refuse deposits. Vessels were collected from three of the four loci. Locus D included the highest number (n = 41) of vessels, but this reflected the larger overall collection. Vessels also were recovered from Loci A (n = 20) and C (n = 13); none were recovered from Locus B.

Table 18. Ceramic Artifact Types, by Locus

Locus	Body	Rim	Vessel	Clay Bell	Figurine	Handle	Indeterminate Artifact	Total
A	4,836	498	20	—	1	6	2	5,363
B	68	2	—	—	—	—	—	70
C	7,146	398	13	3	1	—	—	7,561
D	39,046	1,982	41	—	3	6	4	41,082
Total	51,096	2,880	74	3	5	12	6	54,076

To better evaluate variability in vessel frequencies among the loci, it was important to explore the frequencies relative to the size of each locus collection. We analyzed the vessel frequencies per locus using a Pearson's chi-square contingency table, excluding Locus B because of the very small sample sizes (see Table 18). The contingency table included three cases (Loci A, C, and D) and two variables (vessel counts and nonvessel counts). A chi-square test indicated an extremely low probability (less than 1 in 10,000) that the observed distribution of vessel counts among the loci could be attributed to chance (χ^2=26.6, *df* = 2, *p* <.0001). The variability in vessel counts among the three loci is statistically significant.

The standardized residuals listed in Table 18 express the differences between the observed vessel counts as an estimate of the number of standard deviations above the expected counts. It was calculated as the observed value minus the expected value, divided by the square root of the expected value, and, therefore, provides a means of standardizing the differences between the observed and expected values that accounts for the variability in sample sizes. The standardized residual for Locus A was nearly five standard deviations above the expected frequency of vessels, suggesting a significantly high frequency, based on the marginal totals among the three loci. By contrast, the observed number of vessels in Locus D was two standard deviations below the expected frequency. The observed frequency of vessels in Locus C was roughly consistent with the expected frequency (i.e., within one standard deviation).

Small-Sherd Distributions

An independent line of evidence for inferring the depositional contexts at the three main loci came from the proportions of very-small sherds; as explained above, this category was used to code vessel sherds that were too small for the analysts to classify in a general ware category (i.e., painted versus unpainted). We expected that the percentage of very-small sherds would be higher in dispositional contexts that were formed as a result of frequent dumping or trampling (Beck 2006; Schiffer 1987). In these contexts, high percentages of very-small sherds are likely to co-occur with lower-than-expected percentages of vessels. As expected, the percentages of very-small sherds (listed in Table 18) complemented the vessel-distribution analysis (above). In the Locus D collection, very-small sherds accounted for more than half of all ceramic remains (roughly 52 percent). In Locus A, in contrast, the percentage of very-small sherds (29 percent) was considerably lower. The percentage of very-small sherds in Locus C (41 percent) fell approximately between the percentages recorded in Loci A and D.

As stated above, this difference had an effect on our analyses of variability in vessel types and forms among the loci, especially where the differences were subtle but their effects were difficult to quantity or assess. We suspect that any well-defined patterns of variability in types or forms among the loci are reliable. Even so, where relevant, we kept these differences in mind when we compared and interpreted the differences among them.

Summary and Interpretation

The vessel and very-small-sherd distributions provided complementary evidence regarding site-formation processes. Both lines of evidence suggest higher accumulation rates for very-small sherds and lower rates for vessels in Locus D, relative to Loci A and C. Dumping and trampling of ceramic debris (and other domestic trash) may have been more frequent and consistent in Locus D than in Loci A and C. In Locus A, by contrast, a lower percentage of very-small sherds and a higher proportion of vessels were recovered. Following Beck's (2006) observations, we conclude that the deposits in Locus A probably were less frequently subjected to postabandonment dumping and trampling than those in Loci C and D, resulting in less-severe sherd breakage and a higher proportion of reconstructible vessels.

This pattern likely relates to the occupational histories of the three loci; sherd breakage was probably directly correlated with occupational intensity, in this case.

Vanderpot (2001:18; also see Chapter 4, Volume 1) interpreted Locus A as a "discrete Middle Formative period farmstead" that likely did not sustain a large population and may have been seasonally occupied. Given the generally short-term and possibly ephemeral occupation of Locus A, the midden deposits probably were not frequently or intensively subjected to trampling, dumping, cleaning, or other activities that Beck (2006) identified as the principle causes of sherd breakage in secondary depositional contexts.

Conversely, both Loci C and D probably sustained larger and more-permanent habitations or, alternatively, "repeated short-term occupation over many centuries" (Vanderpot 2001:18) (see Chapters 6 and 7, Volume 1). Trampling, dumping, and other activities were therefore more frequent in these more heavily populated and consistently occupied loci, especially Locus D. As explained above, Locus D was subjected to frequent reoccupation and reuse, which likely increased the exposure of ceramic debris to postdepositional trampling and disturbance. The inhabitants of Locus D also superimposed structures over the remains of older ones, which further instigated breakage and postdepositional disturbance of ceramic materials deposited in the older, built-over structures. This pattern of building new structures over older structures no doubt resulted in digging up and moving preexisting trash or midden deposits—among the leading cases of ceramic breakage, according to Beck. The continual reoccupation of Locus D over a long span of time exacerbated processes of ceramic breakage and trampling.

The high ceramic-breakage rate in Locus D also may partially relate to the period of occupation. The principle occupation at Locus D occurred during the Middle Formative A period, whereas Loci A and C were mainly occupied later, during the late Middle Formative B period. Therefore, it is plausible that the later occupants in Loci A and C (mainly the former locus, given its closer proximity to Locus D) used the by-then partially (but not completely) abandoned Locus D for a variety of extramural activities, which may have caused additional breakage of any preexisting ceramic remains in that locus. Complementary analysis of additional material classes will be needed to corroborate these hypotheses.

Wares and Type Distributions

Painted Wares

Table 19 lists the counts of painted types for Loci A, C, and D. Locus B is not included in the table, as only one painted sherd (an indeterminate red-on-brown body sherd) was recovered there during the Phase 2 investigations. Also, because of the large number of type and ware categories recovered in the project area, we only calculated percentages for each broad regional tradition or ware category, rather than for each individual type. A more detailed breakdown and discussion of the painted wares and types is presented separately for each locus, below.

As illustrated in Figure 21, slightly more than one-third of painted ceramics in the Mescal Wash collection (36 percent, or 2,321 specimens) were associated with the Tucson Basin Hohokam regional tradition, mainly red-on-brown wares (Figures 22 and 23). The Mescal Wash site lies roughly 30–40 km southeast of the Tucson Basin, which might explain the prevalence of Tucson Basin painted types. Regardless of its proximity, Vanderpot and Altschul (2007:67–69) made clear that Mescal Wash was not socially or economically integrated into the Tucson Basin Hohokam regional tradition and "culture area." To be sure, they observed many elements of Tucson Basin Hohokam culture in the Mescal Wash project area, most prominently in the architecture and painted ceramics, but they also pointed out many architectural attributes and material culture elements indicative of the Mogollon-Dragoon regional tradition, centered nearby in the San Pedro River valley. In fact, the site lies halfway between the Tucson Basin and the San Pedro Valley. Therefore, the prevalence of Tucson Basin brown ware types in the collection does not *necessarily* reflect migration of Hohokam peoples or a close social or kinship affiliation with Hohokam groups in the Tucson Basin. We cannot rule out that the site was inhabited during the Middle Formative period by a local group unaffiliated with the Hohokam "heartland" that frequently acquired Tucson Basin brown wares through exchange or manufactured them locally through stylistic emulation.

Also prominent in the Mescal Wash collection were painted types associated with the Phoenix Basin Hohokam red-on-buff tradition (23 percent, or 921 specimens) (Figure 24). Indeed, the high proportion of Phoenix Basin Hohokam red-on-buff sherds suggests strong ties to both the Tucson Basin and Phoenix Basin Hohokam regional traditions. All other decorated-pottery traditions were less frequent, including Dragoon-style red-on-brown ware (6 percent), San Simon–style bichrome ware (4 percent), and Roosevelt Red Ware (4 percent). Trincheras-style painted types, Mimbres Black-on-white, San Carlos/Safford–area painted wares, and Babocomari bichromes each composed less than 1 percent of painted wares.

Decorated types affiliated with the Dragoon and San Simon traditions accounted for 10 percent of painted specimens, possibly indicating more-modest social interaction and affiliations with populations residing along the San Pedro and San Simon Valleys, to the east, during the Middle Formative period (Figure 25). Given their stylistic similarities, some scholars have opted to merge the Dragoon tradition with the geographically broader San Simon tradition (Deaver 1984:366–370; Whittlesey et al. 1994:65–82; see also Heckman 2000c). As explained below, the proportions of different regional wares varied considerably over time and among loci, suggesting important patterning related to expressions of social affiliation and/or migration.

Table 19. Painted-Ware and Painted-Ware-Type Counts, by Regional Tradition

Type or Ware Category	Locus A	Locus C	Locus D
Tucson Basin Hohokam			
Indeterminate Pioneer or Colonial Red-on-brown	—	—	2
Snaketown-style red-on-brown	—	—	3
Cañada del Oro or Rillito Red-on-brown	3	1	157
Cañada del Oro Red-on-brown	—	1	33
Rillito Red-on-brown	—	4	115
Rillito or Rincon Red-on-brown	26	23	86
Rincon Red-on-brown	287	116	38
Rincon Polychrome	7	3	—
Rincon Black-on-brown	32	8	2
Rincon or Tanque Verde Red-on-brown	—	1	2
Tanque Verde Red-on-brown	—	3	16
Indeterminate Tucson Basin black-on-brown	8	5	1
Indeterminate Tucson Basin polychrome	3	—	—
Indeterminate Tucson Basin red-on-brown	428	231	676
Total Tucson Basin Hohokam	794	396	1,131
Percent of all painted wares	53.8	28.6	35.7
Percent of all ceramic artifacts[a]	21.0	8.8	5.7
Phoenix Basin Hohokam			
Sweetwater Red-on-gray	—	—	2
Sweetwater or Snaketown Red-on-gray	—	1	2
Snaketown Red-on-buff	—	—	9
Snaketown or Gila Butte Red-on-buff	—	—	9
Gila Butte Red-on-buff	—	2	28
Gila Butte or Santa Cruz Red-on-buff	—	1	38
Santa Cruz Red-on-buff	—	3	83
Santa Cruz or Sacaton Red-on-buff	1	1	26
Sacaton Red-on-buff	6	22	12
Indeterminate buff ware	37	129	509
Total Phoenix Basin Hohokam	44	159	718
Percent of all painted wares	3.0	11.5	22.6
Percent of all ceramic artifacts[a]	1.2	3.5	3.6
Dragoon			
Dragoon Red-on-brown (broad line)	—	1	16
Dragoon Red-on-brown (fine line)	—	15	35
Dragoon Red-on-brown (elaborated)	54	109	19
Dragoon Red-on-brown (indeterminate)	64	29	112
Total Dragoon	118	154	182
Percent of all painted wares	8.0	11.1	5.7
Percent of all ceramic artifacts[a]	3.1	3.4	0.9
San Simon			
Dos Cabezas Red-on-brown	—	—	6
Dos Cabezas or Pinaleno Red-on-brown	—	—	3

continued on next page

Type or Ware Category	Locus A	Locus C	Locus D
Pinaleño or Galiuro Red-on-brown	—	—	1
Galiuro Red-on-brown	—	—	77
Cerros Red-on-white	—	1	5
Encinas Red-on-brown	2	1	—
Indeterminate San Simon Red-on-brown	2	1	26
Total San Simon	4	3	118
Percent of all painted wares	0.3	0.2	3.7
Percent of all ceramic artifacts[a]	0.1	0.1	0.6
Roosevelt Red Ware			
Gila Polychrome	—	—	23
Tonto Polychrome	—	—	3
Gila or Tonto Polychrome	—	—	62
Indeterminate Roosevelt Red Ware	—	—	31
Total Roosevelt Red Ware	—	—	119
Percent of all painted wares	0.0	0.0	3.8
Percent of all ceramic artifacts[a]			0.6
Trincheras			
Trincheras Purple-on-red (nonspecular)	—	—	2
Trincheras Purple-on-red (specular)	—	2	11
Nogales Polychrome	2	—	4
Total Trincheras	2	2	17
Percent of all painted wares	0.1	0.1	0.5
Percent of all ceramic artifacts[a]	0.1	0.04	0.1
Low-Frequency Painted Types			
Mimbres Black-on-white	—	3	1
Babocomari Bichrome (elaborated)	—	1	—
San Carlos Red-on-brown	—	2	—
Indeterminate Maverick Mountain or Tucson Polychrome	2	—	—
Black-on-red	1	—	—
Total low-frequency painted types	3	6	1
Percent of all painted wares	0.2	0.4	0.03
Percent of all ceramic artifacts[a]	0.1	0.1	0.01
Split Categories			
Snaketown Red-on-buff or Snaketown-style red-on-brown	—	—	3
Gila Butte Red-on-buff or Cañada del Oro Red-on-brown	—	—	9
Tucson Basin or Dragoon Red-on-brown (elaborated)	35	17	20
Tucson Basin or Dragoon Red-on-brown (fine)	—	—	2
Tucson Basin or Dragoon Red-on-brown (indeterminate)	114	70	82
Dragoon or San Simon Red-on-brown (elaborated)	1	—	—
Dragoon or San Simon Red-on-brown (fine)	—	1	56
Dragoon or San Simon Red-on-brown (indeterminate)	7	11	144
Total split categories	157	99	316
Percent of all painted wares	10.6	7.2	10.0
Percent of all ceramic artifacts[a]	4.1	2.2	1.6

Type or Ware Category	Locus A	Locus C	Locus D
Indeterminate Categories			
Red-on-brown (indeterminate)[b]	343	557	512
Indeterminate red-on-buff or red-on-brown	11	7	57
Total indeterminate categories	354	564	569
Percent of all painted wares	24.0	40.8	17.9
Percent of all ceramic artifacts[a]	9.4	12.5	2.9
Total	1,476	1,383	3,171
Percent of all ceramic artifacts[a]	39.0	30.7	16.0
Total of all ceramic artifacts	3,784	4,502	19,848

[a] Excluding very-small sherds for which surface-treatment category was not identifiable.

[b] Locus B included one painted sherd (indeterminate red-on-brown) not included in this table.

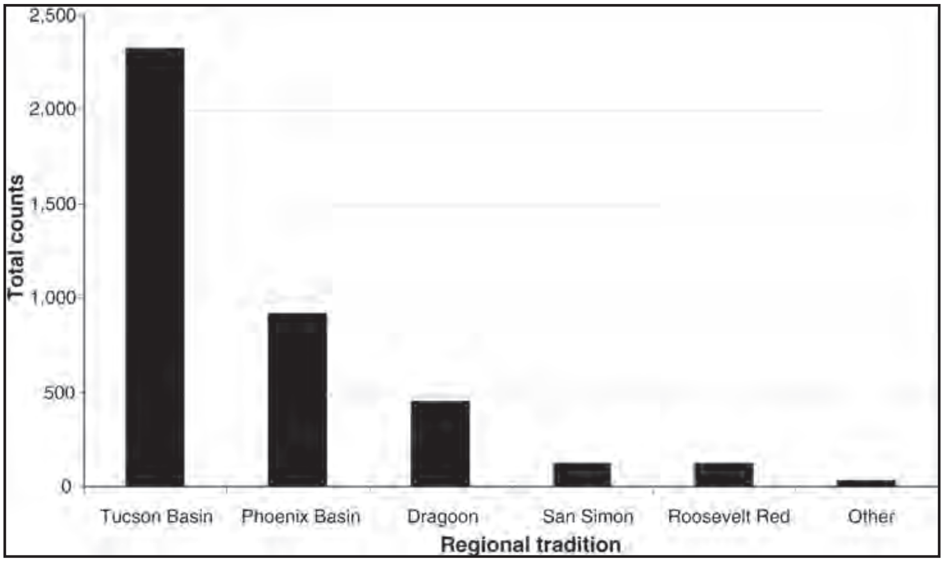


Figure 21. Frequencies of painted-ware classes associated with various regional traditions in the southern deserts, excluding split categories and indeterminate types. The "Other" category consists of the sum of all ware classes with fewer than 25 sherds each.

Figure 22. Photograph of Tucson Basin brown ware sherds or vessels from Mescal Wash: (*a*) Cañada del oro Red-on-brown (Catalog No. 3644), (*b*) Rillito Red-on-brown (Catalog No. 5064), and (*c*) Rincon Black-on-brown (Catalog No. 3215).

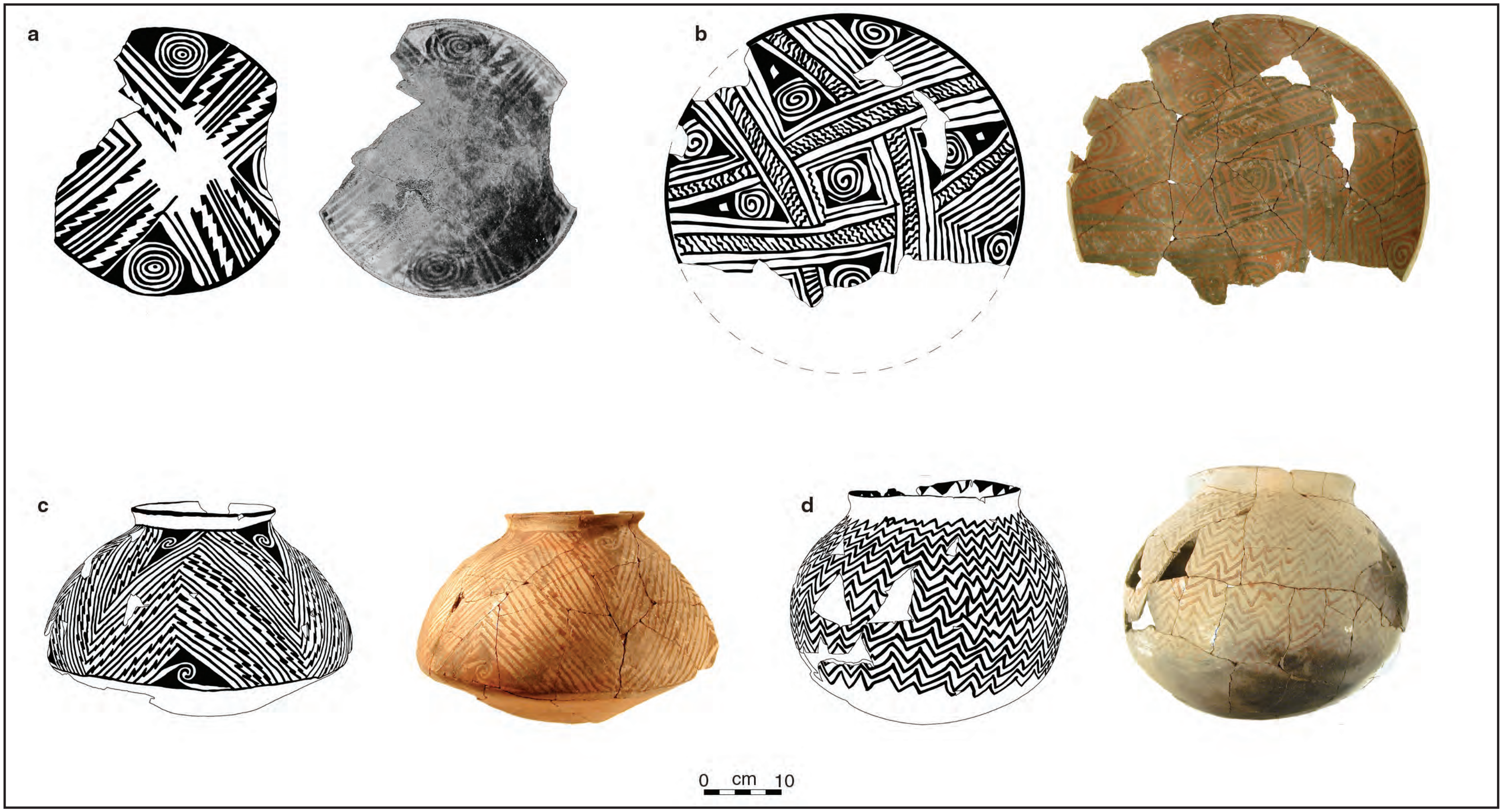


Figure 23. Photographs and illustrations of Rincon Red-on-brown vessels, showing design details: (*a*) bowl (Catalog No. 12403), (*b*) bowl (Catalog No. 12338), (*c*) jar with neck (Catalog No. 12397), and (*d*) jar with neck (Catalog No. 12396).

Figure 24. Photograph of Phoenix Basin buff ware sherds or vessels from Mescal Wash: (*a*) Gila Butte Red-on-buff (Catalog No. 5720), (*b*) Santa Cruz Red-on-buff (Catalog No. 5811), and (*c*) Santa Cruz or Sacaton Red-on-buff plate (Catalog No. 12391).

Figure 25. Photograph of Dragoon and San Simon brown ware sherds from Mescal Wash: (*a*) Dragoon Red-on-brown, fine line (Catalog No. 9919); (*b*) Dragoon Elaborated Red-on-brown bowl fragments (Catalog No. 12355); and (*c*) San Simon (Galiuro) Red-on-brown (Catalog No. 4865).

Vanderpot and Altschul (2007) did not emphasize the prevalence of Phoenix Basin painted-pottery styles but focused instead on material culture affiliated with the geographically proximate Tucson Basin and Dragoon traditions, but Phoenix Basin buff ware sherds actually outnumbered Dragoon brown ware sherds by a considerable margin in most areas of the site, with the exception of Locus A (see also Deaver et al. 2010:4.1–4.10). On the whole, the Phoenix and Tucson Basin painted wares accounted for 58 percent of the painted types. So, the Middle Formative inhabitants of Mescal Wash mainly used Hohokam-style painted pottery from the Tucson and Phoenix Basins and may have established a more intensive social relationship with the populations in those regions than with other regional communities in the U.S. Southwest and northern Mexico. An alternative possibility is that populations from the Phoenix and Tucson Basins more frequently established settlements at Mescal Wash than did populations from areas to the south and east (see above).

A very small number of painted sherds were ascribed to the Trincheras culture area of northern Mexico (21 specimens), the Mimbres-Mogollon area of southwestern New Mexico (4 specimens), or the Safford/San Carlos area of east-central Arizona (2 specimens). Only one Babocomari-style sherd was recovered, which is surprising, given that the Babocomari region is located roughly 60–70 km to the southeast, in the middle San Pedro Valley. To some extent, these possibly weaker linkages may reflect greater distances, as in the case of the Mimbres region, but distance does not appear to be an effective predictor of pottery exchange, as types affiliated with the relatively distant Phoenix Basin tradition well outnumbered types affiliated with the less-distant Babocomari and San Simon traditions. Additional research is needed to infer whether these differences relate to the movement of pots (exchange patterns), the movement of people (immigrant populations making painted pottery in the traditions of their homelands), or the local imitation of foreign pottery styles, as discussed above (see Vanderpot and Altschul 2007:65–69).

Roosevelt Red Ware sherds (119 specimens) also were prevalent in the collection, mainly from the Late Formative B period component in Locus D (Figure 26). Roosevelt Red Ware was clearly the dominant decorated, painted ware during the Late Formative period (see Crown 1994) and also the dominant painted ware recovered at sites in the lower San Pedro Valley, to the east, during the Late Formative period (after the early A.D. 1300s) (Clark and Lyons 2003). Clark and Lyons (2003) noted that Roosevelt Red Ware first appeared at sites in the San Pedro Valley in the early A.D. 1300s and eventually emerged as the dominant ware class throughout the valley. Assuming the same for Mescal Wash, we can reasonably conclude that the Late Formative B period settlement was inhabited during the middle or late A.D. 1300s or the early 1400s. The only other Late Formative period painted types recovered from the site were Tanque Verde Red-on-brown and San Carlos Red-on-brown, which accounted for only 19 and 2 sherds, respectively, although it is possible that additional Tanque Verde Red-on-brown sherds were present among the sherds in the large "indeterminate Tucson Basin brown ware" category (see Table 19).

Painted-Ware Distributions among Loci

The proportions of types associated with the various regional traditions varied among Loci A, C, and D. Figure 27 illustrates the percentages of painted wares associated with the regional traditions, per locus. Percentage calculations excluded the split categories and indeterminate types, and the "Other" category encompassed several low-frequency wares—the Trincheras, Mimbres, Safford/San Carlos, and Babocomari traditions. In this section, we focus on variability in the percentages of the more-prevalent ware classes illustrated in Figure 27. Below, we present the results of a more detailed analysis of variability in distributions of particular types among loci and among contemporaneous features within each loci. We also discuss the analysis of these patterns using more-refined chronological information.

The variability between the percentages from Locus D and those from Loci A and C is mostly attributable to differences in periods of occupation, as explained below, but in some cases, the variability may reflect differences in patterns of interaction among coeval households or communities. In all three loci, the percentages of types associated with the Tucson Basin and Phoenix Basin Hohokam traditions were roughly consistent, accounting for 77–87 percent across the loci, but the percentages of types ascribed to these traditions varied substantially among the loci. Surprisingly, this difference was most pronounced between Loci A and C, which possessed mostly contemporaneous features dating to the Middle Formative B period. A small percentage of Phoenix Basin types was recovered from Locus A (5 percent), but more than four times that percentage was recovered from Locus C (22 percent). A higher proportion of the identifiable types from Locus A were associated with the Tucson Basin tradition (82 percent) than the proportion among identifiable types from Locus C (55 percent), possibly indicating a temporal trend (see below). This pattern underscores the importance of detecting variability in provisioning patterns and extralocal interaction on an intrasite level.

Dragoon Red-on-brown wares were more frequent in Loci A (12 percent) and C (21 percent) than in Locus D (8 percent), which might indicate the development of a more intense social connection with Dragoon-area populations during the Middle Formative B period than during the preceding Middle Formative A period. In contrast, social connections with populations in the San Simon River valley seem to have been more intense during the Middle Formative A period, because more than 12 times the percentage of San Simon types were recovered from Locus D (5 percent) than from Loci A and C (0.4 percent in both

Figure 26. Photograph of Roosevelt Red Ware vessels from Mescal Wash: (*a*) Tonto Polychrome jar with neck (Catalog No. 12398) and (*b*) Gila Polychrome jar with neck (Catalog No. 12339).

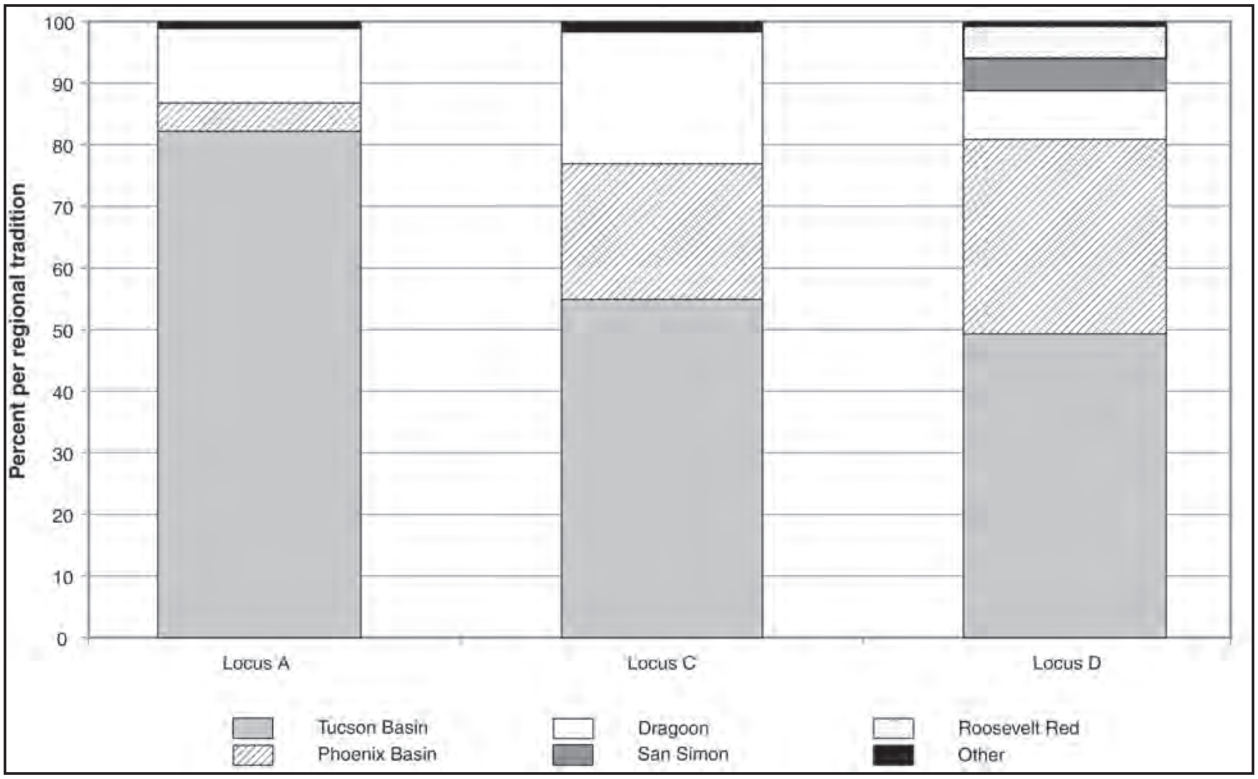


Figure 27. Bar graph showing the percentages of painted-ware classes associated with various regional traditions within each locus, excluding split categories and indeterminate types. The "Other" category consists of the sum of all ware classes with fewer than 25 sherds each.

loci, combined). The percentages of types associated with the various "other traditions" constituted 1 percent or less in all three loci.

Unpainted Wares

Excluding the very-small sherds, unpainted wares composed roughly 70 percent of the project collection (22,129 of 28,173 specimens) (Table 20). The vast majority of unpainted sherds and vessels (96.7 percent) were plain wares (Figure 28). The remaining 3 percent were mostly red wares (3.3 percent) (Figure 29). Two unpainted sherds were from corrugated brown ware vessels, a type frequently recovered from Late Formative period sites in the San Pedro Valley (DiPeso 1951). The low frequency of red wares likely stemmed from a primary occupation of the site during the Middle Formative period. Red wares generally peaked in southern and central Arizona during the Early Formative period (Pioneer period) and Late Formative period (Classic period).

Type II plain wares (sand or crushed-rock inclusions) and Type III plain wares (micaceous-rock inclusions) constituted about 96 percent of all unpainted sherds. Type II plain wares were the single most common type in the project collection, accounting for 74 percent of the unpainted wares and 58 percent of all ceramic artifacts (see Table 20). The high frequency of Type II plain wares implies that they were made in the vicinity of the Mescal Wash site, using locally available materials (likely alluvial, sandy clays), assuming that local wares would have been more abundant than imports (the criterion of abundance). Type III plain wares, the second-most-common unpainted type, were considerably less abundant, composing 22 percent of unpainted sherds and 17 percent of all ceramic artifacts. The generally high proportion of Type III plain wares in the collection also suggests the possibility that they were manufactured locally or were imported from relatively nearby production locations.

Type I and IV plain wares (169 and 91 specimens, respectively) occurred infrequently in the collection, each accounting for less than 1 percent of unpainted vessels and well below 1 percent of all ceramic artifacts (see Table 20). Like Type II vessels, Type I vessels possess sand inclusions but differ from Type II specimens in that they are noticeably poorly formed, with bumpy, uneven surfaces.

Table 20. Unpainted-Ware-Type Counts and Percentages, by Locus

Unpainted Type	Locus A			Locus B			Locus C			Locus D			All Loci		
	Count	Unpainted (%)	All Ceramics (%)	Count	Unpainted (%)	All Ceramics (%)	Count	Unpainted (%)	All Ceramics (%)	Count	Unpainted (%)	All Ceramics (%)	Total	Unpainted (%)	All Ceramics (%)
Type I plain ware	8	0.3	0.2	—	—	—	26	0.8	0.6	135	0.8	0.7	169	0.8	0.6
Type II plain ware	1,344	58.3	35.5	38	100.0	97.4	2,575	82.6	57.2	12,333	74.0	62.1	16,290	73.6	57.8
Type III plain ware	764	33.1	20.2	—	—	—	338	10.8	7.5	3,741	22.4	18.8	4,843	21.9	17.2
Type IV plain ware	4	0.2	0.1	—	—	—	12	0.4	0.3	75	0.4	0.4	91	0.4	0.3
Red Type I red ware	—	—	—	—	—	—	—	—	—	3	—	—	3	0.01	0.01
Red Type II red ware	177	7.7	4.7	—	—	—	161	5.2	3.6	366	2.2	1.8	704	3.2	2.5
Red Type III red ware	8	0.3	0.2	—	—	—	3	0.1	0.1	15	0.1	0.1	26	0.1	0.1
Red Type IV red ware	—	—	—	—	—	—	1	—	—	—	—	—	1	0.005	0.004
Brown corrugated ware	—	—	—	—	—	—	—	—	—	2	—	—	2	0.01	0.01
Total unpainted	2,305	100.0	60.9	38	100.0	97.4	3,116	100.0	69.2	16,670	100.0	84.0	22,129	100.0	78.5
Total ceramic artifacts[a]	3,784			39			4,502			19,848			28,173		

[a] Excluding very-small sherds for which surface-treatment category was not identifiable.

Figure 28. Plain ware vessels from Mescal Wash: (*a*) Type II plain ware jar with neck (Catalog No. 12399) and (*b*) Type III neckless jar (Catalog No. 12381).

Figure 29. Late Formative period Type II red ware bowl fragment (Catalog No. 12387).

Given that their paste compositions are similar to those of Type II specimens, it is not possible to infer whether Type I specimens were made locally or imported based on the criterion of abundance, but the low proportion of Type IV plain wares suggests a high probability of nonlocal imports.

Nearly all red ware specimens recovered in the project area exhibited Type II pastes (704 specimens, or 96 percent). Type II red wares composed 3 percent of unpainted wares and 2.5 percent of all ceramic artifacts in the project collection. Type I (n = 3), Type III (n = 26), and Type IV (n = 1) red wares were considerably less abundant: each constituted one-tenth or less than one-tenth of 1 percent of the project collection. Type III and IV red wares, along with the two corrugated brown ware sherds, may have been imported into the area, given their low frequency, but compositional or other lines of evidence will be needed to test these hypotheses concerning vessel provenance.

Unpainted-Ware Distributions among the Loci

Excluding very-small sherds, the percentage of plain wares in the ceramic artifact collection from each locus ranged from 61 to 97 percent. In Locus B, only 1 of 39 identifiable sherds (i.e., excluding very-small sherds) had painted decoration. Moreover, all of the 38 unpainted sherds were from Type II plain wares. The reason for the overwhelming preponderance of unpainted sherds in this locus collection is not clear. Locus E was primarily inhabited during the Late Formative period, and perhaps its dearth of painted wares indicates a contraction of interregional exchange for decorated pottery at that time, but the generally small sample size of the collection renders this interpretation suspect. The low diversity of types in Locus E is also suspicious; many of the sherds may have been from one or a few Type II plain ware vessels that the analysts were unable to refit.

Roughly 60–70 percent of sherds or vessels from Loci A and C were unpainted wares, and most of the remainder were composed of painted wares (see Table 20). In contrast, unpainted wares composed a higher proportion (84 percent) of ceramic artifacts from Locus D. The variability in unpainted-sherd percentages between Loci A/C and Locus D may relate to differences in periods of occupation. Loci A and C were both primarily inhabited during the Middle Formative B period (equivalent to the Sedentary period in the Hohokam sequence), and their occupation spans likely overlapped with the height of the network of interconnected Hohokam ball-court villages (Wilcox and Sternberg 1983) and the regional exchange system focused on that network during the A.D. 900s and 1000s (Abbott 2006, 2010; Abbott, Smith, and Gallaga 2007). The Sedentary period was an era of intense interregional interaction in southern and central Arizona, as evidenced by the formation of interconnected ball-court villages that encompassed much of Arizona (Wilcox and Sternberg 1983).

Conversely, the excavated portion of Locus D was mainly inhabited during the Middle Formative A period (equivalent to the Colonial period in the Hohokam sequence), likely predating the peak florescence of the ball-court-village-based network and interaction system. Decorated-pottery vessels likely were more frequently exchanged among settlements over a wider area during the Middle Formative B period—the height of the ball-court system—than during the Middle Formative A period, resulting in higher proportions of decorated wares to plain wares in Loci A and C than in the earlier Locus D. In other words, the ball-court system might have facilitated the widespread distribution of decorated pottery and amplified its availability in different areas within, and possibly also on the margins of, the Hohokam region. We explore this argument in more detail below.

Vessel Forms and Functions

General Form Classes

The ceramic analysts were able to infer general form classes for 1,905 rim sherds and whole/reconstructible vessels, mostly from Locus A (n = 425), Locus C (n = 316), and Locus D (n = 1,162). Table 21 lists the counts and percentages of form classes, as well as bowl-to-jar ratios per locus. For the site as whole, the overwhelming majority (98 percent) of identifiable forms were bowls (n = 1,355, or 71 percent) or jars with necks (n = 516, or 27 percent). Low-frequency forms included neckless jars (n = 27), scoops (n = 6), and 1 plate. Bowls outnumbered jars (with and without necks, combined) by about 2.5 to 1 in the overall project collection, and unsurprisingly, painted decoration was much more prevalent on bowls than on jars: approximately four times the percentage of bowls (57 percent) as jars (15 percent) had painted decoration.

The ratio of bowls to jars was considerably higher in Locus A (3.8 to 1) than in Loci C and D (2.6 and 2.2 to 1, respectively). In addition, the proportion of painted bowls from Locus A (3.1 painted to 1 unpainted) was higher than the proportion from Locus C (1.9 to 1) and Locus D (0.9 to 1). A higher proportion of painted to unpainted jars also was recovered from Locus A (0.5 to 1), relative to Loci C and D (0.3 to 1 and 0.1 to 1, respectively). The only decorated scoop and one of two decorated neckless jars in the project collection also were recovered from Locus A.

The higher ratios of bowls to jars might reflect the probable smaller or ephemeral residential population of Locus A, relative to Loci C and D (see Vanderpot 2001:18). Ciolek-Torrello (personal communication 2008) suggested that bowls tend to outnumber jars in archaeological deposits generated by small or ephemeral habitations (see above). In larger habitations, he suggested, jars tend to outnumber bowls, because of the need for long-term storage. Following Ciolek-Torrello's reasoning, the possibly shorter duration and less-intense occupation in Locus A may explain the higher ratio of bowls to jars than in Loci C and D. Locus A also contained a higher proportion of painted sherds than Loci C and D. Most painted types were bowls; therefore, the higher proportion of painted sherds may simply be a by-product of the overall higher proportion of bowls in the Locus A collection. To be sure, ratios of jars and bowls likely varied for a variety of reasons, in addition to the duration and length of habitation of a site. More evidence and additional hypotheses need to be considered to explain variability in bowl-to-jar ratios among the loci.

One alternative hypothesis is that the inhabitants of Locus A more frequently used and procured bowls, especially decorated bowls, than did the inhabitants of Loci C and D. Perhaps Locus A was regularly used for feasting or other public commensal events that required a large inventory of painted serving bowls. If so, the trash deposits in Locus A may have been partially generated as a result of nonresidential activities. This explanation better accommodates the higher proportions of both painted bowls and jars (individually) to the total number of bowls and jars in Locus A (see above). One problem with the feasting hypothesis, though, is that it does not account for the presence of a likely single-component occupation in Locus A

Table 21. Counts and Percentages of General Form Classes, by Locus

Vessel Form	Ware	Locus A		Locus B		Locus C		Locus D		All Loci	
		Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Bowl											
	painted	254	59.8	—	—	149	47.2	376	32.4	779	40.9
	unpainted	82	19.3	—	—	79	25.0	415	35.7	576	30.2
	all wares	336	79.1	—	—	228	72.2	791	68.1	1,355	71.1
Jar with neck											
	painted	27	6.4	—	—	18	5.7	36	3.1	81	4.3
	unpainted	58	13.6	2	100.0	67	21.2	308	26.5	435	22.8
	all wares	85	20.0	2	100.0	85	26.9	344	29.6	516	27.1
Neckless jar											
	painted	1	0.2	—	—	—	—	1	0.1	2	0.1
	unpainted	2	0.5	—	—	2	0.6	21	1.8	25	1.3
	all wares	3	0.7	—	—	2	0.6	22	1.9	27	1.4
Plate											
	painted	—	—	—	—	—	—	1	—	1	0.1
Scoop											
	painted	1	0.2	—	—	—	—	—	—	1	0.1
	unpainted	—	—	—	—	1	0.3	4	0.3	5	0.3
	all wares	1	0.2	—	—	1	0.3	4	0.3	6	0.3
All identifiable forms		425	100.0	2	100.0	316	100.0	1,162	100.0	1,905	100.0
Bowl-to-jar ratio		3.8 to 1				2.6 to 1		2.2 to 1		2.5 to 1	

and multiple components in Loci C and D. The higher proportion of bowls and painted wares may reflect a temporal trend rather than a spatial pattern. Moreover, additional lines of evidence, beyond the ceramic evidence alone, will be needed to corroborate that feasting was more prevalent in Locus A than in Loci C and D. We explore this hypothesis in greater detail below.

Another, less likely hypothesis is that the same formation processes discussed above (trampling and dumping) that generated generally larger sherds and a higher proportion of vessels in Locus A also generated a bias in the accumulation of bowl rims in the collection. Perhaps bowls sherds are more resistant to breakage than jars (e.g., because of stronger vessel walls), but we saw no evidence to support this hypothesis. Also, this explanation does not account for the higher proportion of painted to unpainted bowls from Locus A, assuming that sherd size had no influence on whether a sherd was recognized as being painted or unpainted. Jars do tend to be larger than bowls, and trampling might have generated a higher number of small jar rims than bowls. If that was the case, we might surmise that the higher frequency of trampling in Loci C and D than in Locus A generated elevated frequencies of jar rims relative to bowl rims. Experimental or ethnoarchaeological data would be required to determine whether trampling could account for such a drastic difference. Nor does this explain the higher proportion of painted jar rims relative to unpainted jar rims at Locus A. By our estimation, the higher ratio of bowls to jars in Locus A than in Loci B and C, as well as the higher ratio of painted to unpainted bowls, was probably a product of cultural behavior in the systemic context, rather than a consequence of postdepositional formation processes.

As we discuss below, these patterns are best explained as the results of temporal changes in pottery use. Painted vessels and bowls appeared to have been used more intensively during the Middle Formative B period, which explains the higher proportions in Locus A. Participation in the large-scale Hohokam exchange network also may have promoted increased use of decorated bowls as serving containers during feasting and public ceremonial events, which would favor increased rates of deposition and accumulation of both bowls and painted sherds in Loci A and C relative to Locus D. Accordingly, the reason for the lower proportions of bowls and painted sherds in Locus D relative to Loci A and C may pertain to that locus's principle period of habitation, during the Middle Formative A period, predating the zenith of the interregional interaction system associated with ball-court villages.

Functional Classes and Feature Activities

Table 22 shows the distributions of general form classes per feature type, excluding the materials recovered from the fill of human-burial features (see above). The majority of rims and vessels identified by form class (80 percent) were collected from structures. No other feature types accounted for more than 5–6 percent of identified forms. These data suggest that most broken pottery, and presumably other domestic debris, was discarded in the remains of abandoned structures and old house pits. Comparatively less debris was discarded in other feature contexts.

Among those feature types for which at least 30 rims or vessels were classified according to form class (the five categories listed first in Table 22), structures, extramural pits, and the "multiple features" category possessed roughly equal frequencies of bowls (ca. 70–85 percent) and jars (ca. 25–30 percent). Conversely, in borrow pits and roasting pits, the percentages of bowls and jars were 62 and 38 percent, respectively. These patterns suggest the possibility that different activities occurred in connection with these different feature types, assuming that these feature collections included discarded materials from extramural activities that occurred at or near the locations at which the materials were recovered. The greater prevalence of jars in roasting pits might indicate the use of jars as cooking implements (for roasting) or as carrying devices. The higher proportions of bowls in structures and extramural pits (generally) could suggest that they contained various sorts of domestic debris. Additional lines of evidence are needed to test these hypotheses and to better infer the range of activities associated with the different feature types.

These results are important for prefacing the analyses presented later in this chapter, which rely on comparisons of form distributions among temporal and spatial units (e.g., periods and loci). These units of analysis may encompass different mixes of feature types, and this could bias analyses of temporal or spatial changes in form classes. The ceramic data will vary according to the composition of feature types encompassed by each analytical unit, but the results listed in Table 22 suggest that the majority of rims and vessels identified by form class from all of the site loci and components were collected from structures or features with similar form frequencies (extramural pits or "multiple features"). The inclusion of roasting pits, therefore, likely would not bias form-distribution patterns to a great extent, given that only 7 percent of all identified forms were recovered from these features. This pattern suggests that analysis of changes in ceramic frequencies over time or across loci is both feasible and productive, in light of the similar depositional contexts.

Detailed Form-Class Assessments

As described above, we classified a sample of 581 large rims and whole/reconstructible vessels into one of 42 detailed form and functional categories based on Braun's (1980, 1983) detailed morphological classification system. In the first section, we discuss variability in functional categories among the three main loci. We present these results in several levels of detail for each locus. Table 23 lists the

Table 22. General Form Classes, by Feature Type

Feature Type	Value	Bowl	Jar with Neck	Neckless Jar	Plate	Scoop	Total
Structure							
	count	1,002	361	21	—	4	1,388
	row percent	72.2	26.0	1.5	—	0.3	100.0
Nonthermal extramural pit							
	count	76	22	1	1	1	101
	row percent	75.2	21.8	1.0	1.0	1.0	100.0
Roasting pit							
	count	55	32	2	—	—	89
	row percent	61.8	36.0	2.2	—	—	100.0
Multiple features							
	count	63	24	—	—	1	88
	row percent	71.6	27.3	—	—	1.1	100.0
Borrow pit							
	count	21	13	—	—	—	34
	row percent	61.8	38.2	—	—	—	100.0
Horno							
	count	11	3	—	—	—	14
	row percent	78.6	21.4	—	—	—	100.0
Fire pit							
	count	4	1	—	—	—	5
	row percent	80.0	20.0	—	—	—	100.0
Cache							
	count	1	1	2	—	—	4
	row percent	25.0	25.0	50.0	—	—	100.0
Trash mound							
	count	3	—	—	—	—	3
	row percent	100.0	—	—	—	—	100.0
Total	count	1,236	457	26	1	6	1,726

Table 23. Counts and Percentages of General Functional Categories, by Locus

Functional Category	Locus A		Locus C		Locus D		All Loci	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Processing/serving	96	66.2	64	58.2	191	58.6	351	60.4
Storage	8	5.5	14	12.7	22	6.7	44	7.6
Storage/cooking	38	26.2	26	23.6	106	32.5	170	29.3
Storage/transfer	3	2.1	6	5.5	7	2.1	16	2.8
Total	145	100.0	110	100.0	326	100.0	581	100.0

Table 24. Counts and Percentages of Size-Class Categories, by Locus

Size Class	Locus A		Locus C		Locus D		All Loci	
	Count	Percent	Count	Percent	Count	Percent	Count	Percent
Individual	6	4.1	12	10.9	18	5.5	36	6.2
Individual/small	—	—	1	0.9	9	2.8	10	1.7
Small	70	48.3	49	44.5	172	52.8	291	50.1
Small/medium	29	20.0	26	23.6	69	21.2	124	21.3
Medium/large	24	16.6	17	15.5	39	12.0	80	13.8
Large	15	10.3	3	2.7	16	4.9	34	5.9
Indeterminate	1	0.7	2	1.8	3	0.9	6	1.0
Total	145	100.0	110	100.0	326	100.0	581	100.0

counts and percentages of Braun's general functional categories. Table 24 lists the counts and percentages of vessels per size class for each locus. Table 25 lists the counts and percentages of the more detailed functional categories per locus, incorporating both the functional and size-class classifications presented in Tables 23 and 24. Table 26 is a cross-tabulation of the general functional categories and the ware and type categories for each locus.

Loci Comparisons

The variability in the distributions of functional classes among Loci A, C, and D (see Table 23) was statistically significant at the 0.05 level ($\chi^2 = 12.5$, *df* = 6, $p = .05$).[1] Locus B was excluded because of the small collection size.) Most of the specimens in the sample (60 percent) likely functioned as utensils for processing or serving food and drink, in Braun's (1980) classification scheme. Fewer classified vessels were used for cooking or storage (29 percent), storage (8 percent), or storage and/or transfer of goods (3 percent). The Locus A sample included a higher percentage of specimens classified as processing/serving vessels (66 percent) than the samples from Loci C and D (58 and 59 percent, respectively). This is not surprising, as most of the serving/processing vessels were bowls, which, as explained above, were more prevalent in the collection from Locus A than in the collections from the other two loci (see above).

Table 24 lists the distribution of vessel-size classes among the loci. Excluding the indeterminate cases, a chi-square test indicated statistically significant variability in size classes among Loci A, C, and D ($\chi^2 = 20.9$, *df* = 10, $p = .02$). One notable difference among the loci was the slightly higher percentage of large vessels in the Locus A collection (10 percent) than in the Loci C and D collections (3 and 5 percent, respectively). In addition, Locus A included roughly 10 percent fewer individual-sized, small, and small/medium-sized vessels (72 percent, the sum of the four smallest categories listed in Table 24) than did Loci C and D (80 and 82 percent, respectively).

Table 25 lists the counts and percentages of the more detailed functional categories per locus, subdivided by size class; a chi-square test was not appropriate in this case, because most of the expected cell frequencies were less than 5 (attributable to the greater number of categories). These data show that the larger vessels recovered from Locus A were generally used for serving and processing food and drink, although the percentages of large and medium-large storage vessels also were slightly higher in the Locus A collection than in the collections from Loci C and D. The percentages of large and medium-large serving/processing vessels from Locus A were slightly higher than the percentages over all loci, but the percentages of smaller serving/processing vessels from Locus A were roughly consistent with the percentages over all loci. In general, both small and large serving/processing vessels were well represented in Locus A, and smaller storage, cooking, and transfer vessels were more frequent in Loci C and D.

As hypothesized above, a portion of the materials deposited in Locus A may have been related to communal feasting or ceremonial activities. The higher proportion of large vessels supports this possibility, as large vessels are frequently used to store and prepare large amounts of food and drink for congregations or feast participants (see Bray 2003; Dietler 1996). This is a valid interpretation, but

---

[1] Chi-square tests are generally considered to be inappropriate when some of the expected cell frequencies are less than 5, which is the case in this analysis, but some statisticians have noted that a certain number of cells with expected values of less than 5 are acceptable. Cochran (1954), for example, suggested that it is acceptable as long as the number of cells is less than 1 in 5 (20 percent). In our case, 2 cells out of 12 had expected values of less than 5 (17 percent), suggesting that the use of the chi-square test was acceptable in this case.

Table 25. Counts and Percentages of Detailed Functional Categories, by Locus

Detailed Function Category	Size Class	Locus A		Locus C		Locus D		Total	
		Count	Percent	Count	Percent	Count	Percent	Count	Percent
Serving or processing vessels									
Serving/food processing without heat	large	6	4.1	2	1.8	11	3.4	19	3.3
	medium/large	15	10.3	11	10.0	22	6.7	48	8.3
	small	28	19.3	21	19.1	65	19.9	114	19.6
	small/medium	18	12.4	17	15.5	38	11.7	73	12.6
Food processing with or without heat/eating/serving	individual/small	—	—	1	0.9	9	2.8	10	1.7
Food processing without heat/dry cooking/serving/eating	large	8	5.5	—	—	4	1.2	12	2.1
	medium/large	5	3.4	—	—	7	2.1	12	2.1
	small	9	6.2	4	3.6	18	5.5	31	5.3
	small/medium	6	4.1	6	5.5	11	3.4	23	4.0
Food processing without heat/eating/serving	individual	1	0.7	2	1.8	6	1.8	9	1.5
Storage vessels									
Liquid/dry storage	individual	2	1.4	4	3.6	4	1.2	10	1.7
Long-term dry storage	medium/large	—	—	—	—	1	0.3	1	0.2
Short- or long-term dry storage	small	—	—	1	0.9	3	0.9	4	0.7
Specialized liquid/canteen	individual	—	—	—	—	1	0.3	1	0.2
Short- or long-term liquid storage	large	—	—	1	0.9	—	—	1	0.2
Specialized dry storage		1	0.7	2	1.8	3	0.9	6	1.0
Short- or long-term liquid or dry storage	large	1	0.7	—	—	1	0.3	2	0.3
	medium/large	4	2.8	2	1.8	5	1.5	11	1.9
	medium/large	—	—	4	3.6	4	1.2	8	1.4
Storage or Cooking vessels									
Short- or long-term dry storage/cooking	small/medium	4	2.8	2	1.8	7	2.1	13	2.2
Short- or long-term liquid or dry storage/cooking	small/medium	1	0.7	1	0.9	13	4.0	15	2.6
Short-term liquid or dry storage/cooking	small	16	11.0	8	7.3	40	12.3	64	11.0
Short-term liquid storage/cooking	small	17	11.7	15	13.6	46	14.1	78	13.4
Storage or transfer vessels									
Short-term dry/liquid storage	individual	1	0.7	—	—	2	0.6	3	0.5
Liquid storage/carrier	individual	2	1.4	6	5.5	5	1.5	13	2.2
Total		145	100.0	110	100.0	326	100.0	581	100.0

Table 26. Counts of General Functional Categories, by Ware and Type Category

Type	Processing/ Serving	Storage	Storage/ Cooking	Storage/ Transfer	Total
Tucson Basin Hohokam					
Cañada del Oro or Rillito Red-on-brown	4	1	2	—	7
Cañada del Oro Red-on-brown	7	—	—	—	7
Rillito Red-on-brown	9	—	1	—	10
Rillito or Rincon Red-on-brown	8	—	—	—	8
Rincon Black-on-brown	2	2	—	—	4
Rincon Red-on-brown	47	—	7	1	55
Tanque Verde Red-on-brown		—	2	—	2
Indeterminate Tucson Basin red-on-brown	5	2	3	—	10
Total Tucson Basin Hohokam	82	5	15	1	103
Percent	79.6	4.9	14.6	1.0	100.0
Phoenix Basin Hohokam					
Snaketown Red-on-buff	1	—	—	—	1
Snaketown or Gila Butte Red-on-buff	—	1	—	—	1
Gila Butte Red-on-buff	1	—	1	—	2
Gila Butte or Santa Cruz Red-on-buff	2	—	1	—	3
Santa Cruz Red-on-buff	12	—	—	—	12
Santa Cruz or Sacaton Red-on-buff	—	—	—	1	1
Sacaton Red-on-buff	10	1	2	1	14
Indeterminate Red-on-buff	13	—	2	—	15
Total Phoenix Basin Hohokam	39	2	6	2	49
Percent	79.6	4.1	12.2	4.1	100.0
Dragoon					
Dragoon Red-on-brown (broad line)	1	—	—	—	1
Dragoon Red-on-brown (fine line)	2	—	—	—	2
Dragoon Red-on-brown (elaborated)	29	2	—	—	31
Dragoon Red-on-brown (indeterminate)	9	—	—	—	9
Total Dragoon	41	2	—	—	43
Percent	95.3	4.7			100.0
San Simon					
Pinaleno or Galiuro Red-on-brown	1	—	—	—	1
Galiuro Red-on-brown	5	—	—	—	5
Cerros Red-on-white	1	—	—	—	1
Total San Simon	7	—	—	—	7
Percent	100.0				100.0
Roosevelt Red Ware					
Gila Polychrome	2	1	—	—	3
Tonto Polychrome	—	—	1	—	1
Indeterminate Roosevelt Red Ware	—	1	—	—	1
Total Roosevelt Red Ware	2	2	1	—	5
Percent	40.0	40.0	20.0		100.0
Low-frequency painted types					
Trincheras Purple-on-red (specular)	2	—	—	—	2
Babocomari Bichrome (elaborated)	1	—	—	—	1

Type	Processing/ Serving	Storage	Storage/ Cooking	Storage/ Transfer	Total
Total low-frequency painted types	3	—	—	—	3
Percent	100.0				100.0
Indeterminate and split painted categories					
Dragoon or San Simon Red-on-brown (fine)	4	—	—	—	4
Dragoon or San Simon Red-on-brown (indeterminate)	2	—	—	—	2
Tucson Basin or Dragoon Red-on-brown (elaborated)	9	—	1	—	10
Tucson Basin or Dragoon Red-on-brown (indeterminate)	6	1	1	—	8
Red-on-brown (Indeterminate)	11	—	5	—	16
Total indeterminate and split painted categories	32	1	7	—	40
Percent	80.0	2.5	17.5		100.0
Unpainted wares					
Type II red ware	20	—	2	—	22
Type I plain ware	—	1	—	2	3
Type II plain ware	84	23	96	8	211
Type III plain ware	41	8	43	3	95
Total unpainted wares	145	32	141	13	333
Percent	43.5	9.6	42.3	3.9	100.0
All wares and types					
Total	351	44	170	16	581
Percent	60.4	7.6	29.3	2.8	100.0

as explained below, it probably reflects increased feasting activity during the Middle Formative B period *as a whole*, rather than a concentration of feasting activity within Locus A relative to Loci C and D. When we isolated the Middle Formative B components, for example, we noted that all three loci contained high frequencies of processing/serving vessels and large vessels (see below). So, the inclusion of Middle Formative A and Late Formative period components in the Loci C and D ceramic collections (especially the latter) may have partially "diluted" the proportions of processing/serving vessels and larger vessels relative to the single-component collection from Locus A, but we cannot rule out other, behavioral bases for these differences.

Other plausible hypotheses can be proffered to explain the difference in vessel sizes between Locus A and Loci C and D. First, variability in eating practices might account for the greater prevalence of larger vessels in Locus A. For example, the inhabitants of Locus A might have frequently prepared and served meals in larger, group-sized vessels rather than in individual-sized vessels, which might have been the norm among households in Loci C and D. That is, in Locus A, multiple individuals might have eaten out of the same vessels, rather than using individual vessels. But the presence of both larger processing/serving vessels *and* storage vessels does not support this hypothesis.

The differences in sizes also may be attributable to differences in household sizes between Locus A and the other two loci. Larger vessels may have been needed to prepare meals for larger numbers of household members in Locus A. We cannot conclusively rule out this possibility, but it does not explain the overall higher ratio of bowls (processing/serving vessels) to jars (storage and cooking vessels) in Locus A than in Loci C and D. Overall, the hypothesis of more-frequent feasting and commensal gatherings in Locus A than in Loci C and D provides the most parsimonious explanation, but additional lines of evidence will be needed to corroborate this hypothesis.

Functional-Class Distributions among Ware and Type Categories

Table 26 lists the counts of general functional categories per type and ware class. One important pattern concerns the greater variety of functional classes for the Tucson and Phoenix Basin (i.e., Hohokam) painted wares, compared to the other painted-ware traditions. The majority of Hohokam painted rims and vessel fragments were from serving/processing vessels (80 percent), which is typical of painted pottery, but storage/cooking vessels (12–15 percent), storage vessels (4–5 percent), and storage/transfer vessels (1–4 percent) were also represented. Conversely, the Dragoon-, San

Simon–, Trincheras-, and Babocomari-style rims and vessels were virtually all serving/processing vessels (96 percent, or 51 of 53 specimens). A variety of functional classes of Roosevelt Red Ware also were recovered, but the percentages are suspect because of the very small sample size of identifiable forms (n = 5).

A 2-by-2 chi-square analysis suggested a highly significant difference between the distributions of processing/serving vessels (bowls) and the combined storage/cooking/transfer vessels (jars) ($\chi^2 = 6.9$, $df = 1$, $p = .009$). Yet the distribution of processing/serving vessels and the storage/cooking/transfer vessels among the two Hohokam traditions (Tucson and Phoenix Basin) were virtually identical ($\chi^2 = .05$, $df = 1$, $p = .82$). For both ware traditions, the ratio of processing/serving vessels to storage/cooking/transfer vessels was roughly 4 to 1, compared to about 26 to 1 for the non-Hohokam ware traditions. These results suggest that the differences in the distributions of form and functional classes between the Hohokam and non-Hohokam painted vessels were not random; rather, they reflect differences in preferences for, or the availability of, painted pottery used for different tasks.

The inhabitants of Mescal Wash procured (or imitated) a variety of vessel forms and functional classes from areas to the west and northwest in the Phoenix and Tucson Basins, but they procured almost exclusively serving/processing vessels (bowls) from the San Pedro and San Simon Valleys. The inhabitants of Mescal Wash may have viewed the non-Hohokam vessels as “exotic” trade wares that were appealing for use as serving containers. In contrast, the Hohokam types appeared to have been viewed as “everyday” wares used for common domestic tasks, including cooking and storage. In our view, this evidence underscores a certain familiarity with, and/or an increased accessibility to, Hohokam pottery wares, relative to the other ware traditions, suggesting a more likely social affiliation or economic connection with Hohokam traditions than with the traditions of other cultural regions in the southern deserts.

The unpainted wares were primarily serving/processing vessels (44 percent) and cooking/storage vessels (42 percent), although these calculations were slightly biased by the inclusion of red wares, which were predominately serving/processing vessels (91 percent). The majority of plain wares (excluding red wares) were cooking/storage vessels (45 percent) and serving/processing vessels (40 percent). Storage and storage/transfer vessels composed 10 percent of plain wares. The percentages per functional categories for Type II and III plain wares were nearly identical. For both types, serving/processing vessels accounted for roughly 40 percent, cooking/storage vessels accounted for 46 percent, storage vessels accounted for about 10 percent, and storage/transfer vessels accounted for 4 percent. The inhabitants of Mescal Wash did not seem to have favored one plain ware type over the other for different domestic tasks and functions.

Size-Class Distributions among Ware and Type Categories

Analysis of the distributions of size classes among regional ware categories provided a different perspective (Table 27). For ease of interpretation, we have merged the individual and individual/small categories, the small and small/medium categories, and the medium/large and large categories in Table 27. The middle size class (small and small/medium) was the dominant one for all of the ware classes. Notable, though, are the higher percentages of larger-sized vessels among the Tucson Basin and Dragoon vessels (ca. 30 percent for each) and the smaller percentages of larger vessels among the Phoenix Basin and San Simon vessels (11 and 14 percent, respectively). Conversely, the percentage of Phoenix Basin vessels (83 percent) included in the middle size group (small and small/medium) was considerably higher than the percentages of Tucson Basin (64 percent), Dragoon (71 percent), and San Simon (71 percent) vessels. The smallest size class (individual and individual/small) was generally infrequent among all of the regional ware categories.

Table 27. Distribution of Size-Class Categories, by Regional Ware Tradition

Ware Tradition	Individual and Individual/Small		Small and Small/Medium		Medium/Large and Large		Total
	Count	Row %	Count	Row %	Count	Row %	
Tucson Basin	6	5.8	66	64.1	31	30.1	103
Phoenix Basin	3	6.4	39	83.0	5	10.6	47
Dragoon	—		31	70.5	13	29.5	44
San Simon	1	14.3	5	71.4	1	14.3	7
Babocomari	1	100.0	—		—		1
Trincheras	—		1	100.0	—		1
Roosevelt Red	1	20.0	3	60.0	1	20.0	5
Total	12	5.8	145	69.7	51	24.5	208

Altogether, the results presented in this section and the previous sections suggest important differences among the four major painted-ware traditions in Mescal Wash. Tucson Basin brown ware pottery, the most frequent ware class, occurred in a variety of functional classes and in both the larger and smaller size classes. Phoenix Basin buff ware pottery also occurred in a variety of functional classes, but mostly as small vessels. Dragoon pottery occurred almost exclusively as bowls (serving/processing vessels), suggesting a limited range of functional applications, but in both larger and smaller size classes. Finally, San Simon brown ware pottery, the least frequent among the four regional ware classes, occurred in a limited range of forms (bowls) and sizes (mainly small vessels).

The implications of this pattern are intriguing. Given the logistical constraints imposed by long-distance movement of pottery—especially given the absence of wheel technology or reliable water transport—we expect that larger vessels tended to be trafficked over smaller areas than did smaller vessels. Long-distance exchange more likely involved smaller bowls or other unrestricted vessel forms (e.g., plates) that were readily nestable, for stacking (see Zedeño 1994). Following this assumption, we infer that the smaller Phoenix Basin and San Simon vessels were more likely to have been imported from afar, rather than locally manufactured. The San Simon wares were infrequent and mostly occurred as small bowls, which is consistent with the expectations for low-level importation from production sources in the San Simon River valley. The San Simon brown wares might have been sporadically available to the inhabitants of Mescal Wash through down-the-line exchange.

But the sheer volume of Phoenix Basin buff ware sherds in the collection is not consistent with low-level imports from a distant source area. Furthermore, the prevalence of nonnestable jar forms among the Phoenix Basin wares does not conform to the expectation for long-distance exchange. If buff wares were, in fact, imported from the Phoenix Basin (likely from production sources in the middle Gila Valley [Abbott, Watts, and Lack 2007]), then the scale of exchange and product trafficking must have been substantial. It is extremely unlikely that down-the-line exchange or sporadic exchange among kin or affines could have sustained large-scale product trafficking over such as long distance.

One mechanism that might have been able to accommodate this scale of trafficking is a formal system of interconnected marketplaces centered on Hohokam ball-court villages, as Abbott (2010; Abbott, Smith, and Gallaga 2007) has posited for the Phoenix Basin. Abbott argued that decorated buff ware pottery was widely available and sold frequently in ball-court villages in the pre-Classic period Hohokam heartland of the Phoenix Basin. It is possible that Phoenix Basin pottery also was widely available in ball-court villages located at a distance from the Hohokam heartland, in southern and central Arizona, via the efforts of long-distance commercial merchants that regularly and frequently moved these goods among villages. Ethnographic studies have shown that frequent and widespread merchant activity can potentially distribute goods over wide areas and on a large scale (see Chandler 1985). Abbott (2010) argued for the presence of such long-distance "middleman traders" (Abbott 2010:69) among the pre-Classic period Hohokam, based on the inferred presence of a merchants' tool kit at the site of Palo Verde Ruin, north of Phoenix, which lends credibility to this hypothesis. If so, the inhabitants of Mescal Wash would have had consistent access to Phoenix Basin buff wares in ball-court villages. Vanderpot and Altschul (2007:62–63) pointed out that several ball-court villages were located within ca. 25–50 km of Mescal Wash, and perhaps additional undetected ball-court villages were present in areas closer to the site. This hypothesis is consistent with the evidence for large-scale movement of mostly small vessels amenable to long-distance transportation.

A competing hypothesis is that migrants from the Phoenix Basin settled at Mescal Wash on a large scale (possibly seasonally) and brought their "homeland" pottery vessels with them during these moves. If this were the case, though, we would still need to account for the low frequency of larger-sized vessels among the Phoenix Basin buff wares. Presumably, large vessels would have been vital to these (or any) migrants for bulk storage of water and some staples (e.g., shelled maize). One possibility is that they lugged small, painted vessels along with mainly unpainted, large vessels. Another possibility is that they brought small, painted vessels and locally procured the larger or bulkier vessels, given the dearth of large Phoenix Basin buff ware vessels in the collection.

The mix of functional classes (bowls and jars) and vessel sizes among the Tucson Basin brown wares is consistent with the expectations for local production and/or short-distance trafficking. The close proximity of Mescal Wash to the Tucson Basin likely meant that the inhabitants of Mescal Wash could readily access a variety of Tucson Basin brown ware vessels without encountering the logistical restrictions outlined above. Proximity and ease of movement may account for the high frequency and formal variety of Tucson Basin brown wares in the Mescal Wash collection, but we cannot rule out the possibility that these wares were made locally in the Mescal Wash area, possibly by migrants from the Tucson Basin.

The Dragoon brown wares present an interesting case, as they were probably widely available in the area, given the site's proximity to the San Pedro River valley. This proximity helps explain the high proportion of large-sized vessels among the Dragoon wares, but it does not explain the prevalence of bowls. Dragoon brown wares were manufactured as both bowls and jars (Heckman 2000b), and presumably, both forms were equally available for exchange or purchase. So, the virtual absence of jars is perplexing. This limited array of forms is not consistent with a pattern of migrants from the Dragoon region that brought pottery with them from their homelands; had the site been settled by such migrants, we would expect a wider variety and higher frequency of Dragoon brown ware sherds. It is possible that Dragoon peoples migrated to the site but opted to procure locally available pottery (probably mostly Hohokam wares), rather than Dragoon-style wares from their homelands, although, if this were the case, painted pottery might not have been an important medium for expressing social identity and affiliation among the Dragoon migrants.

In sum, the mixes of sizes and forms among the ware classes are potentially informative concerning questions about procurement practices and migration, at least as a tool for generating credible and testable hypotheses. We explore these issues in additional detail in the discussion section below. Even so, additional data will be needed to evaluate these hypotheses.

Modified Sherds

A total of 184 sherds from the Phase 2 project area showed evidence of modification (Table 28). The majority were recycled sherds that were ground or chipped into circular, oval, or rectangular “disks.” Some, but not all, of the disks were perforated and were possibly used as spindle whorls. Others may have been used as scraping or smoothing tools, or possibly cooking griddles (*comales*). Recycled sherds were infrequent: only 0.3 recycled sherds per 100 sherds were recovered from the Phase 2 project area. This frequency is relatively consistent in the three loci: 0.43, 0.29, and 0.32 recycled sherds per 100 sherds were recovered from Loci A, C, and D, respectively. Small numbers of repaired (n = 3), refurbished (n = 1), and reused (n = 1) sherds also were recovered, all from Locus D. One sherd from Locus D exhibited evidence of use wear.

Table 28. Modified-Sherd Frequencies, by Locus

Modification	Locus A	Locus C	Locus D	Total
Recycled	23	22	133	178
Refurbished	—	—	1	1
Repaired	—	—	3	3
Reused	—	—	1	1
Use wear	—	—	1	1

Individual Locus Results

Locus A

SRI’s excavations in Locus A encompassed roughly the southern half of the locus (see also Deaver et al. 2010). Vanderpot (2001; Vanderpot and Altschul 2000; see Chapter 4, Volume 1) has interpreted Locus A, located about 130 m south of the floodplain of Mescal Wash, as a farmstead occupied primarily during the Middle Formative B period (ca. A.D. 950–1150). Based on detailed analyses of AM data, Lengyel (see Chapter 2, this volume) suggested a narrower occupation span of ca. A.D. 935–1050, indicating habitation during the first century of the Middle Formative B period (see also Deaver 2010). In Phase 2, ceramic artifacts were recovered from 39 partially or fully excavated features in Locus A, including structures, intramural features, extramural thermal and nonthermal pits, roasting pits, a midden, and a trash mound. Two of the structures exhibited a possibly local architectural style that resembled styles observed in the Dragoon area and the San Pedro Valley (Vanderpot 2001; Vanderpot and Altschul 2007). These latter structures were characterized by large, circular recessed areas, with hearths placed in the middle of the sunken areas, referred to as RHS structures by Vanderpot. Nearly all features excavated in Locus A were assigned to the Middle Formative B period.

A total of 5,363 sherds were collected during Phase 2 in Locus A, including 20 whole/reconstructible vessels, 498 rims, 4,836 body sherds, 6 handle fragments, 1 figurine fragment, and 2 indeterminate ceramic artifacts. These totals include 1,579 sherds (all body sherds) that were too small to identify according to ware or type categories. A total of 3,784 ceramic artifacts from Locus A were classified according to these categories. Below, we compare our results with the painted-ceramic collections obtained during WestLand’s 2008 excavation of structures and extramural domestic features in Loci A and G (Deaver et al. 2010:4.5–4.13); most of their collections derived from data recovery in the northern portion of Locus A. Together, SRI’s and WestLand’s excavations encompassed the entire locus. Chronometric data from WestLands’s excavations indicated occupation during the Middle Formative B period, suggesting likely contemporaneity with the features excavated by SRI.

The counts and percentages of ceramic artifacts from Locus A are listed in Table 29 (see Appendix 3.A for a summary of the ceramic artifacts recovered during Phase 1). Approximately 93 percent of the ceramics recovered from Locus A (3,533 of 3,784 specimens, excluding the very-small sherds) were from features assigned to the Middle Formative B period. The remaining 7 percent (251 specimens) were from features that could not be assigned to a specific period, but the less-specific age

Table 29. Counts and Percentages of Ceramic Artifacts, Locus A

Ware Category	Middle Formative B Period		Middle/Late Formative A Period		Post-A.D. 500		Post-A.D. 700		Indeterminate		Total		Percent within Ware/ Tradition
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Unpainted Wares													
Type I plain ware	8	0.20	—	—	—	—	—	—	—	—	8	0.2	0.3
Type II plain ware	1,211	34.30	36	37.1	3	75.0	4	28.6	90	66.2	1,344	35.5	58.3
Type III plain ware	742	21.00	11	11.3	—	—	2	14.3	9	6.6	764	20.2	33.1
Type IV plain ware	4	0.10	—	—	—	—	—	—	—	—	4	0.1	0.2
Type II red ware	175	5.00	—	—	—	—	—	—	2	1.5	177	4.7	7.7
Type III red ware	8	0.20	—	—	—	—	—	—	—	—	8	0.2	0.3
Subtotal	2,148	60.80	47	48.5	3	75.0	6	42.9	101	74.3	2,305	60.9	100.0
Tucson Basin Hohokam													
Cañada del Oro or Rillito Red-on-brown	2	0.10	1	1.0	—	—	—	—	—	—	3	0.1	0.4
Rillito or Rincon Red-on-brown	24	0.70	1	1.0	—	—	—	—	1	0.7	26	0.7	3.3
Rincon Red-on-brown	278	7.90	3	3.1	—	—	—	—	6	4.4	287	7.6	36.1
Rincon Black-on-brown	32	0.90	—	—	—	—	—	—	—	—	32	0.8	4.0
Rincon Polychrome	6	0.20	—	—	—	—	1	7.1	—	—	7	0.2	0.9
Indeterminate Tucson Basin black-on-brown	8	0.20	—	—	—	—	—	—	—	—	8	0.2	1.0
Indeterminate Tucson Basin polychrome	3	0.10	—	—	—	—	—	—	—	—	3	0.1	0.4
Indeterminate Tucson Basin red-on-brown	415	11.70	9	9.3	—	—	—	—	4	2.9	428	11.3	53.9
Subtotal	768	21.70	14	14.4	—	—	1	7.1	11	8.1	794	21.0	100.0
Phoenix Basin Hohokam													
Santa Cruz or Sacaton Red-on-buff	1	0.03	—	—	—	—	—	—	—	—	1	0.0	2.3
Sacaton Red-on-buff	5	0.10	—	—	—	—	—	—	1	0.7	6	0.2	13.6
Indeterminate buff ware	25	0.70	10	10.3	—	—	—	—	2	1.5	37	1.0	84.1
Subtotal	31	0.90	10	10.3	—	—	—	—	3	2.2	44	1.2	100.0
Dragoon													
Dragoon Red-on-brown (elaborated)	53	1.50	—	—	—	—	—	—	1	0.7	54	1.4	45.8
Dragoon Red-on-brown (indeterminate)	54	1.50	9	9.3	—	—	—	—	1	0.7	64	1.7	54.2
Subtotal	107	3.00	9	9.3	—	—	—	—	2	1.5	118	3.1	100.0

continued on next page

Ware Category	Middle Formative B Period		Middle/Late Formative A Period		Post-A.D. 500		Post-A.D. 700		Indeterminate		Total		Percent within Ware/ Tradition
	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	Count	Percent	
Subtotal	107	3.00	9	9.3	—	—	—	—	2	1.5	118	3.1	100.0
San Simon													
Encinas Red-on-brown	2	0.10	—	—	—	—	—	—	—	—	2	0.1	50.0
Indeterminate San Simon Red-on-brown	2	0.10	—	—	—	—	—	—	—	—	2	0.1	50.0
Subtotal	4	0.10	—	—	—	—	—	—	—	—	4	0.1	100.0
Low-frequency decorated types													
Nogales Polychrome	2	0.10	—	—	—	—	—	—	—	—	2	0.1	40.0
Indeterminate Maverick Mountain or Tucson Polychrome	2	0.10	—	—	—	—	—	—	—	—	2	0.1	40.0
Black-on-red	1	0.03	—	—	—	—	—	—	—	—	1	0.0	20.0
Subtotal	5	0.10	—	—	—	—	—	—	—	—	5	0.1	100.0
Split categories and indeterminate types													
Tucson basin or Dragoon Red-on-brown (elaborated)	35	1.00	—	—	—	—	—	—	—	—	35	0.9	6.8
Tucson Basin or Dragoon Red-on-brown (indeterminate)	112	3.20	1	1.0	1	25.0	—	—	—	—	114	3.0	22.3
Dragoon or San Simon Red-on-brown (elaborated)	1	0.03	—	—	—	—	—	—	—	—	1	0.0	0.2
Dragoon or San Simon Red-on-brown (indeterminate)	6	0.20	1	1.0	—	—	—	—	—	—	7	0.2	1.4
Red-on-brown (indeterminate)	304	8.60	13	13.4	—	—	7	50.0	19	14.0	343	9.1	67.1
Indeterminate red-on-buff or red-on-brown	9	0.30	2	2.1	—	—	—	—	—	—	11	0.3	2.2
Subtotal	467	13.20	17	17.5	1	25.0	7	50.0	19	14.0	511	13.5	100.0
Other ceramic artifacts													
Figurine	1	0.03	—	—	—	—	—	—	—	—	1	0.0	33.3
Other modeled artifact	1	0.03	—	—	—	—	—	—	—	—	1	0.0	33.3
Possible unfired clay	1	0.03	—	—	—	—	—	—	—	—	1	0.0	33.3
Subtotal	3	0.10	—	—	—	—	—	—	—	—	3	0.1	100.0
Total	3,533	100.0	97	100.0	4	100.0	14	100.0	136	100.0	3,784	100.0	

designations accommodate the date range of the Middle Formative B period; it is therefore likely that all or nearly all of the materials collected from Locus A dated to this period (see Chapter 2, this volume).

Painted Wares

As explained above, painted wares composed a considerably higher percentage of the Locus A collection than of the other locus collections (see Table 29). Painted sherds associated with the Tucson Basin Hohokam tradition composed 54 percent of painted wares and 21 percent of all ceramics, which substantially exceeds the percentages of Tucson Basin types over all loci (38 and 12 percent, respectively). In WestLand's collections from Loci A and G, 63 percent of painted sherds were Tucson Basin wares (Deaver et al. 2010:Table 4.3)—only slightly higher than the percentage observed in our collection. More than half of the Tucson Basin types recovered in SRI's project area were indeterminate red-on-brown sherds (54 percent). Excluding these indeterminate cases, the majority were Rincon phase types, including Rincon Red-on-brown (78 percent), Rincon Black-on-brown (4 percent), Rincon Polychrome (1 percent), and the less-distinctive Rillito or Rincon Red-on-brown (3 percent). Deaver et al. (2010) also reported a predominance of Rincon phase painted types in their collection. These types underscore a Middle Formative B period occupation, which corresponds to the Rincon phase in the Tucson Basin and the Sacaton phase in the Phoenix Basin. Among the Tucson Basin types recovered, only three sherds (all Cañada del Oro or Rillito Red-on-brown) possibly predated this period.

In our sample, painted types affiliated with the Phoenix Basin Hohokam tradition composed only 2 percent of painted sherds and 1 percent of all ceramic artifacts from Locus A. Deaver et al. (2010:Table 4.3) reported a similar frequency of 3.2 percent of painted sherds (47 of 1,481). This is a marked contrast with Loci C and D, where Phoenix Basin buff wares composed, respectively, 12 and 23 percent of painted sherds (see below). These percentages also are well below the percentages calculated over all loci (15 percent). The few identifiable Phoenix Basin types were mostly Sacaton Red-on-buff, the Phoenix Basin equivalent of the Rincon Red-on-brown tradition in the Tucson Basin. Sacaton Red-on-buff was also the more frequent Phoenix Basin type in WestLand's excavation collection (Deaver et al. 2010).

In SRI's collection, Dragoon brown wares accounted for 8 percent of painted wares and 3 percent of all ceramic artifacts, which are consistent with the percentages over all loci (8 percent and 2 percent, respectively). The only identifiable type was Dragoon elaborated, which dated to ca. A.D. 950–1400 (Heckman and Whittlesey 2000:126–127), and this is consistent with chronometric results that suggested a Middle Formative B period occupation. Here, our results vary considerably from those reported by Deaver et al. (2010:Table 4.3): in their collection from the northern half of Locus A, about 23 percent of painted wares were assigned to the Dragoon painted-pottery tradition. Dragoon brown wares outnumbered Phoenix Basin buff wares in Locus A, which varied from the painted-ware counts in Loci C and D.

Only four San Simon Red-on-brown sherds were recovered from Locus A in Phase 2 (0.3 percent of painted types), well below the percentage of San Simon types over all loci (2 percent of painted types). Two of the four sherds were identified as Encinas Red-on-brown, a contemporary of Rincon Red-on-brown and Sacaton Red-on-buff. Similarly, Deaver et al. (2010) reported only eight San Simon painted sherds in their collection, all of which were Encinas phase types. Other low-frequency painted types (five sherds) composed less than 1 percent of all painted types in SRI's Locus A collection, including two Nogales Polychrome sherds (Trincheras tradition), two Tucson or Maverick Mountain Polychrome sherds (possibly associated with the San Carlos/Safford–area tradition), and one indeterminate bichrome black-on-red sherd. Deaver et al. (2010) also reported one Trincheras-series sherd (Nogales Polychrome) in their collection from Loci A and G. Roughly one-third of the painted wares from Locus A (511 sherds) could not be identified to a specific type or ware, all of which were unknown red-on-brown sherds (indeterminate and split categories).

In sum, the collections by both SRI and WestLand suggest that the Middle Formative B inhabitants of Locus A preferred Tucson Basin– and Dragoon-style painted pottery, especially the former, and infrequently used Phoenix Basin, San Simon, or other painted-pottery styles. In SRI's collection, excluding the indeterminate and split categories, the Tucson Basin and Dragoon types accounted for 95 percent of all painted types, and the Tucson Basin wares alone accounted for 82 percent. Perhaps the inhabitants of Locus A primarily engaged in exchange with populations in the Tucson Basin and Dragoon areas. Another possibility is that populations from the Tucson Basin and Dragoon areas physically settled in Locus A and made painted pottery in the styles of their homelands.

Unpainted Wares

Unpainted wares constituted 61 percent of the Locus A collection, most of which were plain wares (92 percent); red wares constituted only 8 percent (see Table 29). The percentage of unpainted wares recovered from Locus A was substantially lower than the percentage over all loci (79 percent). The most frequent pottery type was Type II plain ware, which composed 58 percent of unpainted wares and 36 percent of all ceramic artifacts from Locus A. The second-most-frequent type was Type III micaceous plain ware, which composed 33 percent of unpainted wares and 20 percent of all ceramic artifacts. Notably, Deaver et al. (2010:4.11) reported a similar frequency of micaceous plain wares (39 percent) in the unpainted-ceramic collection excavated by WestLand in Loci A and G. Deaver (1984:392–398) argued that the popularity of micaceous pottery was on the decline during this time in the broader region, but the evidence from Loci A and G does not support this trend. Type I (8 sherds) and Type IV (4 sherds) plain wares were rare in the Locus A collection.

Nearly all red wares had Type II pastes with sand temper (175 of 183 sherds); 8 others had Type III paste with a micaceous sheen. Red wares were about twice as frequent in the Locus A collections (5 percent) than in the overall project collection (2.6 percent), which is surprising, because red wares are generally more commonly recovered in Late Formative period collections than in Middle Formative period collections in the Hohokam region.

Three nonvessel artifacts were recovered from Locus A, including a figurine fragment, an indeterminate modeled artifact, and a possible lump of unfired clay. The unfired-clay body suggests the possibility of ceramic production in Locus A, but no additional evidence for production has been uncovered. The figurine fragment was recovered from structure Feature 200 and appeared to include the lower torso and legs of a humanoid or animal figure (Figure 30).

Figure 30. Figurine fragment from Feature 200, Locus A, likely the lower torso and legs of a humanoid or animal figure (Catalog No. 693).

Form and Functional Classes

General form classes were inferred for a total of 425 rims and 5 whole/reconstructible vessels from Locus A. Table 30 lists the counts and percentages of forms among painted and unpainted rims, excluding cases for which a specific form was indeterminate. As discussed above, the majority of identifiable forms (79 percent) were bowls. Most of the remaining forms were jars with necks (20 percent). Three neckless jars and 1 scoop also were identified. Bowls outnumbered jars (both with and without necks) by 9.1 to 1 for painted wares and by 1.4 to 1 for unpainted wares.

The distribution of functional categories for Locus A are listed in Table 31. Most of the identified functional classes were from features assigned to the Middle Formative B period (126 of 145 specimens; 87 percent); only 12 specimens were from features dated to the less-specific age groups. Above, we discussed the distribution of functional categories in the Locus A collection, and we briefly summarize our findings here. Two-thirds of all identifiable cases were serving/processing vessels, and roughly one-quarter (23 percent) were medium/large or large serving/processing vessels, which well exceeds the percentage over all loci (16 percent). Storage and storage/transfer vessels composed only about 8 percent, only slightly below the percentage over all loci (10 percent), and cooking/storage vessels made up 26 percent, which is roughly consistent with the percentage over all loci (29 percent). Above, we interpreted these data to suggest possible evidence that Locus A housed communal feasts or congregations where large amounts of food and drink were served (but not cooked), a hypothesis we discuss in considerable detail below.

Feature Ceramics

Below, we report the distributions of ceramic artifact types, wares, and form classes per feature type and per individual feature. The tables below summarize the unpainted- and painted-ceramic frequencies for features assigned to specific time periods; the ceramics from undated features are not listed.

Ceramic Distribution among Feature Types

Table 32 lists the distribution of ceramic artifacts among feature types in Locus A. (The data is combined for all structures, extramural pits, one midden, and one trash mound.) Table 33 displays the results of a Pearson's chi-square contingency-table analysis showing the observed and observed-minus-expected percentages of ware categories per feature type. The expected counts were calculated as the column total (i.e., the total number of sherds per ware class) times the row total (the total number of sherds per

Table 30. Counts and Percentages of General Form Classes, Locus A, by Period

Counts/ percentages	Painted Vessels					Unpainted Vessels				Total
	Bowl	Jar with Neck	Neckless Jar	Scoop	Painted Total	Bowl	Jar with Neck	Neckless Jar	Unpainted Total	
	Middle Formative B Period									
Count	229	27	1	1	258	77	55	2	134	392
Percent, painted	88.8	10.5	0.4	0.4	100.0	57.5	41.0	1.5	100.0	
Percent, all forms	58.4	6.9	0.3	0.3	65.8	19.6	14.0	0.5	34.2	
	Middle/Late Formative A Period									
Count	15	—	—	—	15	2	—	—	2	17
Percent, painted	100.0	—	—	—	100.0	100.0	—	—	100.0	
Percent, all forms	88.2	—	—	—	88.2	11.8	—	—	11.8	
	Post-A.D. 500									
Count	1	—	—	—	1	—	—	—	—	1
Percent, painted	100.0	—	—	—	100.0	—	—	—	—	
Percent, all forms	100.0	—	—	—	100.0	—	—	—	—	
	Post-A.D. 700									
Count	1	—	—	—	1	—	—	—	—	1
Percent, painted	100.0	—	—	—	100.0	—	—	—	—	
Percent, all forms	100.0	—	—	—	100.0	—	—	—	—	
	Indeterminate Age									
Count	8	—	—	—	8	3	3	—	6	14
Percent, painted	100.0	—	—	—	100.0	50.0	50.0	—	100.0	
Percent, all forms	57.1	—	—	—	57.1	21.4	21.4	—	42.9	
	All Age Designations									
Count	254	27	1	1	283	82	58	2	142	425
Percent, painted	89.8	9.5	0.4	0.4	100.0	57.7	40.8	1.4	100.0	
Percent, all forms	59.8	6.4	0.2	0.2	66.6	19.3	13.6	0.5	33.4	

Table 31. Detailed Functional Categories, Locus A

Detailed Functional Category	Size Class	Middle Formative B Period		Middle/Late Formative A Period		Indeterminate Age		All Ages	
		Count	Percent	Count	Percent	Count	Percent	Count	Percent
Serving or processing vessels									
Serving/food processing without heat	large	4	3.2	—		2	16.7	6	4.1
	medium/large	14	11.1	1	14.3	—		15	10.3
	small	25	19.8	2	28.6	1	8.3	28	19.3
	small/ medium	15	11.9	3	42.9	—	0.0	18	12.4
Food processing without heat/dry cooking/ serving/eating	large	6	4.8	—		2	16.7	8	5.5
	medium/large	5	4.0	—		—		5	3.4

continued on next page

Detailed Functional Category	Size Class	Middle Formative B Period		Middle/Late Formative A Period		Indeterminate Age		All Ages	
		Count	Percent	Count	Percent	Count	Percent	Count	Percent
	small	7	5.6	—	—	2	16.7	9	6.2
	small/ medium	5	4.0	1	14.3	—		6	4.1
Food processing without heat/eating/serving	individual	—		—		1	8.3	1	0.7
Subtotal		81	64.3	7	100.0	8	66.7	96	66.2
Storage vessels									
Liquid/dry storage	individual	2	1.6	—		—		2	1.4
Short- or long-term liquid or dry storage	large	1	0.8	—		—		1	0.7
	medium/large	4	3.2	—		—		4	2.8
Specialized dry storage		1	0.8	—		—		1	0.7
Subtotal		8	6.3	—		—		8	5.5
Storage or Cooking vessels									
Short- or long-term dry storage/cooking	small/ medium	4	3.2	—		—		4	2.8
Short- or long-term liquid or dry storage/cooking	small/ medium	1	0.8	—		—		1	0.7
Short-term liquid or dry storage/cooking	small	16	12.7	—		—		16	11.0
Short-term liquid storage/ cooking	small	13	10.3	—		4	33.3	17	11.7
Subtotal		34	27.0	—		4	33.3	38	26.2
Storage or transfer vessels									
Liquid storage/carrier	individual	2	1.6	—		—		2	1.4
Short-term dry/liquid storage	individual	1	0.8	—		—		1	0.7
Subtotal		3	2.4	—		—		3	2.1
Total		126	100.0	7	100.0	12	100.0	145	100.0

Table 32. Summary of Ceramic Artifacts by Feature Type, Locus A

Feature Type	Ceramics (n)	Ceramics (%)	Small Sherds (n)	Small Sherds (%)	Vessels (n)	Vessels (5)	Plain Ware (n)	Plain Ware[a] (%)	Red Ware (n)	Red Ware[a] (%)	Painted (n)	Painted[a] (%)
Structure	4,793	91.6	1,424	29.7	18	0.4	1,870	55.6	180	5.3	1,316	39.1
Extramural pit[b]	323	6.2	96	29.7	2	0.6	110	48.5	1	0.4	116	51.1
Midden	32	0.6	9	28.1	—	—	17	73.9	1	4.3	5	21.7
Trash mound	83	1.6	31	37.3	—	—	36	69.2	1	1.9	15	28.8

[a] Very-small sherds excluded from calculations.

[b] Includes roasting pits.

Table 33. Contingency Table Showing Observed and Observed-Minus-Expected Percentages of Wares, by Feature Type, Locus A

Feature Type	Plain Wares				Red Wares				Painted Wares			
	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]
Structure	1,870	1,865.6	4.4	0.1	180	167.9	12.1	0.4	1,316	1,332.5	–16.5	–0.5
Extramural pit	110	125.8	–15.8	–7.0	1	11.3	–10.3	–4.5	116	89.9	26.1	11.5
Midden	17	12.7	4.3	18.5	1	1.1	–0.1	–0.6	5	9.1	–4.1	–17.8
Trash mound	36	28.8	7.2	13.8	1	2.6	–1.6	–3.1	15	20.6	–5.6	–10.7

[a] Observed minus expected, divided by total count per feature type, times 100.

feature type), divided by the grand total of sherds. To evaluate the magnitude of the observed-minus-expected results listed in Table 33, we divided the observed-minus-expected values by the overall numbers of sherds per feature type, times 100 (see Garraty et al. 2010). This scaled value converts the variation between the observed and expected to percentage values. So, a residual of –3 with 10 sherds indicates 30 percent fewer sherds than expected; for the sample size of 1,000 sherds, this result suggests only 0.3 percent fewer small sherds than expected. When interpreting the observed-minus-expected results, therefore, we concentrated on the scaled results rather than the "raw" results. One caveat with this approach is that, because the overwhelming majority of sherds were collected from structures, the proportional differences in marginal totals, which were used to calculate the expected values, will have closely matched the proportional differences for the structures. So, in effect, this calculation measured the variability in ware percentages between structures and the other feature types. We do not view this as a problem, because the line of variability is still informative about compositional differences among feature types—in this case, the differences were simply calculated relative to the structures.

The majority of ceramics (92 percent) were recovered from 7 excavated structures, with an average of 685 specimens per structure. Six percent of ceramic artifacts were excavated from 29 extramural pits (including 1 roasting pit). On average, the extramural pits included only 11 specimens per feature. Other features with ceramics included a midden (32 specimens) and a trash mound (83 specimens), neither of which was fully excavated. We analyzed all feature types together because they all likely date to the same time period.

As explained above, the proportions of very-small sherds and vessels potentially shed light on the depositional contexts of the features. As shown in Table 32, structures, pits, and middens included roughly similar percentages of very-small sherds (relative to total counts). The trash mound had a higher proportion of small sherds, which may indicate that the mound deposits were subjected to more-frequent trampling or other disturbance. The trash-mound deposits were not buried or shielded from human activities, which likely accounts for the high frequency of small sherds (see above for the rationale behind this interpretation). The overall similar frequencies of small sherds among feature types suggest that the feature deposits were formed as the results of similar processes. The distributions of vessels did not indicate any clear patterning among feature types.

Variability in the composition of the ceramics among feature types suggests that they were associated with different activities. A chi-square test showed significant variability in the overall distributions of plain wares, red wares, and painted wares among feature types ($\chi^2 = 27.70$, $df = 6$, $p < .001$). Roughly half of the ceramics from the structures and extramural pits were plain wares; in contrast, nearly three-quarters from the midden and trash mound were plain wares (see Table 32). The scaled observed-minus-expected values indicated that the midden and trash mound contained considerably higher-than-expected plain ware concentrations (see Table 33). The frequencies among the extramural pits were slightly lower than expected. Extramural pits, middens, and the trash mound also had slightly lower-than-expected red ware frequencies (see Table 33), but the scaled observed-minus-expected values suggest that this may largely have been a product of the higher overall amount of sherds recovered from structures than from other feature types.

Painted wares were more prevalent in extramural pit features than in other feature types (see Table 32). Painted-ware percentages in the midden and trash mound were particularly low, which is best evidenced by the scaled observed-minus-expected values. Extramural pits contained roughly 12 percent more painted wares than expected, given the marginal totals. Conversely, the midden and trash mound contained about 18 and 11 percent fewer than expected, respectively. These results suggest that whole or fragmented painted vessels were more likely to have been deposited in extramural pits than in the other feature types. One possible explanation for this pattern is that debris generated during possible feasting or ceremonial occasions was deposited in extramural pits. Domestic or other trash may have been more frequently deposited in abandoned structures, the midden, and the trash mound. The distribution of form classes per feature supports this possibility (Table 34), as extramural pits included a slightly higher ratio of bowls to jars (6 to 1) than did structures (3.6 to 1), but too few identifiable form classes were recovered from the trash mound and midden to evaluate this hypothesis.

Table 34. Summary of General Form Classes, by Feature Type, Locus A

Feature Type	Bowls	Jars with Necks	Neckless Jars	Scoops	Total	Bowl-to-Jar Ratio
Structure	299	79	3	1	382	3.6 to 1
Extramural pit[a]	24	4	—	—	28	6 to 1
Trash mound	3	—	—	—	3	3 to 0

Note: Very-small sherds excluded from calculations.

[a] Includes roasting pits.

Ceramic Distribution among Individual Features and Feature Types

Table 35 lists the counts and percentages of ceramic wares per feature in Locus A according to age assignment, excluding features of indeterminate age. Table 36 lists the counts and percentages of ceramic wares per feature *for painted types only*, which facilitates interpretations of possible variability in cultural affiliation among features.

The variability in plain ware and red ware percentages was relatively consistent among the structures, composing between 51 and 64 percent, with a mean of 59.2 percent and a standard deviation of 4.5 percent (see Table 35). No structures contained a plain ware percentage greater than two standard deviations above or below the mean (above 68.2 or below 50.2). The extramural pits, for the most part, possessed plain ware percentages roughly in line with the percentages recovered from the structures. Notably, the midden and the trash mound contained 69 and 77 percent plain wares, respectively, both of which were more than two standard deviations above the mean for structures, which complements the above analysis, indicating higher proportions of plain wares in the midden and trash mound. Nearly all of the red wares recovered in Locus A were from structures. The red ware percentages per structure ranged from 1 to 7 percent, with a mean of 4.9 percent and a standard deviation of 2.3 percent.

Variation in painted-ware frequencies was more pronounced. Percentages of Tucson Basin wares (mainly red-on-brown) ranged from 15 to 35 percent among structures, with a mean of 22.3 percent and a standard deviation of 6.4 percent (see Table 35). Thirty-five percent of wares recovered from structure Feature 1189 were Tucson Basin types, which is more than 11 percent higher than the structure with the second-highest percentage (Feature 2160). The percentage from Feature 1189 also was roughly two standard deviations above the mean, and 91 percent of painted sherds from Feature 1189 were Tucson Basin types (see Table 36). The site inhabitants that discarded painted pottery in Feature 1189 clearly preferred Tucson Basin painted wares over other painted-pottery styles. When the counts were summed together by feature type, Tucson Basin types composed 60 percent of all painted ceramics from structures and 55 percent of all painted ceramics from extramural pits.

Phoenix Basin buff wares were considerably less frequent in Locus A, as explained above. Among structures, the percentage of Phoenix Basin buff wares ranged from 0.3 to 2.5 percent, with a mean of 1 percent and a standard deviation of 0.8 percent (see Table 35). They composed between 1 and 6 percent of painted ceramics (i.e., excluding unpainted wares) among structures, with a mean of 2.6 percent, suggesting relatively little variation among the structures. Noteworthy is the variation in percentages of Phoenix Basin buff wares between structures and extramural pits. When summing the counts by feature type, the mean percentage of Phoenix Basin buff wares from structures was 2.6, well below the percentage of 9.9 for extramural pits (see Table 36). For whatever reason, Phoenix Basin buff wares were more frequently discarded in extramural pits than in residential loci. If feasting debris was more frequently discarded in pits than in residential features, as hypothesized above, an ensuing possibility is that the inhabitants of Locus A preferred Phoenix Basin–style painted vessels over other painted types for use as serving containers during communal feasts or ceremonial events.

Dragoon brown wares constituted between 0 and 5 percent of the ceramic artifacts from the structures, with a mean of 2.5 percent and a standard deviation of 1.4 percent (see Table 35). One structure, Feature 2192, contained a percentage (4.9 percent) that more than doubled the second-highest percentage (2.8 percent), but this may not be a significant difference, given the overall small percentage of these wares. The percentages of Dragoon brown wares relative to all painted-ware classes were relatively consistent among structures (9 percent) and extramural pits (12 percent). San Simon brown wares and other low-frequency painted wares were recovered exclusively from structures and composed less than 1 percent of all ceramics in any feature.

Table 37 lists the general form classes per feature from Locus A. The overall sample size of identifiable form classes was small for most features. Among five structures with a minimum of 20 identifiable forms, bowls generally outnumbered jars by between 2 and 45 to 1, with a ratio of 3.6 to 1 over all structures. Features 2160 and 2192 contained the highest ratios (4.5 and 3.6 to 1, respectively). For extramural pits, the sample size from any feature was too small for robust analysis. Over all of the extramural pits, the bowl-to-jar ratio was 7 to 1, about twice the ratio from structures.

Modified Sherds

A total of 23 modified sherds were recovered from Locus A, all of which were recycled sherds (Table 38). Most of the recycled sherds were from structures (n = 20). Two others were recovered from the midden, and 1 was recovered from the trash mound. As shown in Table 38, more recycled sherds per 100 sherds were recovered from the midden (6.3) and trash mound (1.2) than from the 5 structures (0.45). These higher ratios may be a product of small sample sizes for the midden and trash mound but could also reflect an association between sherd tools and certain extramural activities. No modified sherds were recovered from extramural pits. Recycled sherds were likely related to domestic activities, such as spinning, scraping, and cooking, which underscores that the deposits in the midden and trash mound were probably generated from domestic activities.

Table 35. Ceramic Artifacts, by Age and Feature, Excluding Features of Indeterminate Age, Locus A

Feature No.	Feature Type	Plain Ware		Red Ware		Tucson Basin		Phoenix Basin		Dragoon		San Simon		Other Tradition		Indetermined Painted		Total
		n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	
	Middle Formative B Period																	
200	structure	299	61.1	24	4.9	75	15.3	3	0.6	13	2.7	1	0.2	2	0.4	72	14.7	489
207	structure	252	63.5	10	2.5	70	17.6	1	0.3	11	2.8	2	0.5	—		51	12.8	397
288	nonthermal extramural pit	31	55.4	—		25	44.6	—		—		—		—		—		56
290	structure	144	61.5	15	6.4	45	19.2	1	0.4	—		—		—		29	12.4	234
522	trash mound	36	69.2	1	1.9	5	9.6	—		—		—		—		10	19.2	52
1180	nonthermal extramural pit	8	44.4	1	5.6	7	38.9	—		2	11.1	—		—		—		18
1188	nonthermal extramural pit	2	28.6	—		4	57.1	—		1	14.3	—		—		—		7
1189	structure	70	60.9	1	0.9	40	34.8	—		2	1.7	—		—		2	1.7	115
2143	midden	17	77.3	1	4.5	2	9.1	—		—		—		—		2	9.1	22
2153	nonthermal extramural pit	—		—		3	100.0	—		—		—		—		—		3
2157	structure	90	61.6	9	6.2	30	20.5	2	1.4	3	2.1	—		—		12	8.2	146
2160	structure	203	51.0	28	7.0	95	23.9	10	2.5	3	0.8	—		—		59	14.8	398
2168	nonthermal extramural pit	1	33.3			2	66.7	—		—		—		—		—		3
2192	structure	812	54.9	94	6.4	365	24.7	14	0.9	72	4.9	1	0.1	2	0.1	118	8.0	1,478
	Middle/Late Formative A Period																	
1150	nonthermal extramural pit	2	33.3	—		—		1	16.7	—		—		—		3	50.0	6
1179	nonthermal extramural pit	1	33.3	—		1	33.3	1	33.3	—		—		—		—		3
1195	nonthermal extramural pit	36	50.0	—		11	15.3	6	8.3	9	12.5	—		—		10	13.9	72
2165	nonthermal extramural pit	8	66.7	—		—		1	8.3	—		—		—		3	25.0	12
2197	nonthermal extramural pit	—		—		2	66.7	1	33.3	—		—		—		—		3

Table 36. Painted Wares, by Age and Feature, Locus A

Feature No.	Feature Type	Tucson Basin		Phoenix Basin		Dragoon		San Simon		Other Tradition		Indetermined Painted		Total
		n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	n	Row (%)	
Middle Formative B Period														
200	structure	75	45.2	3	1.8	13	7.8	1	0.6	2	1.2	72	43.4	166
207	structure	70	51.9	1	0.7	11	8.1	2	1.5	—		51	37.8	135
288	nonthermal extramural pit	25	100.0	—		—		—		—		—		25
290	structure	45	60.0	1	1.3	—		—		—		29	38.7	75
522	trash mound	5	33.3	—		—		—		—		10	66.7	15
1180	nonthermal extramural pit	7	77.8	—		2	22.2	—		—		—		9
1188	nonthermal extramural pit	4	80.0	—		1	20.0	—		—		—		5
1189	structure	40	90.9	—		2	4.5	—		—		2	4.5	44
2143	midden	2	50.0	—		—		—		—		2	50.0	4
2153	nonthermal extramural pit	3	100.0	—		—		—		—		—		3
2157	structure	30	63.8	2	4.3	3	6.4	—		—		12	25.5	47
2160	structure	95	56.9	10	6.0	3	1.8	—		—		59	35.3	167
2168	nonthermal extramural pit	2	100.0	—		—		—		—		—		2
2192	structure	365	63.8	14	2.4	72	12.6	1	0.2	2	0.3	118	20.6	572
Middle/Late Formative A Period														
1150	nonthermal extramural pit	—		1	25.0	—		—		—		3	75.0	4
1179	nonthermal extramural pit	1	50.0	1	50.0	—		—		—		—		2
1195	nonthermal extramural pit	11	30.6	6	16.7	9	25.0	—		—		10	27.8	36
2165	nonthermal extramural pit	—		1	25.0	—		—		—		3	75.0	4
2197	nonthermal extramural pit	2	66.7	1	33.3	—		—		—		—		3

Table 37. Form Classes, by Age and Feature, Locus A

Feature No.	Feature Type	Bowl	Jar with Neck	Neckless Jar	Scoop	Total	Bowl-to-Jar Ratio
	Middle Formative B Period						
200	structure	41	19	—	—	60	2.2 to 1
207	structure	27	11	—	—	38	2.5 to 1
288	nonthermal extramural pit	1	—	—	—	1	1 to 0
290	structure	15	4	1	—	20	3 to 1
522	trash mound	3	—	—	—	3	3 to 0
1180	nonthermal extramural pit	2	2	—	—	4	1 to 1
1188	nonthermal extramural pit	1	—	—	—	1	1 to 0
1189	structure	12	1	—	—	13	12 to 1
2157	structure	9	1	—	—	10	9 to 1
2160	structure	29	7	1	—	37	3.6 to 1
2168	nonthermal extramural pit	—	1	—	—	1	0 to 1
2192	structure	166	36	1	1	204	4.5 to 1
	Middle/Late Formative A Period						
1150	nonthermal extramural pit	2	—	—	—	2	2 to 0
1179	nonthermal extramural pit	1	—	—	—	1	1 to 0
1195	nonthermal extramural pit	11	—	—	—	11	11 to 0
2165	nonthermal extramural pit	2	—	—	—	2	2 to 0
2197	nonthermal extramural pit	1	—	—	—	1	1 to 0

Table 38. Modified-Sherd Frequencies, by Feature, Locus A

Feature	Feature Type	Recycled (n)	Total	Recycled, per 100 Sherds (n)
200	structure	2	686	0.29
207	structure	7	623	1.12
290	structure	2	299	0.67
522	trash mound	1	83	1.20
2143	midden	2	32	6.25
2160	structure	2	650	0.31
2192	structure	7	2,151	0.33
Total		23	4,524	0.43

Locus B

Locus B consisted of a series of surface deposits covering an area of 230 by 200 m. Phase 1 test excavations exposed one definite pit house and three possible pit houses (Vanderpot and Altschul 2000; see Chapter 5, Volume 1), but this locus was not intensively investigated during Phase 2 (see Appendix 3.A for a discussion of the ceramic artifacts recovered during Phase 1). During the Phase 2 data recovery, SRI archaeologists excavated two test pits in a surface concentration, thought to be a possible midden, that mostly consisted of surface remains with little subsurface depth (Vanderpot 2001:15). A total of 70 ceramics were recovered from the test excavations, but nearly half (n = 31, or 44 percent) were too small for type or ware identification. All but 1 of the remaining ceramic materials were Type II plain ware sherds (n = 38, or 54 percent)—all but 2 of which were body sherds. Two Type II plain ware rims were identified as jars with necks. One indeterminate red-on-brown body sherd also was recovered. No modified sherds were recovered.

Locus C

Locus C measured 250 by 100 m in area, much of which had been subjected to heavy disturbance from road construction (Vanderpot 2001; Vanderpot and Altschul 2000; see Chapter 6, Volume 1). This locus encompassed a dense cluster of structures mostly dating to the Middle Formative B period and has been interpreted as a long-term habitation or repeated short-term habitations (Vanderpot 2001:18). Lengyel (see Chapter 2, this volume) identified four occupational episodes in Locus C using AM data from structures. Most of the structures were abandoned at roughly the same time as those in Locus A (between ca. A.D. 935–1050), suggesting peak occupation during the first century of the Middle Formative B period. Nearly 100 features were completely or partially excavated, including structures, thermal pits, nonthermal pits, human burials, animal burials, and a midden.

Three of the Middle Formative B period structures (Features 379, 995, and 6098) were examples of what Vanderpot (2001:12) has called RHS structures (see above for description), which could be indicative of a Dragoon cultural affiliation (Vanderpot and Altschul 2007). Of particular note is Feature 379, which was significantly larger than the other structures at the site; it was also unique in having an east-facing entryway and a series of parallel floor grooves outside the recessed-hearth area, suggesting a raised floor (see Chapter 6, Volume 1). Vanderpot and Altschul (2007:60) speculated that this large structure served a communal function.

A total of 7,561 ceramic artifacts were recovered from this locus during Phase 2 (Table 39) (see Appendix 3.A for a discussion of the ceramic artifacts recovered during Phase 1). In our calculations, we excluded the 3,059 very-small sherds and focused solely on the 4,502 sherds identifiable to a painted-ware or unpainted-type category. Excluding very-small sherds, the data set included 4,087 body sherds, 398 rims, 13 whole/reconstructible vessels, 3 clay bells, and 1 figurine. Approximately 71 percent of the ceramic artifacts (3,193 of 4,502 specimens) were from features assigned to the Middle Formative B period (see Table 39). Most of the others (n = 808, or 18 percent) were from contexts of indeterminate age. Small amounts of ceramic materials were recovered from features dated to the Middle Formative/Late Formative A period (n = 56, or 1.2 percent) and the Late Formative B period (n = 9); the remaining sherds were from features that could not be assigned a specific age designation. Based on changes in ceramic frequencies, the excavated portion of Locus C appeared to have been lightly occupied during the Middle Formative A period, heavily occupied during the Middle Formative B period, and very lightly occupied during the Late Formative period.

Painted Wares

Painted wares composed 31 percent of the Locus C collection. Tucson Basin brown wares accounted for 29 percent of painted wares and 9 percent of all ceramics (see Table 39)—slightly below the percentages over all loci (38 and 12 percent, respectively). More than half of the Tucson Basin brown wares were indeterminate red-on-brown sherds (58 percent). Excluding these indeterminate cases, the majority were Rincon phase types (80 percent), including Rincon Red-on-brown (73 percent), Rincon Black-on-brown (5 percent), and Rincon Polychrome (2 percent). The indeterminate Rillito or Rincon Red-on-brown split category composed another 14 percent. Low-frequency Tucson Basin red-on-brown types included Rillito Red-on-brown (n = 4), Tanque Verde Red-on-brown (n = 3), Cañada del Oro Red-on-brown (n = 1), and additional split categories of red-on-brown (n = 2). The predominance of the Rincon phase types underscores the mainly Middle Formative B period occupation of the locus. By the same token, the small amount of Cañada del Oro, Rillito, and Tanque Verde Red-on-brown suggests that the Middle Formative A and Late Formative period components were relatively minor.

Phoenix Basin buff wares from this locus composed about 12 percent of painted sherds and 3.5 percent of all ceramic artifacts—higher percentages than were recovered from the roughly contemporaneous Locus A collection (2 and 1 percent, respectively). Eighty percent of the Phoenix Basin buff ware sherds were composed of sherds for which specific types were not discernible. Among the identifiable types, about three-quarters were classified as Sacaton Red-on-buff, the Phoenix Basin equivalent of Rincon Red-on-brown. Pre-Sacaton types included one Sweetwater or Snaketown Red-on-gray sherd, two Gila Butte Red-on-buff sherds, one

Table 39. Counts and Percentages of Ceramic Artifacts, Locus C

Ware Category	Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late FormativeB Period		Middle Formative Period		Various—Ambiguous Age		Indeterminate Age		All Age Designations	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Unpainted wares																
Type I plain ware	1	1.4	22	0.70	—		—		—		—		3	0.40	26	0.60
Type II plain ware	57	82.6	1,667	52.20	42	75.0	7	77.8	81	64.8	196	81.0	524	65.10	2,574	57.20
Type III plain ware	7	10.1	225	7.00	1	1.8	—		13	10.4	10	4.1	82	10.20	338	7.50
Type IV plain ware	—		12	0.40	—		—		—		—		—		12	0.30
Type II red ware	—		142	4.40	—		—		—		—		19	2.40	161	3.60
Type III red ware	—		2	0.10	—		—		—		—		1	0.12	3	0.10
Type IV red ware	—		1	0.03	—		—		—		—		—		1	0.02
Subtotal	65	94.2	2,071	64.90	43	76.8	7	77.8	94	75.2	206	85.1	626	77.80	3,115	69.20
Tucson Basin Hohokam																
Cañada del Oro Red-on-brown	1	1.4	—		—		—		—		—		—		1	0.02
Cañada del Oro or Rillito Red-on-brown	—		—		—		—		—		—		1	0.1	1	0.02
Rillito Red-on-brown	—		—		—		—		—		—		4	0.5	4	0.10
Rillito or Rincon Red-on-brown	—		20	0.60	—		—		—		—		3	0.4	23	0.50
Rincon Red-on-brown	—		104	3.30	—		1	11.1	—		—		11	1.4	116	2.60
Rincon Black-on-brown	—		8	0.30	—		—		—		—		—		8	0.20
Rincon Polychrome	—		3	0.10	—		—		—		—		—		3	0.10
Rincon or Tanque Verde Red-on-brown	—		1	0.03	—		—		—		—		—		1	0.02
Tanque Verde Red-on-brown	—		3	0.10	—		—		—		—		—		3	0.10
Indeterminate Tucson Basin red-on-brown	—		180	5.60	3	5.4	—		9	7.2	4	1.7	35	4.3	231	5.10
Indeterminate Tucson Basin black-on-brown	—		5	0.20	—		—		—		—		—		5	0.10
Subtotal	1	1.4	324	10.10	3	5.4	1	11.1	9	7.2	4	1.7	54	6.7	396	8.80

Ware Category	Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late FormativeB Period		Middle Formative Period		Various—Ambiguous Age		Indeterminate Age		All Age Designations	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Phoenix Basin Hohokam																
Sweetwater or Snaketown Red-on-gray	—		1	0.03	—		—		—		—		—		1	0.02
Gila Butte Red-on-buff	—		—		—		—		—		—		2	0.2	2	0.04
Gila Butte or Santa Cruz Red-on-buff	—		—		—		—		—		—		1	0.1	1	0.02
Santa Cruz Red-on-buff	—		—		—		—		—		2	0.8	1	0.1	3	0.10
Santa Cruz or Sacaton Red-on-buff	—		—		—		—		—		—		1	0.1	1	0.02
Sacaton Red-on-buff	—		14	0.40	—		—		—		—		8	1.0	22	0.50
Indeterminate buff ware	—		94	2.90	5	8.9	—		3	2.4	—		27	3.4	129	2.90
Subtotal	—		109	3.40	5	8.9	—		3	2.4	2	0.8	40	5.0	159	3.50
Dragoon																
Dragoon Red-on-brown (broad line)	—		—		—		—		1	0.8	—		—		1	0.02
Dragoon Red-on-brown (fine line)	1	1.4	2	0.10	—		—		1	0.8	—		11	1.4	15	0.30
Dragoon Red-on-brown (elaborated)	—		100	3.10	—		—		—		—		9	1.1	109	2.40
Dragoon Red-on-brown (indeterminate)	—		24	0.80	1	1.8	1	11.1	—		2	0.8	1	0.1	29	0.60
Subtotal	1	1.4	126	3.90	1	1.8	1	11.1	2	1.6	2	0.8	21	2.6	154	3.40
San Simon																
Cerros Red-on-white	—		1	0.03	—		—		—		—		—		1	0.02
Encinas Red-on-brown	—		1	0.03	—		—		—		—		—		1	0.02
Indeterminate San Simon Red-on-brown	—		—		1	1.8	—		—		—		—		1	0.02
Subtotal	—		2	0.10	1	1.8	—		—		—		—		3	0.10
Low-frequency decorated types																
Trincheras Purple-on-red (specular)	—		—		—		—		—		—		2	0.2	2	0.04

continued on next page

Ware Category	Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late FormativeB Period		Middle Formative Period		Various—Ambiguous Age		Indeterminate Age		All Age Designations	
	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)	Count	(%)
Mimbres Black-on-white	—		3	0.10	—		—		—		—		—		3	0.10
Babocomari Bichrome (elaborated)	—		1	0.03	—		—		—		—		—		1	0.02
San Carlos Red-on-brown	—		2	0.10	—		—		—		—		—		2	0.04
Subtotal	—		6	0.20	—		—		—		—		2	0.2	8	0.20
Split categories and indeterminate types																
Tucson Basin or Dragoon Red-on-brown (elaborated)	—		10	0.30	1	1.8	—		2	1.6	—		4	0.5	17	0.40
Tucson Basin or Dragoon Red-on-brown (indeterminate)	—		64	2.00	—		—		3	2.4	—		3	0.4	70	1.60
Dragoon or San Simon Red-on-brown (fine)	—		1	0.03	—		—		—		—		—		1	0.02
Dragoon or San Simon Red-on-brown (indeterminate)	—		10	0.30	—		—		—		—		1	0.1	11	0.20
Indeterminate red-on-buff or red-on-brown	—		3	0.10	—		—		—		—		4	0.5	7	0.20
Red-on-brown (indeterminate)	2	2.9	465	14.60	2	3.6	—		12	9.6	26	10.7	50	6.2	557	12.40
Subtotal	2	2.9	553	17.30	3	5.4	—		17	13.6	26	10.7	62	7.7	663	14.70
Other ceramic artifacts																
Figurine	—		1	0.03	—		—		—		—		—		1	0.02
Clay bell	—		1	0.03	—		—		—		2	0.8	—		3	0.10
Subtotal	—		2	0.06	—		—		—		2	0.8	—		4	0.10
Total	69	100.0	3,193	100.00	56	100.0	9	100.0	125	100.0	242	100.0	805	100.0	4,502	100.00

Gila Butte or Santa Cruz Red-on-buff sherd, and three Santa Cruz Red-on-buff sherds. These types likely pertained to the Middle Formative A period component. One sherd was classified as Santa Cruz or Sacaton Red-on-buff.

Dragoon brown wares from this locus constituted 11 percent of painted sherds and 3.4 percent of all ceramics, which is roughly equal to the percentages of Phoenix Basin buff wares. Dragoon brown wares included specimens with broad-line (1 percent), fine-line (10 percent), elaborated (71 percent), and indeterminate (19 percent) decorative attributes (see Heckman 2000b). Excluding indeterminate cases, the majority had elaborated decoration (87 percent) and dated to the Middle Formative B and Late Formative periods. The fine-line and broad-line types probably related to the Middle Formative A period component.

Other identifiable decorated wares accounted for 0.2 percent of the painted sherds, including three San Simon painted sherds, three Mimbres Black-on-white sherds, two Trincheras Purple-on-red sherds, and one Babocomari Bichrome sherd with elaborated decoration. The dearth of the other painted-ware classes suggests that the inhabitants of Locus C established far-more-intense social and economic relationships with populations in the Tucson Basin, Phoenix Basin, and Dragoon areas than with populations in other areas of the greater Southwest.

In sum, compared to the roughly contemporary inhabitants of Locus A, the inhabitants of Locus C obtained and used proportionally fewer Tucson Basin painted wares and more Phoenix Basin and Dragoon painted wares. Excluding split and indeterminate categories, Tucson Basin, Phoenix Basin, and Dragoon painted sherds and vessels composed, respectively, 82, 5, and 12 percent of painted sherds in Locus A; in Locus C, they made up 55, 22, and 21 percent. Whereas the populace of Locus A mainly interacted with populations in the Tucson Basin, the Locus C population appeared to have maintained a more diversified set of economic and social relationships with populations in the Tucson Basin, Phoenix Basin, and Dragoon areas.

Unpainted Wares

Unpainted wares constituted 69 percent of the ceramic artifacts from Locus C, most of which were plain wares (95 percent); red wares constituted 5 percent of unpainted wares (see Table 39). This percentage of unpainted wares recovered in Locus C is about 10 percent lower than the percentage over the entire site collection (79 percent). Most frequent was Type II plain ware, which made up 83 percent of unpainted wares and 57 percent of all ceramic artifacts. Type III plain ware (micaceous paste) composed 11 percent of unpainted wares and 8 percent of all ceramic artifacts. Type I (26 sherds) and Type IV (12 sherds) plain ware were rare in the collection, and each accounted for less than 1 percent of unpainted types. All but 4 of the 165 red ware sherds had Type II pastes. Type III (3 sherds) and Type IV (1 sherd) red wares were rare.

The Middle Formative A period collection, although small (69 sherds), was almost completely composed of plain wares (94 percent). Only four painted sherds were recovered, including one fine-line Dragoon Red-on-brown sherd, one Cañada del Oro Red-on-brown sherd, and two indeterminate red-on-brown sherds. In contrast, more than one-third of the Middle Formative B period collection was composed of painted wares (35 percent). The Middle Formative B period collection included 30 percent fewer unpainted wares than the Middle Formative A period collection, suggesting a drastic change in pottery consumption and use. In the Middle Formative/Late Formative A period collection, the percentage of unpainted types again increased to 77 percent, suggesting yet another change in pottery consumption and use.

The type composition of the unpainted collection changed only slightly during this span. The Late Formative A period unpainted collection included 88 percent Type II plain wares and 11 percent Type III plain wares. No red wares were collected from Late Formative A period contexts. During the Middle Formative B period, the percentage of Type II plain wares declined slightly to 81 percent, and the percentage of Type III plain wares remained roughly the same (10.9 percent). The relatively low percentage of Type III sherds was surprising in light of the higher percentages (ca. 33–40 percent) in the roughly contemporaneous features in Locus A (see above and Deaver et al. 2010:4.11). For unknown reasons, the Middle Formative B period inhabitants in Locus C were less likely than the inhabitants in Locus A to use pottery with micaceous pastes. This frequency is more consistent with the relatively low frequencies of micaceous pottery recorded at sites assigned to this period in the Santa Rita Mountains (Deaver 1984:392–398).

The lower percentage of Type II plain wares probably does not suggest a change in provisioning practices but, rather, accommodates the addition of red wares to the unpainted collection, which composed about 8 percent of unpainted wares. Assuming that the unpainted types refer to specific production sources, these data suggest little change in plain-ware-pottery provisioning practices over a long span of time, from the Middle Formative A to Middle Formative B period. This is a marked contrast with the painted-pottery evidence, in which considerable changes were noted (see below). The Middle/Late Formative A period unpainted collection included no red wares, and virtually all plain wares (42 of 43) had Type II pastes.

Four nonvessel artifact types were recovered from Locus C, including one figurine fragment and three clay bells, one of which is shown in Figure 31. One of the clay bells included a Type III paste with a micaceous sheen. Another intact clay bell was well burnished and hollow and still possessed a loose rattle piece in the hollow area.

Figure 31. Top and side views of clay bell recovered from PD 7403 (Catalog No. 8755), Feature 3098, Locus C.

The figurine fragment was a humanoid effigy and likely was part of a larger vessel, possibly an appliqué.

Form and Functional Classes

General form classes were determined for 316 rims and 5 whole/reconstructible vessels. Table 40 lists the counts and percentages of forms per ware category for rims, excluding cases for which form class was indeterminate. The majority of forms were bowls (72 percent). Other forms included jars with necks (27 percent), neckless jars (0.6 percent), and scoops (0.3 percent). Overall, Locus C contained about 10 percent fewer bowls and 10 percent more jars than Locus A. Bowls outnumbered jars by 2.6 to 1 in Locus C, compared to 3.8 to 1 in Locus A. Locus A also had higher ratios of bowls to jars for painted and unpainted wares. Painted bowls from Locus C outnumbered jars by 8.3 to 1, slightly lower than the ratio of 9.1 to 1 in Locus A. The numbers of unpainted bowls and jars were roughly equal in Locus C (1.1 to 1).

The distribution of functional categories (subdivided by size class) is listed in Table 41. Functional classes were defined for 110 rims and whole/reconstructible vessels. About half were from features assigned to the Middle Formative B period (57 of 110 specimens), and most of remaining cases were from features of indeterminate age. As explained above, Locus C included a lower frequency of processing/serving vessels (58 percent) than Locus A (66 percent), and proportionally more than twice as many storage vessels (12 percent) and storage/transfer vessels (6 percent) than did Locus A (6 and 2 percent, respectively). The percentages of cooking/storage vessels were about the same for the two loci: 24 percent for Locus C and 26 percent for Locus A.

An insufficient number of form and functional classes were identified from Middle Formative A and Late Formative period contexts to permit a diachronic study of changes in vessel functions, but if we isolate the data from the Middle Formative B period features, the distribution of form and functional classes compares favorably to that of Locus A. The bowl-to-jar ratio for the Middle Formative B period component in Locus C was 3.9 to 1, which is about equal to the 3.8 to 1 ratio in Locus A. The bowl-to-jar ratios for painted and unpainted vessels from the Middle Formative B period features (8.1 to 1 and 1.8 to 1) also compare favorably to those of Locus A (8.1 to 1 and 1.4 to 1, respectively).

Among the detailed functional categories, the Middle Formative B period component in Locus C included 61 percent processing/serving vessels, slightly below the percentage from Locus A (66 percent). This component also included nearly three times as many storage vessels (16 percent) as in Locus A (6 percent). Moreover, the percentage of medium/large and large storage/serving vessels from Middle Formative B period features in Locus C was 3.5, compared to the much higher 23 percent in Locus A. Again, the percentages of cooking/storage vessels were about even: 23 in the Middle Formative B period component of Locus C and 26 in the Locus A collection. No storage/transfer vessels were recovered from the features assigned to the Middle Formative B period in Locus C.

Feature Ceramics

Ceramic materials were recovered from 17 structures and various extramural features. The tables below summarize the ceramic data collected from those features assigned to specific time periods; the ceramics from undated features are not listed.

Ceramic Distribution among Feature Types

As shown in Table 42, most of the ceramic artifacts collected from Locus C (82 percent) were excavated from structures, an average of about 298 per feature. Eleven percent were recovered from extramural pits of indeterminate function, which included 19 ceramics per feature, on average. About 3 percent were excavated from roasting pits, averaging roughly 14 ceramics per feature. One *horno* with 137 sherds accounted for 2 percent of the ceramic materials, and the two fire pits accounted for another 1 percent (30.5 sherds per feature).

We again analyzed proportions of very-small sherds and vessels to interpret patterns of depositional contexts for the various feature types (see Table 42). The percentage of very-small sherds varied from 32 to 55 percent among feature types. Generally, very-small sherds composed about half of the ceramics in fire pits (49 percent) and extramural nonthermal pits (55 percent) and a slightly lower percentage in the *horno* (40 percent), roasting pits (32 percent), and structures (37 percent). The accumulations of small sherds in the extramural nonthermal pits and fire pits may have related to frequent dumping, trampling, or thermal activity in the vicinities of these features. Perhaps the

Table 40. Counts and Percentages of General Form Classes, Locus C

Age Designation	Value	Painted			Unpainted					Total
		Bowl	Jar with Neck	Painted Total	Bowl	Jar with Neck	Neckless Jar	Scoop	Unpainted Total	
Middle Formative A period	count	—	—	—	—	3	—	—	3	3
	percent of ware category	—	—	—	—	100.0	—	—	100.0	
	percent of all wares	—	—	—	—	100.0	—	—	100.0	
Middle Formative B period	count	121	15	136	54	29	1	—	84	220
	percent of ware category	89.0	11.0	100.0	64.3	34.5	1.2	—	100.0	
	percent of all wares	55.0	6.8	61.8	24.5	13.2	0.5	—	38.2	
Middle /Late Formative A period	count	1	—	1	—	2	—	—	2	3
	percent of ware category	100.0	—	100.0	—	100.0	—	—	—	
	percent of all wares	33.0	—	33.0	—	—	—	—	—	
Late Formative B period	count	—	—	—	2	—	—	—	2	2
	percent of ware category	—	—	—	100.0	—	—	—	100.0	
	percent of all wares	—	—	—	100.0	—	—	—	100.0	
Middle Formative period	count	4	1	5	3	6	—	—	9	14
	percent of ware category	80.0	20.0	100.0	33.3	66.7	—	—	100.0	
	percent of all wares	28.6	7.1	35.7	21.4	42.9	—	—	64.3	
Post-A.D. 1	count	2	—	2	—	1	—	—	1	3
	percent of ware category	100.0	—	100.0	—	100.0	—	—	1000.0	
	percent of all wares	66.7	—	66.7	—	33.3	—	—	33.3	
Post-A.D. 500	count	2	—	2	4	5	1	—	10	12
	percent of ware category	100.0	—	100.0	40.0	50.0	10.0	—	100.0	
	percent of all wares	16.7	—	16.7	33.3	41.7	8.3	—	83.3	
Indeterminate age	count	19	2	21	16	21	—	1	38	59
	percent of ware category	90.5	9.5	100.0	42.1	55.3	—	2.6	100.0	
	percent of all wares	32.2	3.4	35.6	27.1	35.6	—	1.7	64.4	
All age designations	count	149	18	167	79	67	2	1	149	316
	percent of ware category	89.2	10.8	100.0	53.0	45.0	1.3	0.7	100.0	
	percent of all wares	47.2	5.7	52.8	25.0	21.2	0.6	0.3	47.2	

Table 41. Detailed Functional Categories, Locus C

Detailed Functional Category	Size Class	Middle Formative A Period		Middle Formative B Period		Middle Formative Period		Post-A.D. 1		Post-A.D. 500		Indeterminate Age		All Age Designations	
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Serving or processing vessels															
Serving/food processing without heat	large	—		2	3.5	—		—		—		—		2	1.8
	medium/large	—		8	14.0	—		—		1	20.0	2	4.8	11	10.0
	small	—		11	19.3	1	33.3	—		—		9	21.4	21	19.1
	small/medium	—		8	14.0	1	33.3	—		1	20.0	7	16.7	17	15.5
Food processing with or without heat/eating/serving	individual/small	—		1	1.8	—		—		—		—		1	0.9
Food processing without heat/dry cooking/serving/eating	small	—		1	1.8	—		—		—		3	7.1	4	3.6
	small/medium	—		3	5.3	—		—		—		3	7.1	6	5.5
Food processing without heat/eating/serving	individual	—		1	1.8	—		—		1	20.0	—		2	1.8
Subtotal		—		35	61.4	2	66.7	—		3	60.0	24	57.1	64	58.2
Storage vessels															
Liquid/dry storage	individual	—		4	7.0	—		—		—		—		4	3.6
Specialized dry storage		—		1	1.8	—		—		1	20.0	—		2	1.8
Short- or long-term dry storage	small	—		—		—		—		—		1	2.4	1	0.9
Short- or long-term liquid or dry storage	medium/large	—		2	3.5	—		—		—		—		2	1.8
Short- or long-term liquid storage	large	—		—		—		—		—		1	2.4	1	0.9
	medium/large	—		2	3.5	—		—		—		2	4.8	4	3.6
Subtotal		—		9	15.8	—		—		1	20.0	4	9.5	14	12.7
Storage or cooking vessels															

Detailed Functional Category	Size Class	Middle Formative A Period		Middle Formative B Period		Middle Formative Period		Post-A.D. 1		Post-A.D. 500		Indeterminate Age		All Age Designations	
		Count	%	Count	%	Count	%	Count	%	Count	%	Count	%	Count	%
Short- or long-term dry storage/cooking	small/medium	—		2	3.5	—		—		—		—		2	1.8
Short- or long-term liquid or dry storage/cooking	small/medium	—		—		—		1	100.0	—		—		1	0.9
Short-term liquid or dry storage/cooking	small	1	50.0	6	10.5	1	33.3	—		—		—		8	7.3
Short-term liquid storage/cooking	small	—		5	8.8	—		—		1	20.0	9	21.4	15	13.6
Subtotal		1	50.0	13	22.8	1	33.3	1	100.0	1	20.0	9	21.4	26	23.6
Storage or transfer vessels															
Liquid storage/carrier	individual	1	50.0	—		—		—		—		5	11.9	6	5.5
Subtotal		1	50.0	—		—		—		—		5	11.9	6	5.5
Total		2	100.0	57	100.0	3	100.0	1	100.0	5	100.0	42	100.0	110	100.0

Table 42. Summary Of Ceramic Artifacts, by Feature Type, Excluding Burials, Locus C

Feature Type	Ceramics (n)	Feature Ceramics (n)	Small Sherds (n)	Small Sherds (%)	Vessels (n)	Vessels (%)	Plain Ware (n)	Plain Ware[a] (%)	Red Ware (n)	Red Ware[a] (%)	Painted (n)	Painted[a] (%)
Structure	5,063	83.2	1,848	36.5	5	0.1	1,988	61.9	142	4.4	1,083	33.7
Roasting pit	165	2.7	52	31.5	—		86	76.1	4	3.5	23	20.4
Fire pit	61	1.0	30	49.2	—		14	45.2	1	3.2	16	51.6
Horno	137	2.3	55	40.1	—		54	65.9	—		28	34.1
Nonthermal extramural pit	657	10.8	361	54.9	—		236	79.7	4	1.4	56	18.9

[a] Very-small sherds excluded from calculations.

ceramic debris deposited in the *horno*, roasting pits, and structures was partially shielded from frequent postdepositional trampling (e.g., if the deposits were more deeply buried or removed from high-traffic activity areas).

With regard to the roasting pits (and possibly also the *horno*), the inhabitants of Locus C may have deliberately used larger sherds in connection with roasting or other thermal activities. Van Buren et al. (1992) and Garraty et al. (2010) observed higher proportions of large sherds in the vicinities of roasting pits than in other feature types. Van Buren et al. (1992) maintained that the sherds themselves were used as processing tools, although they were not able to infer their exact function. Many of the sherds they observed were burned, suggesting they may have been used directly in the roasting process, perhaps as scooping or shoveling tools to remove burned remnants from the smoldering pit. Large sherds also may have been used for processing flesh or pulp (e.g., removing sharp spines from xerophytic crops). Most of the sherds recovered from the roasting pit were relatively large and heavy, which would have been necessary for their users to avoid coming into contact with the burned remains and/or long cactus spines. A small number of smaller sherds, Van Buren et al. (1992) argued, were pieces broken off from larger sherds during use. We did not record sherd-size information and are unable to test this hypothesis, but it is plausible that this activity accounted for the generally low percentage of very-small sherds in roasting-pit features in Locus C.

We employed a Pearson's chi-square contingency-table analysis to analyze variability in ware composition among feature types (frequencies of plain wares, red wares, and painted wares) (Table 43). Again, because most ceramic materials were collected from structures, they more or less defined the marginal totals; therefore, the chi-square test essentially measured the proportional variability between structures and other feature types. The chi-square results indicated statistically significant variability in the distributions of ware classes among feature types ($\chi^2 = 58.30$, $df = 10$, $p < .001$), which may suggest variable depositional contexts and activities.

In contrast with the results from Locus A, the nonthermal extramural pits and roasting pits possessed higher frequencies of plain wares and lower frequencies of painted wares than expected, given the marginal totals. For Locus A, we speculated that the higher-than-expected frequencies of painted wares indicated deposition of feasting refuse in nonthermal extramural pits. In Locus C, the lower frequencies of painted wares suggest a different depositional context, one more likely related to mundane domestic activities. For whatever reason, only fire pits contained substantially higher-than-expected frequencies of painted wares.

The distribution of vessel forms among feature types is listed in Table 44. The low ratios of bowls to jars in roasting pits and extramural nonthermal pits (1 and 1.5 to 1, respectively) paralleled the low percentages of painted wares in these feature types, because most painted wares were bowls. For roasting features, this may suggest a preference for the use of larger and thicker jar sherds in connection with roasting activities (see above). With respect to extramural features in general, this pattern contrasts with that of Locus A, where bowls outnumbered jars by about 6 to 1. This may suggest that different items were discarded in the extramural nonthermal pits between Loci A and C; these pits may have been associated with different activities in the two loci, although the sample sizes of identified forms were small for these feature types.

Ceramic Distribution among Individual Features and Feature Types

Table 45 lists the counts and percentages of ceramics per feature by period designation, excluding features of indeterminate or ambiguous age (e.g., "post-A.D. 500" and like categories). Table 46 lists the counts and percentages per feature for painted wares only. We mainly focus our discussion here on the Middle Formative B period features, given the dearth of features dating to the Middle Formative A, Middle/Late Formative A, and Late Formative B periods.

Excluding three Middle Formative B period structures with fewer than 15 ceramics (Features 6095, 6153, and 7201), the plain ware percentages among structures (Features 379, 995, 6098, 6129, 6154, and 7129) ranged from 55 to 77 percent, with a mean of 63.9 percent and a standard deviation of 7.7 percent (see Table 45). The mean percentage of plain wares among structures was 5 percent greater than in Locus A, as was the standard deviation, suggesting more variability. The percentages of plain wares for all combined nonthermal extramural pits and roasting pits dating to the Middle Formative B period were 68 and 71 percent, respectively. (We did not calculate means and standard deviations among features because of the small sample sizes for these types.) Slightly higher percentages of plain wares were recovered from nonthermal extramural and roasting pits than from the structures. The percentages for these feature types fell within one standard deviation of the mean for structures, which suggests that the differences may be negligible.

As in Locus A, virtually all red wares (142 of 145) were recovered from structures. Red ware percentages per structure ranged from 1 to 7 percent, with a mean of 3.7 percent and a standard deviation of 2.3 percent. These are essentially equal to the mean and standard deviation of red wares from structures in Locus A, suggesting little difference in use of, or access to, red wares in the two loci. Many of the red wares may have been mixed in from later episodes of deposition during the Late Formative period, as a result of later deposition of broken pottery and other trash in abandoned-structure depressions.

Variation in painted frequencies among Middle Formative B period structures and other features was conspicuous, a pattern observed also in Locus A. For Tucson Basin brown wares, percentages per structure ranged from 1 to 19, with a mean of 8.5 percent and a standard deviation

Table 43. Contingency Table Showing Observed and Observed-Minus-Expected Percentages of Wares, by Feature Type, Locus C

Feature Type	Plain Wares				Red Wares				Painted Wares			
	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]
Structure	1,988	2,049.4	–61.4	–1.9	142	127.9	14.1	0.4	1,083	1,035.7	47.3	1.5
Roasting pit	86	72.1	13.9	12.3	4	4.5	–0.5	–0.4	23	36.4	–13.4	–11.9
Fire pit	14	19.8	–5.8	–18.6	1	1.2	–0.2	–0.8	16	10.0	6.0	19.4
Horno	54	52.3	1.7	2.1	0	3.3	–3.3	–4.0	28	26.4	1.6	1.9
Extramural nonthermal pit	236	188.8	47.2	15.9	4	11.8	–7.8	–2.6	56	95.4	–39.4	–13.3

Note: As noted in the text, these ceramics were recovered in the overlying fill of the burial features and were determined to be unassociated with the human remains. They likely were not interred as part of the mortuary events.

[a] Observed minus expected, divided by total count per feature type, times 100.

Table 44. General Form Classes, by Feature Type, Locus C

Feature Type	Bowls	Jars with Necks	Neckless Jars	Total	Bowl-to-Jar Ratio
Structure	164	51	1	216	3.2 to 1
Roasting pit	3	3	—	6	1 to 1
Fire pit	4	1	—	5	4 to 1
Horno	7	1	—	8	7 to 1
Extramural nonthermal pit	12	7	1	20	1.5 to 1

Table 45. Ceramic Artifacts by Age and Feature, Excluding Features of Indeterminate Age, Locus C

Feature	Feature Type	Plain Ware		Red Ware		Tucson Basin		Phoenix Basin		Dragoon		San Simon		Other Tradition		Indeterminate Painted		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
	Middle Formative A Period																	
6010	structure	65	94.2	—		1	1.4	—		1	1.4	—		—		2	2.9	69
	Middle Formative B Period																	
379[a]	structure	751	54.5	96	7.0	179	13.0	66	4.8	27	2.0	—		2	0.1	258	18.7	1,379
917	roasting pit	16	72.7	—		1	4.5	—		—		—		—		5	22.7	22
995[a]	structure	221	60.2	11	3.0	70	19.1	8	2.2	7	1.9	—		—		50	13.6	367
6095	structure	7	53.8	1	7.7	2	15.4	—		—		—		—		3	23.1	13
6098[a]	structure	198	61.9	11	3.4	31	9.7	8	2.5	39	12.2	—		1	0.3	32	10.0	320
6114	roasting pit	4	66.7	—		—		—		1	16.7	—		—		1	16.7	6
6129	structure	140	76.9	3	1.6	2	1.1	1	0.5	8	4.4	—		—		28	15.4	182
6146	fire pit	13	50.0	1	3.8	1	3.8	—		—		—		—		11	42.3	26
6148	nonthermal extramural pit	—		—		—		—		—		—		—		—		—
6153	structure	4	100.0	—		—		—		—		—		—		—		4
6154	structure	157	62.3	15	6.0	11	4.4	13	5.2	28	11.1	—		—		28	11.1	252
6162	cremation fill[b]	—		—		—		1	50.0	—		—		—		1	50.0	2
7145	nonthermal extramural pit	9	81.8	1	9.1	—		—		1	9.1	—		—		—	—	11
7153	*horno*	54	65.9	—		6	7.3	—		3	3.7	—		2	2.4	17	20.7	82
7170	inhumation fill[b]	9	52.9	—		1	5.9	—		1	5.9	—		—		6	35.3	17
7194	nonthermal extramural pit	4	44.4	—		1	11.1	—		—		1	11.1	—		3	33.3	9
7196	nonthermal extramural pit	25	73.5	1	2.9	—		—		—		—		1	2.9	7	20.6	34
7201	structure	1	100.0	—		—		—		—		—		—		—		1
7458	inhumation fill[b]	11	61.1	—		—		—		2	11.1	—		—		5	27.8	18
7461	structure	290	67.9	5	1.2	15	3.5	12	2.8	8	1.9	—		—		97	22.7	427
9327	nonthermal extramural pit	11	68.8	—		3	18.8	—		—		1	6.3	—		1	6.3	16
9328	nonthermal extramural pit	1	33.3	—		1	33.3	—		1	33.3	—		—		—		3
	Middle/Late Formative A Period																	
1141	fire pit	1	20.0	—		—		1	20.0	—		1	20.0	—		2	40.0	5
6085	roasting pit	5	83.3	—		—		1	16.7	—		—		—		—		6

Feature	Feature Type	Plain Ware		Red Ware		Tucson Basin		Phoenix Basin		Dragoon		San Simon		Other Tradition		Indeterminate Painted		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
6087	nonthermal extramural pit	18	78.3	—		3	13.0	1	4.3	1	4.3	—		—		—		23
6134	nonthermal extramural pit	2	50.0	—		—		1	25.0	—		—		—		1	25.0	4
7163	roasting pit	17	94.4	—		—		1	5.6	—		—		—		—		18
	Late Formative B Period																	
235	structure	7	77.8	—		1	11.1	—		1	11.1	—		—		—		9

Note: Excludes very-small sherds.

[a] Recessed-hearth structures.

[b] As noted in the text, these ceramics were recovered in the overlying fill of the burial features and were determined to be unassociated with the human remains.

Table 46. Painted Ware, by Age and Feature, Locus C

Feature No.	Feature Type	Tucson Basin		Phoenix Basin		Dragoon		San Simon		Other Tradition		Indeterminate Painted		Total
		n	Row %	n	Row %	n	Row %	n	Row %	n	Row %	n	Row %	
	Middle Formative A Period													
6010	structure	1	25.0	—		1	25.0	—		—		2	50.0	4
	Middle Formative B Period													
379	structure	179	33.6	66	12.4	27	5.1	—		2	0.4	258	48.5	532
917	roasting pit	1	16.7	—		—		—		—		5	83.3	6
995	structure	70	51.9	8	5.9	7	5.2	—		—		50	37.0	135
6095	structure	2	40.0	—		—		—		—		3	60.0	5
6098	structure	31	27.9	8	7.2	39	35.1	—		1	0.9	32	28.8	111
6114	roasting pit	—		—		1	50.0	—		—		1	50.0	2
6129	structure	2	5.1	1	2.6	8	20.5	—		—		28	71.8	39
6146	fire pit	1	8.3	—		—		—		—		11	91.7	12
6154	structure	11	13.8	13	16.3	28	35.0	—		—		28	35.0	80
6162	cremation fill[a]	—		1	50.0	—		—		—		1	50.0	2
7145	nonthermal extramural pit	—		—		1	100.0	—		—		—		1
7153	*horno*	6	21.4	—		3	10.7	—		2	7.1	17	60.7	28
7170	inhumation fill[a]	1	12.5	—		1	12.5	—		—		6	75.0	8
7194	nonthermal extramural pit	1	20.0	—		—		1	20.0	—		3	60.0	5
7196	nonthermal extramural pit	—		—		—		—		1	12.5	7	87.5	8
7458	inhumation fill[a]	—		—		2	28.6	—		—		5	71.4	7
7461	structure	15	11.4	12	9.1	8	6.1	—		—		97	73.5	132
9327	nonthermal extramural pit	3	60.0	—		—		1	20.0	—		1	20.0	5
9328	nonthermal extramural pit	1	50.0	—		1	50.0	—		—		—		2
	Middle/Late Formative A Period													
1141	fire pit	—		1	25.0	—		1	25.0	—		2	50.0	4
6085	roasting pit	—		1	100.0	—		—		—		—		1
6087	nonthermal extramural pit	3	60.0	1	20.0	1	20.0	—		—		—		5
6134	nonthermal extramural pit	—		1	50.0	—		—		—		1	50.0	2
7163	roasting pit	—		1	100.0	—		—		—		—		1
	Late Formative B Period													
235	structure	1	50.0			1	50.0	—		—		—		2

[a] As noted in the text, these ceramics were recovered in the overlying fill of the burial features and were determined to be unassociated with the human remains.

of 6.8 percent (see Table 45). These percentages were slightly lower than the Tucson Basin brown ware percentages from structures in Locus A (mean of 22 percent). Excluding unpainted sherds, percentages of Tucson Basin brown wares among structures ranged from 5 to 52 percent, with a mean of 23.9 percent and a standard deviation of 17.3 percent (see Table 46). In Locus A, by contrast, the range was from 45 to 91 percent, with a mean of 61.8 percent. So, the Middle Formative B period structures in Locus A included, on average, roughly twice the frequency of Tucson Basin brown wares in Locus C. Given that most of the features in Loci A and C were roughly coeval (see Chapter 2, this volume), this variability is probably indicative of different exchange and consumption patterns among inhabitants of these loci.

The percentages of Phoenix Basin buff wares ranged from 0.5 to 5 among Middle Formative B period structures, with a mean of 3 percent and a standard deviation of 1.7 percent (see Table 45). They composed between 3 and 16 percent of painted wares, with a mean of 9 percent. These results also contrast with percentages from Locus A, in which Phoenix Basin types accounted for less than 3 percent of painted wares and composed no more than 6 percent of painted wares in any structure. For whatever reason, the Middle Formative B period inhabitants of Locus C more frequently procured and used Phoenix Basin buff ware pottery than did the inhabitants of Locus A. Above, we determined that a higher percentage of Phoenix Basin buff ware ceramics were recovered from extramural pits than from structures in Locus A. In this light, it is worth noting that no Phoenix Basin buff wares were recovered from nonthermal extramural pits in Locus C. Here again, we suspect that these differences reflect different consumption and nonlocal exchange relationships among roughly contemporaneous groups residing in Loci A and C.

Dragoon brown wares constituted between 2 and 12 percent of ceramics from Middle Formative B period structures in Locus C, with a mean of 5.6 percent and a standard deviation of 4.8 percent (see Table 45). Excluding unpainted ceramics, Dragoon brown wares composed between 5 and 35 percent of all painted wares, with a mean of 18 percent and a standard deviation of 14.6 percent, which roughly doubles the percentage in Locus A (7 percent). Again, the Middle Formative B period inhabitants of Locus C procured and used a higher proportion of Dragoon brown ware pottery than did the inhabitants of Locus A. In both loci, Dragoon brown wares slightly outnumbered Phoenix Basin buff wares.

In all, among the six structures assigned to the Middle Formative B period, Tucson Basin brown wares outnumbered Phoenix Basin and Dragoon painted wares by about 2.9 to 1 and 2.6 to 1, respectively. Dragoon brown wares only slightly outnumbered Phoenix Basin buff wares (1.1 to 1). In Locus A, by contrast, among seven structures, Tucson Basin–style painted wares outnumbered Phoenix Basin buff wares and Dragoon brown wares by much larger margins of 23 to 1 and 7 to 1, respectively, and Dragoon brown wares outnumbered Phoenix Basin types by 3.4 to 1. If these structures were inhabited concurrently, we might conclude that the inhabitants of the two loci maintained separate and distinct interregional social and economic connections or established different cultural relationships with populations in other regions of southeastern Arizona.

San Simon brown wares and other low-frequency painted wares were poorly represented in the Middle Formative B period collections in Loci A and C. No San Simon brown wares were recovered from Middle Formative B period structures in Locus C, and only three were recovered from any well-dated features (i.e., excluding features with indeterminate or ambiguous dates). Similarly, only four sherds were recovered in Locus A. One Mimbres Black-on-white sherd was recovered from Feature 6098, a structure in Locus C, and two San Carlos Red-on-brown sherds were recovered from structure Feature 379 in Locus C. One Babocomari Bichrome sherd was recovered from a Middle Formative B period *horno* in Locus C.

Table 47 lists the form classes per feature from Locus C, again excluding features of indeterminate or ambiguous age. The overall sample size of identifiable forms was small for most features, but five of seven Middle Formative B period structures included at least 20 identifiable form classes (Features 379, 995, 6098, 6154, and 7461). A bimodal pattern was evident among these structures: the bowl-to-jar ratios for three structures (Features 379, 995, and 6154) ranged from 6.6 to 8.7 to 1. For two others (Features 6098 and 7461, which intersect spatially), the ratios were 2.3 and 1.0 to 1, respectively. Both modal groups included at least 1 RHS: Features 379 and 995 in the high-ratio group and Feature 6098 in the low-ratio group).

Over all structures, the ratio was 3.9 bowls to 1 jar, which is about equal to the ratio of 3.6 to 1 for structures in Locus A. The ratio over all nonthermal extramural and roasting pits (combined) was roughly the same as for the structures (3.5 to 1). For the *horno* and fire pit (combined), the ratio was 10 to 1, which may indicate functional differences among these feature types; bowls may have been used more frequently in association with the activities performed at or near these features. Perhaps the bowls were used as cooking utensils.

Modified Sherds

A total of 22 recycled sherds were recovered, which amounts to only 0.3 recycled sherds per 100 ceramic artifacts (Table 48). This frequency is roughly equal to the 0.4 recycled sherds per 100 ceramics in Locus A. Most of the recycled sherds were sherd disks, several of which were perforated. Twenty of the 22 recycled sherds were recovered from eight structures; 2 others were recovered from an indeterminate extramural pit and a nonfeature context.

Table 47. Form Classes, by Age and Feature, Locus C

Feature No.	Feature Type	Bowl	Jar with Neck	Neckless Jar	Total	Bowl-to-Jar Ratio
	Middle Formative A Period					
6010	structure	—	3	—	3	0 to 3
	Middle Formative B Period					
379	structure	66	10	—	76	6.6 to 1
917	roasting pit	1	—	—	1	
995	structure	26	2	1	29	8.7 to 1
6095	structure	—	1	—	1	0 to 1
6098	structure	21	9	—	30	2.3 to 1
6129	structure	6	3	—	9	2 to 1
6146	fire pit	3	—	—	3	3 to 0
6154	structure	23	3	—	26	7.7 to 1
6162	cremation fill[a]	—	1	—	1	0 to 1
7145	nonthermal extramural pit	2	1	—	3	2 to 1
7153	*horno*	7	1	—	8	7 to 1
7170	inhumation fill[a]	2	1	—	3	2 to 1
7194	nonthermal extramural pit	—	1	—	1	0 to 1
7196	nonthermal extramural pit	3	—	—	3	3 to 0
7458	inhumation fill[a]	3	—	—	3	3 to 0
7461	structure	11	11	—	22	1 to 1
9327	nonthermal extramural pit	1	—	—	1	1 to 0
	Middle/Late Formative A Period					
1141	fire pit	1	1	—	2	1 to 1
6087	nonthermal extramural pit	—	1	—	1	0 to 1
	Late Formative B Period					
235	structure	2	—	—	2	2 to 0

[a] As noted in the text, these ceramics were recovered in the overlying fill of the burial features and were determined to be unassociated with the human remains.

Table 48. Modified-Sherd Frequencies, by Age and Feature, Locus C

Feature No.	Feature Type	Recycled (n)	Total	Recycled, per 100 Sherds (n)
	Middle Formative B Period			
379	structure	7	2,228	0.31
995	structure	6	533	1.13
6095	structure	1	20	5.00
6098	structure	1	497	0.20
6129	structure	1	305	0.33
6154	structure	1	398	0.25
7461	structure	1	680	0.15
	Post-A.D. 500			
6171	extramural nonthermal pit	1	135	0.74
	Indeterminate Age			
609	structure	2	76	2.63
	nonfeature	1		
Total		22	7,561	0.29

The number of recycled sherds per 100 ceramic artifacts varied from 0.15 to 5 among the structures. Excluding two structures with ceramic counts below 100, the range was only from 0.15 to 1.1, and all but one had less than 0.3 per 100 artifacts. (Inclusion of features with total counts below 100 artificially inflates the frequency because of their having only 1 or 2 recycled sherds per 100 ceramics.) Feature 995 stood out in having 1.1 recycled sherds per 100 ceramics, which is more than three times the next-highest frequency (0.3, in Feature 6129). Even so, 6 recycled sherds is not an anomalously large count relative to the other features, most of which included only 1 or 2 recycled sherds. This frequency distribution could be attributable to sampling error or stochastic variation.

Locus D

Locus D was the principal focus of SRI's Phase 2 investigations at the Mescal Wash site (Vanderpot 2001; Vanderpot and Altschul 2000:18–19, 2007; see Chapter 7, Volume 1). This locus covered an area of 350 by 200 m along a terrace on the north side of Cienega Creek. More than half of the locus was included in the ROW for the current project, although much of its surface had been disturbed by modern and historical-period railroad and road construction. The excavated area of Locus D was inhabited over a long span, from the Late Archaic period through the Late Formative period, and contained a higher number and density of features and artifacts than did either Loci A or C. Many features were superimposed over preexisting features, forming dense conglomerates. This pattern of superimposition implies that Locus D was a preferred location for recurrent habitation (Vanderpot 2001:6).

Locus D was most intensively occupied during the Middle Formative A period, although two RHS structures in Locus D were assigned to the Middle Formative B period, and several additional features were assigned to the Early Formative (n = 5) and Late Formative B (n = 4) periods. Lengyel's AM study suggested that most the of the features were used and abandoned between about A.D. 700 and 900, suggesting a probably continuous span of occupation throughout the Middle Formative A period. She identified seven occupational episodes for Locus D encompassing the Middle Formative A period and early portion of the Middle Formative B period. The main occupation in Locus D predated the main occupations in Loci A and C, although Lengyel's later occupational episodes (Episodes 5–7) may have been coeval with the residential features in Loci A and C.

Nearly 300 features were partially or completely excavated in Locus D, including structures, nonthermal pits, thermal pits (mostly roasting pits), caches, middens, and human burials. A total of 41,082 ceramic artifacts were recovered during Phase 2, nearly half of which (21,234 sherds) were very-small sherds for which ware or type was unidentifiable (Table 49). We concentrated on the 19,848 ceramic artifacts for which ware class was identifiable. Excluding very-small sherds, the locus collection included 17,813 body sherds, 1,981 rims, 6 handle fragments, 41 whole/reconstructible vessels, 3 figurine fragments, and 4 indeterminate ceramic artifacts.

Slightly less than half of the ceramics recovered from Locus D (9,342 of 19,848 specimens, or 48 percent) were from features assigned to the Middle Formative A period (see Table 49). Fourteen percent (2,652 specimens) were assigned to features dated to the Late Formative B period. Smaller amounts of ceramic materials were collected from features dated to the Early Formative period (81 specimens, or 0.4 percent), the Middle Formative B period (444 specimens, or 2.3 percent), and the Middle Formative/Late Formative A period (51 specimens, or 0.2 percent). Yet another 14 percent (2,730 specimens) were assigned to the more broadly defined Middle Formative period. The remainders of the ceramic artifacts were from contexts of ambiguous age.

If we calculate these percentages without features of indeterminate age, 0.6 percent of ceramics were from Early Formative period features, 74 percent were from Middle Formative A period features, 4 percent were from Middle Formative B period features, 0.4 percent were from Middle Formative/Late Formative A period features, and 21 percent were from Late Formative B period features. It is inadvisable to directly correlate pottery percentages with occupational intensities, given the variability in the levels of effort devoted to different features. Nonetheless, these data suggest considerably more-intensive occupations during the Middle Formative B period and, to a lesser extent, the Late Formative B period, with sparser occupations during the Early Formative, Middle Formative B, and Middle Formative/Late Formative A periods.

Painted Wares

Table 49 lists the percentages of painted-ware classes per period in Locus D. As explained above, only 16 percent of the Locus D collection was composed of painted wares, which is substantially lower than the percentages in Loci A and C.

The majority were Tucson Basin brown wares, which accounted for 36 percent of painted sherds and 6 percent of all ceramics (see Table 49). As a percentage of all painted wares, Locus D included a higher frequency of Tucson Basin brown wares than Locus C (29 percent) and a lower frequency than Locus A (54 percent). Sixty percent were indeterminate red-on-brown sherds. Excluding these indeterminate cases, the majority were Rillito Red-on-brown (25 percent) and the less-distinctive Cañada del Oro or Rillito Red-on-brown (35 percent), underscoring the primarily Middle Formative A period occupation of the locus. Importantly, the percentage of Rillito Red-on-brown was

Table 49. Counts and Percentages of Ceramic Artifacts, Locus D

Ware Category	Early Formative Period		Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late Formative B Period		Early/ Middle Formative Period		Middle Formative Period		Various—Ambiguous Age		Indeterminate Age		All Age Designations	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Unpainted wares																				
Type I plain ware	—		102	1.1	1	0.2	—		2	0.1	2	0.3	17	0.6	5	0.4	6	0.2	135	0.7
Type II plain ware	65	80.2	5,466	58.5	268	60.4	23	45.1	1,840	69.4	529	73.2	1,549	56.7	840	67.7	1,753	67.8	12,333	62.1
Type III plain ware	9	11.1	1,959	21.0	62	14.0	19	37.3	361	13.6	148	20.5	503	18.4	248	20.0	432	16.7	3,741	18.8
Type IV plain ware	—		48	0.5	1	0.2	—		7	0.3	—		11	0.4	1	0.1	7	0.3	75	0.4
Type I red ware	—		—		1	0.2	—		—		—		2	0.1	—		—		3	0.02
Type II red ware	2	2.5	121	1.3	5	1.1	3	5.9	138	5.2	11	1.5	46	1.7	16	1.3	24	0.9	366	1.8
Type III red ware	—		11	0.1	—		1	2.0	2	0.1	—		—		—		1	0.04	15	0.1
Brown corrugated	—		1	0.01	—		—		—		—		—		—		1	0.04	2	0.01
Subtotal	76	93.8	7,708	82.5	338	76.1	46	90.2	2,350	88.6	690	95.4	2128	77.9	1,110	89.5	2,224	86.0	16,670	84.
Tucson Basin Hohokam																				
Indeterminate Pioneer or Colonial Red-on-brown	—		2	0.02	—		—		—		—		—		—		—		2	0.01
Snaketown-style Red-on-brown	—		3	0.03	—		—		—		—		—		—		—		3	0.02
Cañada del Oro Red-on-brown	—		12	0.1	1	0.2	—		5	0.2	3	0.4	5	0.2	2	0.2	5	0.2	33	0.2
Cañada del Oro or Rillito Red-on-brown	—		94	1.0	4	0.9	—		19	0.7	—		25	0.9	4	0.3	11	0.4	157	0.8
Rillito Red-on-brown	—		53	0.6	—		—		7	0.3	—		24	0.9	7	0.6	24	0.9	115	0.6
Rillito or Rincon Red-on-brown	—		46	0.5	—		—		4	0.2	—		30	1.1	1	0.1	5	0.2	86	0.4
Rincon Red-on-brown	—		7	0.1	16	3.6	—		2	0.1	—		7	0.3	—		6	0.2	38	0.2
Rincon Black-on-brown	—		—		—		—		—		—		1	0.04	—		1	0.04	2	0.01
Rincon or Tanque Verde Red-on-brown	—		—		—		—		2	0.1	—		—		—		—		2	0.01

Ware Category	Early Formative Period		Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late Formative B Period		Early/ Middle Formative Period		Middle Formative Period		Various— Ambiguous Age		Indeterminate Age		All Age D esignations	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Tanque Verde Red-on-brown	—		—		—		—		14	0.5	—		—		—		2	0.1	16	0.1
Indeterminate Tucson Basin red-on-brown	—		346	3.7	23	5.2	1	2.0	58	2.2	3	0.4	158	5.8	29	2.3	58	2.2	676	3.4
Indeterminate Tucson Basin black-on-brown	—		—		—		—		—		—		—		1	0.1	—		1	
Subtotal	—		563	6.0	44	9.9	1	2.0	111	4.2	6	0.8	250	9.2	44	3.5	112	4.3	1,131	5.7
Phoenix Basin Hohokam																				
Sweetwater Red-on-gray	—		—		1	0.2	—		—		1	0.1	—		—		—		2	0.01
Sweetwater or Snaketown Red-on-gray	—		1	0.01	—		—		—		—		1	0.04	—		—		2	0.01
Snaketown Red-on-buff	1	1.2	6	0.1	—		—		—		—		—		—		2	0.1	9	0.05
Snaketown or Gila Butte Red-on-buff	—		9	0.1	—		—		—		—		—		—		—		9	0.05
Gila Butte Red-on-buff	—		19	0.2	—		—		—		1	0.1	2	0.1	1	0.1	5	0.2	28	0.1
Gila Butte or Santa Cruz Red-on-buff	—		23	0.2	3	0.7	2	3.9	1	0.04	—		4	0.1	2	0.2	3	0.1	38	0.2
Santa Cruz Red-on-buff	—		41	0.4	1	0.2	1	2.0	—		1	0.1	26	1.0	3	0.2	10	0.4	83	0.4
Santa Cruz or Sacaton Red-on-buff	—		12	0.1	—		—		1	0.04	—		9	0.3	1	0.1	3	0.1	26	0.1
Sacaton Red-on-buff	—		7	0.1	1	0.2	—		—		1	0.1	—		—		3	0.1	12	0.1
Indeterminate buff ware	—		291	3.1	9	2.0	1	2.0	15	0.6	8	1.1	83	3.0	23	1.9	79	3.1	509	2.6
Subtotal	1	1.2	409	4.4	15	3.4	4	7.8	17	0.6	12	1.7	125	4.6	30	2.4	105	4.1	718	3.6
Dragoon																				
Dragoon Red-on-brown (broad line)	—		6	0.1	1	0.2	—		—		—		5	0.2	4		—		16	0.1
Dragoon Red-on-brown (fine line)	—		15	0.2	1	0.2	—		—		—		2	0.1	—		1	0.04	19	0.1

continued on next page

Ware Category	Early Formative Period		Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late Formative B Period		Early/ Middle Formative Period		Middle Formative Period		Various—Ambiguous Age		Indeterminate Age		All Age D esignations	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Dragoon Red-on-brown (elaborated)	—		14	0.1	1	0.2	—		—		1	0.1	7	0.3	4	0.3	8	0.3	35	0.2
Dragoon Red-on-brown (indeterminate)	—		50	0.5	1	0.2	—		2	0.1	—		47	1.7	4	0.3	8	0.3	112	0.6
Subtotal	—		85	0.9	4	0.9	—		2	0.1	1	0.1	61	2.2	12	1.0	17	0.7	182	0.9
San Simon																				
Dos Cabezas Red-on-brown	—		4	0.04	—		—		—		—		—		2	0.2	—		6	0.03
Dos Cabezas or Pinaleno Red-on-brown	—		3	0.03	—		—		—		—		—		—		—		3	0.02
Pinaleno or Galiuro Red-on-brown	—		—		—		—		—		—		—		—		1	0.04	1	0.01
Galiuro Red-on-brown	—		42	0.4	—		—		—		—		26	1.0	6	0.5	3	0.1	77	0.4
Cerros Red-on-white	—				—		—		—		—		5	0.2	—		—		5	0.03
Indeterminate San Simon red-on-brown	—		8	0.1	—		—		—		—		14	0.5	1	0.1	3	0.1	26	0.1
Subtotal	—		57	0.6	—		—		—		—		45	1.6	9	0.7	7	0.3	118	0.6
Roosevelt Red Ware																				
Gila Polychrome	—		1	0.01	—		—		16	0.6	—		—	—	3	0.2	3	0.1	23	0.1
Tonto Polychrome	—		—		—		—		3	0.1	—		—		—		—		3	0.02
Gila or Tonto Polychrome	—		4	0.04	—		—		53	2.0	1	0.1	4	0.1	—		—		62	0.3
Indeterminate Roosevelt Red Ware	—		2	0.02	—		—		29	1.1	—		—		—		—		31	0.2
Subtotal	—		7	0.1	—		—		101	3.8	1	0.1	4	0.1	3	0.2	3	0.1	119	0.6
Low-frequency decorated types																				
Trincheras Purple-on-red (nonspecular)	—		1	0.01	—		—		—		—		1	0.04	—		—		2	0.01
Trincheras Purple-on-red (specular)	—		5	0.1	—		—		—		—		4	0.1	—		2	0.1	11	0.1

Ware Category	Early Formative Period		Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late Formative B Period		Early/ Middle Formative Period		Middle Formative Period		Various— Ambiguous Age		Indeterminate Age		All Age D esignations	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Nogales Polychrome	—		2	0.0	—		—		—		—		2	0.1	—		—		4	0.02
Mimbres Black-on-white	1	1.2	—		—		—		—		—		—		—		—		1	0.01
Subtotal	1	1.2	8	0.1	—		—		—		—		7	0.3	—		2	0.1	18	0.1
Split categories and indeterminate types																				
Gila Butte Red/Buff or Cañada del Oro Red/Brown	—		6	0.1	—		—		1	0.04	—		2	0.1	—		—		9	0.05
Snaketown Red-on-buff or Red-on-brown	—		2	0.0	—		—		—		—		—		—		1	0.04	3	0.02
Tucson Basin or Dragoon red-on-brown (fine)	—		—		1	0.2	—		1	0.04	—		—		—		—		2	0.01
Tucson Basin or Dragoon red-on-brown (elaborated)	—		14	0.1	1	0.2	—		—		—		2	0.1	—		3	0.1	20	0.1
Tucson Basin or Dragoon red-on-brown (indeterminate)	—		44	0.5	7	1.6	—		—		—		17	0.6	1		13	0.5	82	0.4
Dragoon or San Simon red-on-brown (fine)	—		30	0.3	—		—		—		—		15	0.5	4		7	0.3	56	0.3
Dragoon or San Simon red-on-brown (indeterminate)	—		89	1.0	3	0.7	—		9	0.3	—		27	1.0	6		10	0.4	144	0.7
Red-on-brown (indeterminate)	3	3.7	277	3.0	29	6.5	—		57	2.1	13	1.8	38	1.4	21		74	2.9	512	2.6
Indeterminate red-on-buff or red-on-brown	—		38	0.4	—		—		3	0.1	—		9	0.3	—		7	0.3	57	0.3
Subtotal	3	3.7	500	5.4	41	9.2	—		71	2.7	13	1.8	110	4.0	32		115	4.4	885	4.5

continued on next page

Ware Category	Early Formative Period		Middle Formative A Period		Middle Formative B Period		Middle/Late Formative A Period		Late Formative B Period		Early/ Middle Formative Period		Middle Formative Period		Various— Ambiguous Age		Indeterminate Age		All Age D esignations	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Other ceramic artifacts																				
Figurine	—		3	0.03	—		—		—		—		—		—		—		3	0.02
Indeterminate modeled artifact	—		2	0.02	2	0.5	—		—		—		—		—		—		4	0.02
Subtotal	—		5	0.1	—		—		2	0.1	—		—		—		—		7	0.04
Total	81	100.0	9,342	100.0	444	100.0	51	100.0	2,652	100.0	723	100.0	2,730	100.0	1,240	100.0	2,585	100.0	19,848	100.0

five times greater than the percentage of Cañada del Oro Red-on-brown (7), suggesting that the locus was mainly occupied during the latter half of the Middle Formative A period, ca. A.D. 850–950. Together with Lengyel's argument for peak occupation between A.D. 700 and 900, the prevalence of Rillito Red-on-brown may be inferred to suggest a narrower span of A.D. 850–900. On the whole, these data suggest peak occupation in Locus D from about A.D. 800 or 825 to 900. Rincon phase types composed about 9 percent of the identifiable Tucson Basin–style painted sherds, and another 19 percent were indeterminate Rillito or Rincon types.

One Late Formative period type, Tanque Verde Red-on-brown, accounted for less than 4 percent of the identifiable Tucson Basin–style types from Locus D. This type was most intensively used during the Late Formative A period, which suggests at least sparse or ephemeral occupation in Locus D during this period.

Phoenix Basin buff wares composed 23 percent of the painted ceramics and 3.6 percent of all ceramics from Locus D—about twice the percentage of painted specimens from Locus C (12) and almost eight times the percentage from Locus A (3). A higher percentage of Phoenix Basin buff wares is characteristic of the Middle Formative A period occupation in Locus D; roughly one-quarter of painted ceramics for this component were buff wares (409 of 1,629 specimens). In features assigned to the Middle Formative B period, the frequency declined to 14 percent (15 of 106 specimens)—still higher than the percentages in Locus A (2 percent) and Locus C (10 percent). These results suggest that social and economic connections with populations in the Phoenix Basin peaked during the Middle Formative A period (Colonial period in the Phoenix Basin sequence).

Unfortunately, the majority of Phoenix Basin buff wares from Locus D could not be assigned to a specific type (71 percent). About two-thirds of identifiable types were classified as Santa Cruz Red-on-buff (40 percent) or the visually less-distinct Gila Butte or Santa Cruz Red-on-buff (18 percent). Santa Cruz Red-on-buff is the Phoenix Basin equivalent of Rillito Red-on-brown in the Tucson Basin, and both were mainly used during the Middle Formative A period. This prevalence of Santa Cruz Red-on-buff reinforces that the main occupation of Locus D occurred during the latter half of the Middle Formative A period. Most of the pre–Santa Cruz types were Gila Butte Red-on-buff (13 percent of Phoenix Basin types, excluding indeterminate buff ware), dating to the first half of the Middle Formative A period. A small number of earlier Sweetwater and Snaketown phase buff wares also were recovered. The Middle Formative B period type, Sacaton Red-on-buff—the most frequent Phoenix Basin type in Loci A and C—accounted for only 6 percent of identifiable Phoenix Basin buff ware types in Locus D.

Dragoon brown wares constituted 6 percent of painted types and 1 percent of all ceramics, a significantly lower percentage than in Loci A and C (11 percent in both loci). In this case, the difference cannot be attributed to period of occupation. For the Middle Formative A period, Dragoon brown wares composed 5 percent of all painted wares, but that percentage declined to 3.9 percent in the Middle Formative B period. The low percentage of Dragoon brown wares persisted throughout the occupation sequence of Locus D. During the Middle Formative B period, for example, the percentage of Dragoon brown wares (4 percent, relative to all painted ceramics) was less than half the percentages in Locus C (11 percent) and Locus A (8 percent). This result underscores the difference in patterns of exchange, interaction, or affiliation among roughly contemporaneous occupations in the three loci.

San Simon brown wares accounted for 4 percent of painted wares and 0.6 percent of all ceramics, which also is substantially different from Loci A and C. In the latter loci, San Simon–style painted wares accounted for less than 1 percent of painted wares. Notably, excluding the sherds recovered from contexts of ambiguous and indeterminate age, *all* of the San Simon brown wares were from Middle Formative A period features. Interaction and exchange with populations in the San Simon region appears to have peaked during this period. Excluding indeterminate cases, the majority of San Simon bichromes were Galiuro Red-on-brown (84 percent). The approximate date range of A.D. 700–950 for Galiuro Red-on-brown (see Heckman 2000c) encompasses the latter half of the Middle Formative A period. A small number of low-frequency San Simon types recovered in Locus A predated or postdated this time span.

Most of the Roosevelt Red Ware sherds from the project area were recovered from Locus D and relate to the Late Formative B period occupation in the locus (ca. A.D. 1100–1450). Roosevelt Red Ware composed about 4 percent of painted types and 0.6 percent of all ceramic artifacts. Excluding the indeterminate categories, the overwhelming majority in Locus D was Gila Polychrome (23 of 26); only three Tonto Polychrome sherds were recovered. Clark and Lyons (2003) similarly found that Gila Polychrome composed the majority of identifiable Roosevelt Red Ware sherds at Late Formative period sites along the San Pedro River.

Other identifiable decorated wares accounted for only 18 sherds, composing 0.6 percent of the painted wares and less than 0.1 percent of all ceramics from Locus D. Seventeen of the 18 sherds were associated with the Trincheras tradition; 1 other was a Mimbres Black-on-white sherd. Excluding the features of ambiguous or indeterminate age, most of the low-frequency painted types were from Middle Formative A period features. Mimbres- and Trincheras-style ceramics likely entered the site infrequently through sporadic trade or interaction.

Figure 32 summarizes the changes over time in frequencies of the five major painted-ware traditions in Locus D. The percentages were calculated relative to the total

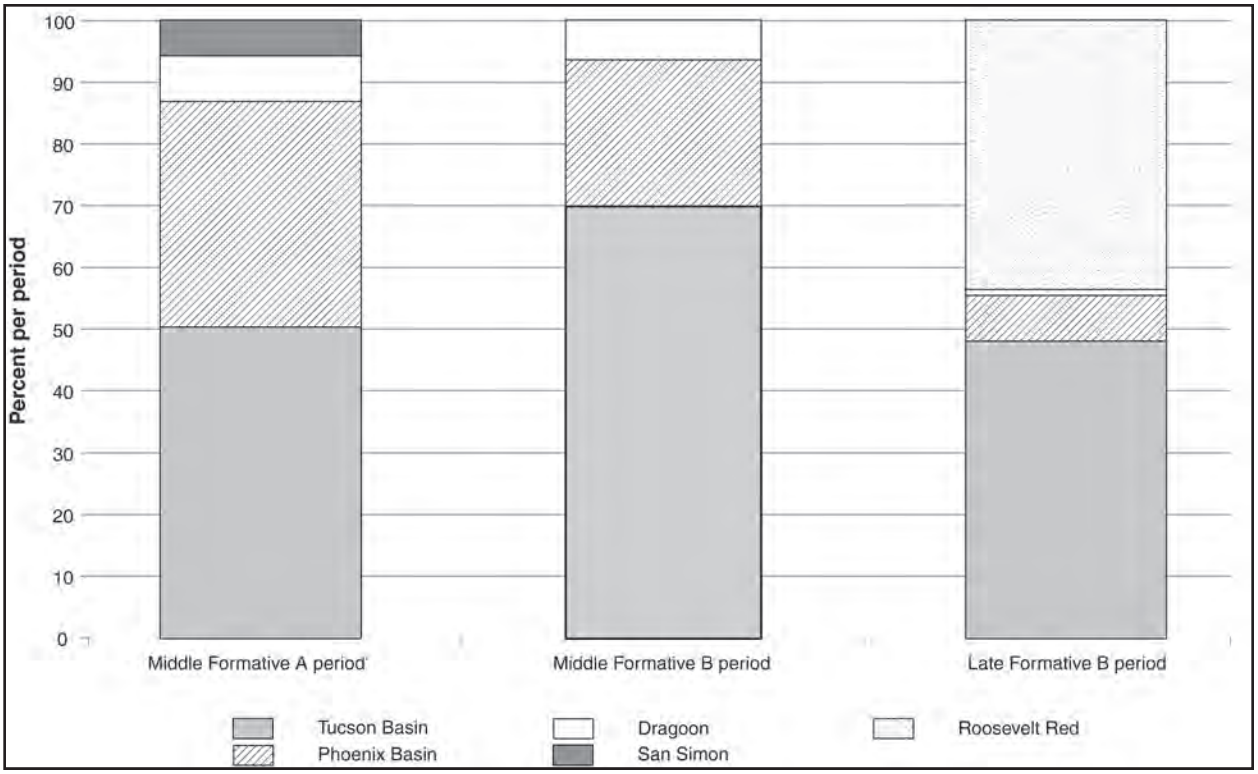


Figure 32. Bar graph showing the percentages of painted-ware classes for three time periods in Locus D, excluding low-frequency ware classes.

number of painted sherds per period, but an insufficient number of painted wares were recovered from features dating to the Early Formative and Middle/Late Formative A periods to include in this graph. The proportions of Tucson Basin and Phoenix Basin painted wares were nearly equal during the Middle Formative A period. Frequencies of San Simon and Dragoon painted wares also peaked during this period. Tucson Basin brown wares dominated the Middle Formative B period component.

The Late Formative B period results were misleading. The raw frequencies suggested that Tucson Basin wares and Roosevelt Red Ware were about equally prevalent, but most identified types from these contexts predated the Late Formative B period and were likely mixed in with sherds from earlier components. As noted above, only a handful of Tanque Verde Red-on-brown wares—the Late Formative period type associated with the Tucson Basin tradition—were recovered from Late Formative B period features. More likely, Roosevelt Red Ware was the dominant painted ware during this period.

Unpainted Wares

Unpainted wares constituted 84 percent of ceramic artifacts from excavation within Locus D, which is about 5 percent higher than the percentage over the entire site collection (79 percent) (see Table 49). Over the entire collection, plain wares composed 82 percent of all ceramics, and red wares constituted about 2 percent. Two additional unpainted sherds were classified as brown corrugated wares and probably date to the Late Formative period. Unpainted ceramics were proportionally more frequent in Locus D than in Loci A or C (61 and 60 percent, respectively). The proportion of unpainted types varied among the occupational components in Locus D. Unpainted ceramics constituted 83–94 percent in the Early Formative, Middle Formative A, and Late Formative periods, but for the Middle Formative B period, the percentage declined to 76 percent, which is about equal to the percentage of unpainted ceramics from contemporaneous features in Locus C (78 percent) but well above the percentage for Locus A (61 percent).

Type II plain wares, the most frequent unpainted type, constituted 74 percent of unpainted wares and 62 percent of all ceramics. Type III plain wares composed 22 percent of unpainted wares and 19 percent of all ceramics. Comparing the Middle Formative A period components of Loci C and D, the difference in Type II plain ware percentages was quite pronounced: 88 and 71 percent, respectively (relative to unpainted counts). Locus D also included a higher percentage of Type III plain wares

(25 percent, relative to all unpainted wares) than did the Locus C collection (11 percent), which mostly included features assigned to the Middle Formative B period. This trend supports Deaver's (1984) argument for a peak in the popularity of micaceous plain ware pottery during the Colonial period (Middle Formative A period) in the Santa Rita Mountains, but as noted above, a higher percentage of Type III sherds (ca. 35–40 percent) was recorded in the Middle Formative B period collections from Loci A and G (see above) (see Deaver et al. 2010:4.11), which fails to supports Deaver's (1984) argument.

For the Middle Formative B period, the percentages of Type II plain wares for Loci C and D were virtually the same: 81 and 80 percent, respectively (relative to unpainted counts); Locus A contained a much lower frequency (56 percent). The variability in Type III plain ware percentages was even more pronounced. Locus A included proportionally more Type III plain wares (35 percent, relative to total unpainted counts) than either Locus C (11 percent) or Locus D (18 percent). This pattern was not related to the higher ratio of bowls to jars in Locus A, as the bowl-to-jar ratios were roughly equal for Type II and III plain wares. These patterns more likely indicate the simultaneous operation of separate provisioning systems for plain wares during the Middle Formative B period.

Type I and IV plain wares were less frequent in the collection, and each accounted for less than 1 percent of unpainted types. Type IV plain wares were low-frequency types throughout the occupational sequence of Locus D. Type I plain wares, on the other hand, were slightly more frequent in features assigned to the Middle Formative A period (102 specimens, or 1 percent of all ceramic artifacts) than in those assigned to other periods. As was the case in Loci A and C, the majority of red wares in the Locus D collection (95 percent) had Type II pastes. In addition, seven nonvessel artifacts were recovered from Locus D, including three figurines and four indeterminate modeled artifacts. One figurine fragment recovered from structure Feature 5994 depicted a humanoid head (Figure 33).

Figure 33. Figurine fragment of a humanoid head from Feature 5994, Locus D (Catalog No. 8691).

Figure 34 summarizes changes over time in the frequencies of the three major unpainted types (Type II and II plain wares and Type II red wares). Type II plain wares constituted the most frequent unpainted type in the five period components. The percentages of Type III plain wares generally fluctuated between about 10 and 25 percent of the unpainted types, except during the Middle Formative/ Late Formative A period, when the percentage spiked to 14 percent, nearly equaling the percentage of Type II plain wares. These data indicate changes over time in plain ware provisioning practices at Locus D.

Form and Functional Classes

Form classes were identified for 1,123 rims and 39 whole/ reconstructible vessels. Table 50 lists the counts and percentages of forms per period, excluding cases for which form class was indeterminate. Slightly more than two-thirds of the identified forms were bowls (60 percent), and most of the remainder were composed of jars with necks (30 percent) and neckless jars (2 percent). Four scoops and 1 plate also were recovered. Overall, bowls outnumbered jars by 2.2 to 1—a lower ratio than that of either Locus A (3.8 to 1) or Locus C (2.6 to 1). Painted bowls outnumbered painted jars by about 10 to 1, but unpainted bowls only slightly outnumbered unpainted jars, by 1.3 to 1.

It may be worth noting that the bowl-to-jar ratio for the Middle Formative B period was 5.3 to 1. For the Middle Formative A and Late Formative B periods, the ratios were 2.1 to 1 and 1.4 to 1, respectively. Bowl frequencies peaked during the Middle Formative B period. Also notable is that, for the Middle Formative A and B periods, painted bowls far outnumbered painted jars (11 to 1 and 13 to 1, respectively). During the Late Formative B period, in contrast, painted bowls outnumbered painted jars by a much smaller margin of 2.6 to 1, which may suggest a change over time in the functional uses of decorated vessels—a point we explore in more detail below. The Middle Formative period painted vessels were mainly bowls, presumably used for serving food and drink, and painted vessels from the Late Formative B period might have been used for additional functions, such as cooking, storage, or water carrying—the typical functions of jars. For unpainted wares, changes in bowl-to-jar ratios were less pronounced. The bowl-to-jar ratios for the Middle Formative A and Late Formative B period collections were essentially equal: 1.1 to 1 and 1.0 to 1, respectively. (We excluded the Middle Formative B period, because of the small sample size of unpainted forms.)

The distributions of functional categories (subdivided by size class) per age designation for Locus D are listed in Table 51. Functional classes were defined for 326 rims and whole or reconstructible vessels. Unfortunately, nearly half (143 of 326, or 44 percent) were from contexts of indeterminate or ambiguous age. Most of the remainder

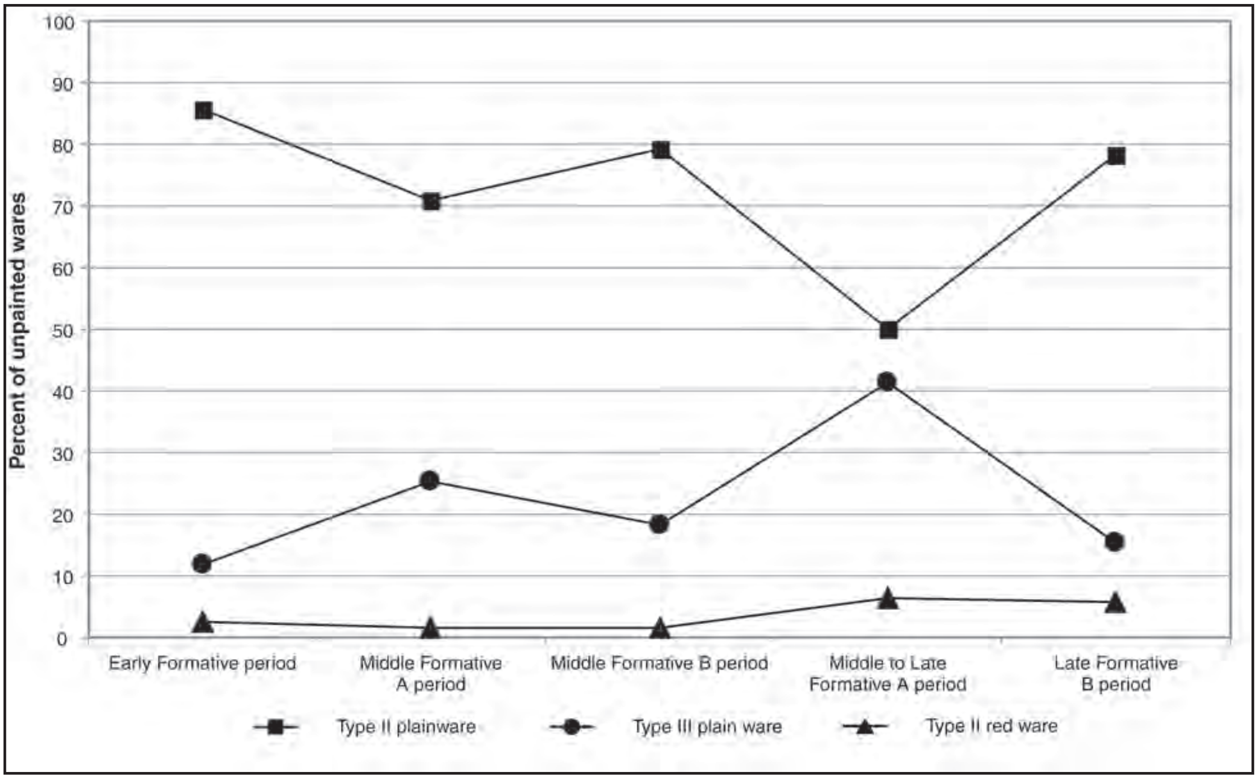


Figure 34. Line graph showing changes in the percentages of unpainted-ceramic types for five time periods in Locus D.

Table 50. Counts and Percentages of General Form Classes, Locus D

Age Designation	Value	Painted Wares Bowl	Painted Wares Jar with Neck	Painted Wares Neckless Jar	Painted Wares Plate	Painted Total	Unpainted Wares Bowl	Unpainted Wares Jar with Neck	Unpainted Wares Neckless Jar	Unpainted Wares Scoop	Unpainted Total	Total
Early Formative period	count	—	—	—	—	—	1	1	—	—	2	2
	percent of ware category						50.0	50.0				
	percent of all wares						50.0	50.0				
Middle Formative A period	count	206	18	—	—	224	177	148	13	2	340	564
	percent of ware category	92.0	8.0			100.0	52.1	43.5	3.8	0.6	100.0	
	percent of all wares	36.5	3.2			39.7	31.4	26.2	2.3	0.4	60.3	
Middle Formative B period	count	13	1	—	—	14	8	3	—	—	11	25
	percent of ware category	92.9	7.1			100.0	72.7	27.3			100.0	
	percent of all wares	52.0	4.0			56.0	32.0	12.0			44.0	

Age Designation	Value	Painted Wares					Unpainted Wares					Total
		Bowl	Jar with Neck	Neckless Jar	Plate	Painted Total	Bowl	Jar with Neck	Neckless Jar	Scoop	Unpainted Total	
Middle/Late Formative A period	count	1	—	—	—	1	3	1	—	—	4	5
	percent of ware category	100.0				100.0	75.0	25.0			100.0	
	percent of all wares	20.0				20.0	60.0	20.0			80.0	
Late Formative B period	count	21	7	1	—	29	37	35	2	—	74	103
	percent of ware category	72.4	24.1	3.4		100.0	50.0	47.3	2.7		100.0	
	percent of all wares	20.4	6.8	1.0		28.2	35.9	34.0	1.9		71.8	
Early/Middle Formative period	count	2	1	—	—	3	30	20	—	—	50	53
	percent of ware category	66.7	33.3			100.0	60.0	40.0			100.0	
	percent of all wares	3.8	1.9			5.7	56.6	37.7			94.3	
Middle Formative period	count	61	—	—	—	61	55	27	1	1	84	145
	percent of ware category	100.0				100.0	65.5	32.1	1.2	1.2	100.0	—
	percent of all wares	42.1				42.1	37.9	18.6	0.7	0.7	57.9	
Various—ambiguous age	count	15	1	—	1	17	26	17	5	—	48	65
	percent of ware category	88.2	5.9		5.9	100.0	54.2	35.4	10.4		100.0	
	percent of all wares	23.1	1.5		1.5	26.2	40.0	26.2	7.7		73.8	
Indeterminate age	count	57	8	—	—	65	78	56	—	1	135	200
	percent of ware category	87.7	12.3			100.0	57.8	41.5		0.7	100.0	
	percent of all wares	28.5	4.0			32.5	39.0	28.0		0.5	67.5	
All age designations	count	376	36	1	1	414	415	308	21	4	748	1,162
	percent of ware category	90.8	8.7	0.2	0.2	100.0	55.5	41.2	2.8	0.5	100.0	
	percent of all wares	32.4	3.1	0.1	0.1	35.6	35.7	26.5	1.8	0.3	64.4	

Table 51. Detailed Functional Categories, Locus D

Detailed Functional Category	Size Class	Middle Formative A Period		Middle Formative B Period		Late Formative B Period		Early/Middle Formative Period		Middle Formative Period		Various—Ambiguous Age		Indeterminate Age		All Age Designations	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Serving or processing vessels																	
Serving/food processing without heat	large	3	3.0	—		3	10.7	—		—		1	4.0	4	3.4	11	3.4
	medium/large	7	6.9	2	20.0	2	7.1	1	6.3	3	10.7	4	16.0	3	2.5	22	6.7
	small	15	14.9	1	10.0	3	10.7	3	18.8	7	25.0	2	8.0	34	28.8	65	19.9
	small/medium	14	13.9	—		3	10.7	2	12.5	8	28.6	1	4.0	10	8.5	38	11.7
Food processing with or without heat/eating/serving	individual/small	4	4.0	2	20.0	—		—		—		—		3	2.5	9	2.8
Food processing without heat/dry cooking/serving/eating	large	1	1.0	1	10.0	—		—		—		—		2	1.7	4	1.2
	medium/large	2	2.0	—		—		—		1	3.6	1	4.0	3	2.5	7	2.1
	small	2	2.0	1	10.0	1	3.6	—		2	7.1	1	4.0	11	9.3	18	5.5
	small/medium	3	3.0	—		1	3.6	1	6.3	1	3.6	—		5	4.2	11	3.4
Food processing without heat/eating/serving	individual	2	2.0	—		—		—		1	3.6	—		3	2.5	6	1.8
Subtotal		53	52.5	7	70.0	13	46.4	7	43.8	23	82.1	10	40.0	78	66.1	191	58.6
Storage vessels																	
Liquid/dry storage	individual	2	2.0	—		1	3.6	—		—		1	4.0	—		4	1.2
Long-term dry storage	medium/large			—		1		—		—		—		—		1	0.3
Specialized liquid/canteen	individual	—		—		1	3.6	—		—		—		—		1	0.3
Short- or long-term dry storage	small	3	3.0	—		—		—		—		—		—		3	0.9
Short- or long-term liquid storage	medium/large	1	1.0	—		—		—		1	3.6	1	4.0	1	0.8	4	1.2
Specialized dry storage		—		—		—		—		—		3	12.0	—		3	0.9
Short- or long-term liquid or dry storage	large	1	1.0	—		—		—		—		—		—		1	0.3

Detailed Functional Category	Size Class	Middle Formative A Period		Middle Formative B Period		Late Formative B Period		Early/Middle Formative Period		Middle Formative Period		Various—Ambiguous Age		Indeterminate Age		All Age Designations	
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
	medium/large	1	1.0	—		—		1	6.3	1	3.6	—		2	1.7	5	1.5
Subtotal		8	7.9	—		3	10.7	1	6.3	2	7.1	5	20.0	3	2.5	22	6.7
Storage or cooking vessels																	
Short- or long-term dry storage/cooking	small/medium	3	3.0	—		1	3.6	1	6.3	—		1	4.0	1	0.8	7	2.1
Short- or long-term liquid or dry storage/cooking	small/medium	1	1.0	—		1	3.6	1	6.3	—		1	4.0	9	7.6	13	4.0
Short-term liquid or dry storage/cooking	small	23	22.8	1	10.0	1	3.6	5	31.3	1	3.6	4	16.0	5	4.2	40	12.3
Short-term liquid storage/ cooking	small	12	11.9	2	20.0	6	21.4	1	6.3	2	7.1	3	12.0	20	16.9	46	14.1
Subtotal		39	38.6	3	30.0	9	32.1	8	50.0	3	10.7	9	36.0	35	29.7	106	32.5
Storage or transfer vessels																	
Short-term dry/liquid storage	individual	1	1.0	—		—		—		—		—		1	0.8	2	0.6
Liquid storage/carrier	individual			—		3	10.7	—		—		1	4.0	1	0.8	5	1.5
Subtotal		1	1.0	—		3	10.7	—		—		1	4.0	2	1.7	7	2.1
Total		101	100.0	10	100.0	28	100.0	16	100.0	28	100.0	25	100.0	118	100.0	326	100.0

Note: Percentages are column percentages.

were from Middle Formative A period features. Overall, about 59 percent of the identified functional classes were processing/serving vessels, which is roughly equal to the overall percentage from Locus C (58 percent) but below the percentage from Locus A (66 percent). The percentage of cooking/storage vessels was 30 percent, roughly matching the percentages from Loci A and C (26 and 24 percent, respectively). Storage vessels and storage/transfer vessels composed 9 and 3 percent of the functional classes, respectively, falling roughly between the percentages from Locus A (6 and 2 percent) and Locus C (12 and 6 percent).

A comparison of functional-class percentages among contemporaneous features in the three loci was not possible, because of small sample sizes. Only the cases assigned to the Middle Formative B components from Loci A and C generated reliable percentages; conversely, in Locus D, only the cases assigned to the Middle Formative A and Late Formative B components were large enough for reliable percentage calculations. For the Middle Formative A period in Locus D, the percentages of functional classes varied little from the percentages over all periods. In the Late Formative B features, the percentages of storage vessels and storage/transfer vessels (11 and 11 percent) were considerably higher than in the Middle Formative A period component (8 and 1 percent). Accordingly, the percentages of processing/serving and cooking/storage vessels were lower in the Late Formative B component (46 and 32 percent) than in the Middle Formative A component (53 and 39 percent). These differences may suggest changes in site function and activities over time.

Feature Ceramics

In this section, we report the distributions of ceramic artifact types, wares, and form classes per feature type and per individual feature. Ceramic materials were recovered from structures, roasting pits, nonthermal extramural pits, borrow pits, *hornos*, fire pits, rock piles, rock clusters, a cache, an extramural posthole, and various conglomerations of superimposed structures in Locus D (Table 52). (As explained above, we exclude from our discussion ceramics recovered in the fill of human burials.) The dense packing and superimposition of structures in Locus D rendered feature identification very difficult, and many were initially categorized as "multiple features" (Vanderpot 2001:4). The tables below summarize the ceramic data collected from these various feature classes. Where possible, we detected diachronic patterns in the data.

Ceramic Distribution among Feature Types

The majority of ceramic materials were from structures (78 percent), which, on average, included about 424 ceramics per structure (see Table 52). A large number of ceramic remains also were collected from "multiple features" contexts (8 percent, or 275 ceramic items per feature), which mainly included residential components. Most of the remaining ceramics were collected from roasting pits (6 percent, or 92 items per feature), borrow pits (3 percent, or 194 items per feature), *hornos* (1 percent, or 136 items per feature), and nonthermal extramural pits (5 percent, or 25 items per feature). About 1 percent were collected from various other feature types.

Table 52 reports the proportions of very-small sherds and vessels, which shed light on possible differences in depositional contexts among feature types (see above). Among the five feature types with the largest collection sizes, the percentages of small sherds were relatively even, varying by no more than about 10 percent. About half of the ceramic items were very-small sherds in these types. Borrow pits contained the smallest percentage of very-small sherds; the reason for this is not clear, but one possibility is that broken pottery discarded in these features was shielded from human trampling and other disturbances. Nonthermal extramural pits also contained fewer very-small sherds and a higher frequency of vessels than other feature types, possibly for the same reason. Notable also is that the percentage of small sherds in roasting pits in Locus D (50 percent) was nearly 20 points higher than in Locus C (32 percent). Above, we hypothesized that the larger sherds were used in connection with roasting activities, but the results from Locus D do not support this interpretation.

We again employed a Pearson's chi-square contingency-table analysis to analyze variability in ware composition (frequencies of plain wares, red wares, and painted wares) among the feature types by comparing observed and observed-minus-expected percentages (Table 53); we excluded feature types with fewer than 100 ceramics (not including very-small sherds), to avoid sampling vagaries. As was the case with Loci A and C, most of the ceramic materials were collected from structures; therefore, this feature type more or less defined the marginal totals against which the other feature types were compared; the chi-square test essentially measured the proportional variability between the structures and other feature types. Overall, the results suggest statistically significant variability in the distributions of ware classes among the feature types ($\chi^2 = 20.07$, $df = 10$, $p = .02$). Even so, the differences in ware frequencies were not as pronounced as they were in Loci A and C. The scaled observed-minus-expected results varied only slightly. One exception was the *hornos*, which included a higher frequency of painted wares than other features types, for unknown reasons.

The distribution of vessel forms among the feature types is listed in Table 54. For most feature types, bowls outnumbered jars by about 2 to 1, with a few exceptions. As was the case in Locus A, nonthermal extramural pits included a conspicuously high ratio of bowls to jars (4 to 1) that was roughly twice the ratio recovered in any other feature type. In the case of Locus A, we suggested the possibility that refuse generated during feasting or communal feeding

Table 52. Summary of Ceramic Artifacts, by Feature Type, Locus D

Feature Type	Ceramics (n)	Feature Ceramics (%)	Small Sherds (n)	Small Sherds (%)	Vessels (n)	Vessels (%)	Plain Ware (n)	Plain Ware[a] (%)	Red Ware (n)	Red Ware[a] (%)	Painted (n)	Painted[a] (%)
Structure	29,661	80.3	15,553	52.4	19	0.1	11,618	82.4	299	2.1	2,148	15.5
Multiple features	2,751	7.5	1,490	54.2	1	0.04	876	69.5	15	1.2	370	29.3
Roasting pit	2,214	6.0	1,101	49.7	2	0.1	936	84.1	22	2.0	155	13.9
Extramural pit	1,777	4.7	809	45.5	11	0.6	790	81.6	15	1.5	163	16.8
Borrow pit	968	2.5	402	41.5	—		475	83.9	15	2.7	76	13.4
Horno	271	0.7	143	52.8	—		94	73.4	2	1.6	32	25.0
Cache	29	0.1	25	86.2	4	13.8	4	100.0	—		—	
Fire pit	26	0.1	19	73.1	—		7	100.0	—		—	
Rock pile	14		10	71.4	—		4	100.0	—		—	
Rock cluster	13		2	15.4	—		6	54.5	—		5	45.5
Posthole	3		2	66.7	—		—		—		1	100.0
Extramural hearth	2		1	50.0	—		1	100.0	—		—	

[a] Very-small sherds excluded from calculations.

Table 53. Contingency Table Showing Observed and Observed-Minus-Expected Percentages of Wares, by Feature Type, Locus D

	Plain Wares				Red Wares				Painted Wares			
Feature Type	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]	Observed Count	Expected Count	Observed MInus Expected	Scaled Observed Minus Expected[a]	Observed Count	Expected Count	Observed Minus Expected	Scaled Observed Minus Expected[a]
Structure	11,618	11,627.3	–9.3	–0.1	299	295.0	4.0	0.0	2,148	2,142.7	5.3	0.0
Roasting pit	936	920.1	15.9	1.4	22	23.3	–1.3	–0.1	155	169.6	–14.6	–1.3
Extramural pit	790	800.2	–10.2	–1.1	15	20.3	–5.3	–0.5	163	147.5	15.5	1.6
Borrow pit	475	467.9	7.1	1.3	15	11.9	3.1	0.6	76	86.2	–10.2	–1.8
Horno	94	105.8	–11.8	–9.2	2	2.7	–0.7	–0.5	32	19.5	12.5	9.8

[a] Observed minus expected, divided by total count per feature type, times 100.

Table 54. General Form Classes, by Feature Type, Locus D

Feature Type	Bowls	Jars with Necks	Neckless Jars	Scoop	Plate	Total	Bowl-to-Jar Ratio
Structure	539	231	17	3	—	790	2.2 to 1
Multiple features	59	24	—	—	—	83	2.5 to 1
Roasting pit	51	29	2	—	—	82	1.6 to 1
Extramural pit	40	10	—	1	1	52	4 to 1
Borrow pit	21	13	—	—	—	34	1.6 to 1
Horno	4	2	—	—	—	6	2 to 1
Cache	1	1	2	—	—	4	0.3 to 1
Rock cluster	1	—	—	—	—	1	1 to 0

events was discarded in the nonthermal extramural pits, resulting in high bowl-to-jar ratios and high percentages of painted types. It is possible that the same explanation applies to some of the nonthermal extramural pits in Locus D, although the frequency of painted types did not greatly exceed the expected frequency (see Table 53).

Ceramic Distribution among Individual Features and Feature Types

Table 55 lists the counts and percentages of ceramic wares per feature in Locus D by period, excluding features of indeterminate age. Table 56 lists the counts and percentages of ceramic wares per feature for painted wares only, and Table 57 lists the general form classes per feature. We mainly concentrate here on variability of ceramic collections among the structures. To manage the large size of the Locus D collection, we present the data separately for the five major period components.

Early Formative Period

Most of the ceramic artifacts assigned to the Early Formative period were from structure Feature 4912, which contained mostly plain wares (92 percent). Only five painted sherds were recovered: one Snaketown Red-on-buff sherd, one Mimbres Black-on-white sherd, and three indeterminate red-on-brown sherds. The Mimbres Black-on-white sherd postdated the Early Formative period and probably was intrusive. The Snakewater Red-on-buff sherd might suggest occupation in the A.D. 700s. Given the dearth of ceramic materials from other features dating to this period, we were unable to compare Feature 4912 with contemporaneous features or loci. One bowl and one jar could be identified in Feature 4912 (see Table 57).

Middle Formative A Period

The excavation in Locus D focused heavily on the Middle Formative A period, mostly structures and various extramural thermal and nonthermal pits. Only 1 structure dating to this period was excavated outside Locus D (Feature 6010 in Locus C), from which a very small number of ceramics were collected. Therefore, a comparison of locus collections was not feasible for this period.

We report type and ware percentages for 17 structures with a minimum of 30 ceramics each. The plain ware percentages among the 17 structures ranged from 67 to 92 percent, with a mean of 82.3 percent and a standard deviation of 8.6 percent (see Table 55). Collections from 2 extramural pits and 4 roasting pits with at least 30 ceramics possessed plain ware percentages that were nearly identical to those of the structures: 83 and 84 percent, respectively. These features and the structures all probably contained broken pottery and refuse deposits generated in domestic contexts. Red wares were relatively rare among the 17 structures, with percentages per structure that ranged from 0 to 5, with a mean of 1.9 percent and a standard deviation of 1.3 percent.

To analyze variability in the distribution of painted types only, we limited our analysis to the 10 structures assigned to this period with at least 30 painted ceramics (see Table 56). The percentages of Tucson Basin brown wares varied considerably among the 10 structures, ranging from 1.6 to 17 percent of all ceramics, with a mean of 6 percent and a standard deviation of 54 percent. Among painted sherds, they ranged from 11 to 55 percent, with a mean of 34.8 percent and a standard deviation of 16.4 percent. The range of percentages was more or less continuous, and no modalities were evident.

The percentage of Phoenix Basin buff wares ranged from 1.7 to 7 percent of all sherds, with a mean of 3.8 percent and a standard deviation of 1.5 percent (see Table 55). They also composed from 13 to 49 percent of painted sherds, with a mean of 3.8 percent and a standard deviation of 1.7 percent (see Table 56). In Features 834 and 7880, the frequencies (relative to all painted wares) were 49 and 45 percent, respectively—14 percent higher than the feature with the next-highest percentage. Similarly, in Feature 11342—an indeterminate nonthermal surface concentration—buff wares outnumbered Tucson Basin–style

Table 55. Ceramic Artifacts, by Age and Feature, Excluding Features of Indeterminate Age, Locus D

Feature No.	Feature Type	Plain Ware		Red Ware		Tucson Basin		Phoenix Basin		Dragoon		San Simon		Roosevelt Red		Other Tradition		Indeterminate		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
Early Formative Period																				
3641	structure	9	100.0	—		—		—		—		—		—		—		—		9
4902	roasting pit	5	100.0	—		—		—		—		—		—		—		—		5
4912	structure	59	92.2	2	3.1	—		1	1.6	—		—		—		1	1.6	1	1.6	64
11251	structure	1	33.3	—		—		—		—		—		—		—		2	66.7	3
Middle Formative A Period																				
438	structure	2,103	88.3	5	0.2	85	3.6	79	3.3	39	1.6	—		—		—		70	2.9	2,381
492	structure	7	100.0	—		—		—		—		—		—		—		—		7
565	structure	7	100.0	—		—		—		—		—		—		—		—		7
825	structure	344	86.2	6	1.5	12	3.0	15	3.8	—		7	1.8	—		—		15	3.8	399
834	structure	307	83.9	6	1.6	6	1.6	26	7.1	—		4	1.1	—		—		17	4.6	366
3501	multiple features	185	45.6	6	1.5	55	13.5	32	7.9	4	1.0	1	0.2	—		—		123	30.3	406
3582	structure	275	69.4	11	2.8	51	12.9	23	5.8	—		6	1.5	—		4	1.0	26	6.6	396
3595	multiple features	30	81.1	—		3	8.1	—		3	8.1	—		—		—		1	2.7	37
3617	structure	352	71.4	13	2.6	75	15.2	17	3.4	—		14	2.8	—		—		22	4.5	493
3668	roasting pit	42	87.5	—		5	10.4	1	2.1	—		—		—		—		—		48
3679	structure	162	79.0	4	2.0	9	4.4	5	2.4	4	2.0	—		—		—		21	10.2	205
3680	structure	40	66.7	2	3.3	10	16.7	3	5.0	—		—		—		—		5	8.3	60
3681	structure	586	66.7	19	2.2	131	14.9	47	5.3	4	0.5	13	1.5	—		2	0.2	77	8.8	879
3696	roasting pit	47	74.6	1	1.6	10	15.9	2	3.2	—		—		—		—		3	4.8	63
3710	structure	229	82.4	7	2.5	23	8.3	9	3.2	3	1.1	2	0.7	—		—		5	1.8	278
3756	roasting pit	37	90.2	—		4	9.8	—		—		—		—		—		—		41
3879	structure	64	84.2	1	1.3	2	2.6	4	5.3	—		2	2.6	—		—		3	3.9	76
3895	nonthermal extramural pit	81	90.0	—		2	2.2	3	3.3	1	1.1	—		—		—		3	3.3	90
3968	nonthermal extramural pit	1	50.0	—		1	50.0	—		—		—		—		—		—		2
4516	structure	2	100.0	—		—		—		—		—		—		—		—		2
5612	roasting pit	367	82.8	11	2.5	13	2.9	34	7.7	2	0.5	3	0.7	—		—		13	2.9	443

continued on next page

Feature No.	Feature Type	Plain Ware		Red Ware		Tucson Basin		Phoenix Basin		Dragoon		San Simon		Roosevelt Red		Other Tradition		Indeterminate		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
5781	structure	95	88.0	—		7	6.5	2	1.9	3	2.8	1	0.9	—		—		—		108
5986	structure	51	83.6	3	4.9	1	1.6	2	3.3	—		—		—		—		4	6.6	61
5994	structure	227	92.3	—		5	2.0	5	2.0	1	0.4	1	0.4	—		—		7	2.8	246
7558	structure	9	45.0	3	15.0	5	25.0	1	5.0	1	5.0	—		—		—		1	5.0	20
7559	structure	2	40.0	—		2	40.0	—		—		—		—		—		1	20.0	5
7697	multiple features	243	90.7	1	0.4	6	2.2	13	4.9	1	0.4	—		—		—		4	1.5	268
7827	roasting pit	4	100.0	—		—		—		—		—		—		—		—		4
7879	structure	12	92.3	—		—		—		—		—		—		—		1	7.7	13
7880	structure	768	89.5	10	1.2	27	3.1	36	4.2	7	0.8	1	0.1	—		—		9	1.0	858
7942	structure	99	90.0	1	0.9	2	1.8	4	3.6	—		—		4	3.6	—		—		110
7943	structure	109	91.6	4	3.4	2	1.7	2	1.7	—		—		2	1.7	—		—		119
7978	structure	27	96.4	—		—		1	3.6	—		—		—		—		—		28
8644	structure	363	86.6	8	1.9	8	1.9	15	3.6	—		2	0.5	—		—		23	5.5	419
8841	structure	—		—		—		—		1	100.0	—		—		—		—		1
11342	surface feature (indeterminate)	299	75.1	10	2.5	1	0.3	28	7.0	11	2.8	—		1	0.3	2	0.5	46	11.6	398
	Middle Formative B Period																			
3569	structure	8	88.9	—		—		—		1	11.1	—		—		—		—		9
3579	rock cluster/ hearth	6	54.5	—		4	36.4	—		1	9.1	—		—		—		—		11
3663	structure	3	100.0	—		—		—		—		—		—		—		—		3
3818	*horno*	43	64.2	—		6	9.0	4	6.0	—		—		—		—		14	20.9	67
4768	structure	264	77.9	6	1.8	33	9.7	8	2.4	1	0.3	—		—		—		27	8.0	339
5795	structure	7	70.0	—		—		2	20.0	1	10.0	—		—	—	—		—		10
10729	structure	1	50.0	—		1	50.0	—		—		—		—	—	—		—		2
10781	structure	—		—		—		1	100.0	—		—		—	—	—		—		1
	Middle/Late Formative A Period																			
4871	roasting pit	35	87.5	—		1	2.5	4	10.0	—		—		—	—	—		—		40
4931	roasting pit	7	100.0	—		—		—		—		—		—	—	—		—		7

Feature No.	Feature Type	Plain Ware		Red Ware		Tucson Basin		Phoenix Basin		Dragoon		San Simon		Roosevelt Red		Other Tradition		Indeterminate		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	
											Late Formative B Period									
1575	structure	541	81.4	64	9.6	38	5.7	3	0.5	2	0.3	—		13	2.0	—		4	0.6	665
3631	nonthermal extramural pit	10	90.9	—		—		—		—		—		1	9.1	—		—		11
4683	structure	550	80.5	23	3.4	24	3.5	8	1.2	—		—		41	6.0	—		37	5.4	683
4684	structure	606	85.0	41	5.8	29	4.1	5	0.7	—		—		17	2.4	—		15	2.1	713
4729	structure	503	86.7	12	2.1	20	3.4	1	0.2	—		—		29	5.0	—		15	2.6	580

Table 56. Painted Wares, by Age and Feature, Excluding Features of Indeterminate Age, Locus D

Feature	Feature Type	Tucson Basin		Phoenix Basin		Dragoon		San Simon		Roosevelt Red		Other		Indeterminate Painted		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	
							Early Formative Period									
4912	structure	—		1	33.3	—		—		—		1	33.3	1	33.3	3
11251	structure	—		—		—		—		—		—		2	100.0	2
							Middle Formative A Period									
438	structure	85	31.1	79	28.9	39	14.3	—		—		—		70	25.6	273
825	structure	12	24.5	15	30.6	—		7	14.3	—		—		15	30.6	49
834	structure	6	11.3	26	49.1	—		4	7.5	—		—		17	32.1	53
3501	multiple features	55	25.6	32	14.9	4	1.9	1	0.5	—		—		123	57.2	215
3582	structure	51	46.4	23	20.9	—		6	5.5	—		4	3.6	26	23.6	110
3595	multiple features	3	42.9	—		3	42.9	—	—	—		—		1	14.3	7
3617	structure	75	58.6	17	13.3	—		14	10.9	—		—		22	17.2	128
3668	roasting pit	5	83.3	1	16.7	—		—		—		—		—		6
3679	structure	9	23.1	5	12.8	4	10.3	—		—		—		21	53.8	39
3680	structure	10	55.6	3	16.7	—		—		—		—		5	27.8	18
3681	structure	131	47.8	47	17.2	4	1.5	13	4.7	—		2	0.7	77	28.1	274

continued on next page

Feature	Feature Type	Tucson Basin		Phoenix Basin		Dragoon		San Simon		Roosevelt Red		Other		Indeterminate Painted		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	
3696	roasting pit	10	66.7	2	13.3	—		—		—		—		3	20.0	15
3710	structure	23	54.8	9	21.4	3	7.1	2	4.8	—		—		5	11.9	42
3756	roasting pit	4	100.0	—		—		—	—	—		—		—		4
3879	structure	2	18.2	4	36.4	—		2	18.2	—		—		3	27.3	11
3895	nonthermal extramural pit	2	22.2	3	33.3	1	11.1	—		—		—		3	33.3	9
3968	nonthermal extramural pit	1	100.0	—		—		—		—		—		—		1
5612	roasting pit	13	20.0	34	52.3	2	3.1	3	4.6	—		—		13	20.0	65
5781	structure	7	53.8	2	15.4	3	23.1	1	7.7	—		—		—		13
5986	structure	1	14.3	2	28.6	—		—	—	—		—		4	57.1	7
5994	structure	5	26.3	5	26.3	1	5.3	1	5.3	—		—		7	36.8	19
7558	structure	5	62.5	1	12.5	1	12.5	—		—		—		1	12.5	8
7559	structure	2	66.7	—		—		—		—		—		1	33.3	3
7697	multiple features	6	25.0	13	54.2	1	4.2	—		—		—		4	16.7	24
7879	structure	—		—		—		—		—		—		1	100.0	1
7880	structure	27	33.8	36	45.0	7	8.8	1	1.3	—		—		9	11.3	80
7942	structure	2	20.0	4	40.0	—		—		4	40.0	—		—		10
7943	structure	2	33.3	2	33.3	—		—		2	33.3	—		—		6
7978	structure	—	—	1	100.0	—		—		—		—		—		1
8644	structure	8	16.7	15	31.3	—		2	4.2	—		—		23	47.9	48
8841	structure	—		—		1	100.0	—		—		—		—		1
11342	surface feature (indeterminate)	1	1.1	28	31.5	11	12.4	—		1	1.1	2	2.2	46	51.7	89
	Middle Formative B Period															
3569	structure	—		—		1	100.0	—		—		—		—		1
3579	rock cluster/ hearth	4	80.0	—		1	20.0	—		—		—		—		5
3818	*horno*	6	25.0	4	16.7	—		—		—		—		14	58.3	24
4768	structure	33	47.8	8	11.6	1	1.4	—		—		—		27	39.1	69

Feature	Feature Type	Tucson Basin		Phoenix Basin		Dragoon		San Simon		Roosevelt Red		Other		Indeterminate Painted		Total
		n	%	n	%	n	%	n	%	n	%	n	%	n	%	
5795	structure	—		2	66.7	1	33.3	—		—		—		—		3
10729	structure	1	100.0	—		—		—		—		—		—		1
10781	structure	—		1	100.0	—		—		—		—		—		1
	Middle/Late Formative A Period															
4871	roasting pit	1	20.0	4	80.0	—		—		—		—		—		5
	Late Formative B Period															
1575	structure	38	63.3	3	5.0	2	3.3	—		13	21.7	—		4	6.7	60
3631	nonthermal extramural pit	—	—	—		—		—		1	100.0	—		—		1
4683	structure	24	21.8	8	7.3	—		—		41	37.3	—		37	33.6	110
4684	structure	29	43.9	5	7.6	—		—		17	25.8	—		15	22.7	66
4729	structure	20	30.8	1	1.5	—		—		29	44.6	—		15	23.1	65

Table 57. Form Classes, by Age and Feature, Excluding Features of Indeterminate Age, Locus D

Feature No.	Feature Type	Bowl	Jar with Neck	Neckless Jar	Plate	Scoop	Total	Bowl-to-Jar Ratio
Early Formative Period								
4912	structure	1	1	—	—	—	2	1 to 1
Middle Formative A Period								
438	structure	71	31	—	—	2	104	2.3 to 1
492	structure	1	—	—	—	—	1	1 to 0
825	structure	14	8	4	—	—	26	1.2 to 1
834	structure	19	12	—	—	—	31	1.6 to 1
3501	multiple features	18	1	—	—	—	19	18 to 1
3582	structure	19	8	—	—	—	27	2.4 to 1
3595	multiple features	1	2	—	—	—	3	0.5 to 1
3617	structure	37	6	—	—	—	43	6.2 to 1
3668	roasting pit	—	1	—	—	—	1	0 to 1
3679	structure	8	—	—	—	—	8	8 to 0
3680	structure	5	—	—	—	—	5	5 to 0
3681	structure	45	21	2	—	—	68	2 to 1
3696	roasting pit	9	1	—	—	—	10	9 to 1
3710	structure	3	7	—	—	—	10	0.4 to 1
3756	roasting pit	1	1	—	—	—	2	1 to 1
3879	structure	—	1	—	—	—	1	0 to 1
3895	nonthermal extramural pit	2	—	—	—	—	2	2 to 0
3968	nonthermal extramural pit	1	—	—	—	—	1	1 to 0
5612	roasting pit	14	16	2	—	—	32	0.8 to 1
5781	structure	6	6	—	—	—	12	1 to 1
5986	structure	6	3	—	—	—	9	2 to 1
5994	structure	12	6	—	—	—	18	2 to 2
7558	structure	1	—	—	—	—	1	1 to 0
7697	multiple features	15	5	—	—	—	20	3 to 1
7879	structure	—	1	—	—	—	1	0 to 1
7880	structure	30	15	3	—	—	48	1.7 to 1
7942	structure	—	4	—	—	—	4	0 to 4
7943	structure	3	1	—	—	—	4	3 to 1
7978	structure	4	—	—	—	—	4	4 to 0
8644	structure	16	6	2	—	—	24	2 to 1
11342	surface feature (indetermined)	22	3	—	—	—	25	7.3 to 1
Middle Formative B Period								
3569	structure	1	—	—	—	—	1	1 to 0
3579	rock cluster/hearth	1	—	—	—	—	1	1 to 0
3818	*horno*	3	—	—	—	—	3	3 to 0
4768	structure	15	4	—	—	—	19	3.8 to 1
10729	structure	1	—	—	—	—	1	1 to 0
Middle/Late Formative A Period								
4871	roasting pit	4	1	—	—	—	5	4 to 1

Feature No.	Feature Type	Bowl	Jar with Neck	Neckless Jar	Plate	Scoop	Total	Bowl-to-Jar Ratio
	Late Formative B Period							
1575	structure	10	14	2	—	—	26	0.6 to 1
3631	nonthermal extramural pit	1	1	—	—	—	2	1 to 1
4683	structure	19	13	1	—	—	33	1.4 to 1
4684	structure	23	11	—	—	—	34	2.1 to 1
4729	structure	5	3	—	—	—	8	1.7 to 1

painted wares by 28 to 1. The people living near these features clearly preferred Phoenix Basin buff ware pottery over other painted varieties.

Over all structures, Tucson Basin brown wares only slightly outnumbered Phoenix Basin buff wares, by 1.6 to 1, but the ratio varied a great deal among the structures. Phoenix Basin buff wares actually outnumbered Tucson Basin brown wares in 4 of the 10 structures (Features 825, 834, 7880, and 8644); the ratio was nearly even (1.1. to 1) in structure Feature 438. In 5 other structures, Tucson Basin brown wares outnumbered Phoenix Basin buff wares by a range of 1.8–4.4 to 1 (Features 3582, 3617, 3679, 3681, and 3710). Perhaps importantly, these features were also spatially segregated. The structures with higher proportions of Phoenix Basin buff wares were generally located in the western portion of Locus D, as was Feature 438. The structures with higher proportions of Tucson Basin brown wares were located in the eastern half of the locus, including a tight cluster near the southeastern corner (Features 3582, 3617, and 3681). These might indicate the presence of distinct kin groups or sodalities with separate identities or affiliations within the Middle Formative A period settlement, a matter we explore in more detail below.

Dragoon brown wares were relatively infrequent in the Middle Formative A period structures in Locus D, compared to Tucson Basin brown wares and Phoenix Basin buff wares. They composed from 0 to 2.8 percent of all ceramics, with a mean of 0.5 percent and a standard deviation of 0.8 percent. Among painted ceramics, the percentage ranged between 0 and 14 percent, with a mean of 4.2 percent and a standard deviation of 5.4 percent. As evidenced by the high standard deviation, the percentages varied considerably among the structures. They were absent in half of the structures (5 of 10) with robust collections. Feature 438 contained the highest count (n = 39) and percentage (14 percent) of Dragoon brown wares—nearly six times as many as the structure with the next-highest count (Feature 7880, with 7 Dragoon sherds). Even so, Feature 438 included half as many Dragoon brown wares as Tucson Basin brown wares (n = 85) and Phoenix Basin buff wares (n = 79).

San Simon brown wares composed between 0 and 2.8 percent of all ceramics, with a mean of 0.9 percent and a standard deviation of 0.9 percent. Among painted sherds, they ranged from 0 to 14 percent, with a mean of 5.3 percent and a standard deviation of 4.6 percent. Features 825 and 3617 possessed notably higher percentages of San Simon brown wares (14 and 11 percent, respectively) than did the other features. In most site and locus components, Dragoon brown wares outnumbered San Simon–style painted wares by a large margin. On the whole, Dragoon brown wares only slightly outnumbered San Simon brown wares among structures assigned to the Middle Formative A period in Locus D (63 sherds to 53). Again, more than half of the Dragoon brown ware sherds were from Feature 438. Excluding this feature, San Simon–style painted wares actually outnumbered Dragoon-style wares by more than 2 to 1 (53 specimens to 24). Moreover, San Simon brown wares were more consistently recovered from structures than were Dragoon brown wares; San Simon brown wares were recovered from 8 of 10 structures with at least 30 painted sherds; conversely, Dragoon brown wares were recovered from only 5 structures. As was the case with Phoenix Basin buff wares, San Simon brown wares appear to have peaked in popularity during the Middle Formative A period, and Dragoon brown wares became more popular during the subsequent Middle Formative B period.

The overall sample size of identifiable form classes was small for most features assigned to the Middle Formative A period (see Table 57): only 11 features included at least 20 sherds with identifiable form classes. Among these features, bowls consistently outnumbered jars, except from the roasting pit (Feature 5612), in which jars outnumbered bowls by 18 to 14. As noted above, several researchers have suggested that broken-jar fragments were used as processing tools in connection with roasting pits (see also Garraty et al. 2010; Van Buren et al. 1992), which might account for the slightly higher ratio of jars to bowls in these features. Among the 8 structures, the bowl-to-jar ratios ranged from 1.2 to 6.2 bowls per jar. The structure with 6.2 bowls per jar was an outlier (Feature 3617); excluding the outlier, the other 7 cases ranged between 1.2

and 2.4 bowls per jar. These ratios were likely generated from domestic refuse deposits.

Middle Formative B Period

Only one of six structures assigned to the Middle Formative B period from Locus D (Feature 4768) contained more than 10 ceramics (see Table 55). The collection from Feature 4768 included 78 percent plain wares, exceeding even the highest percentage among the contemporaneous structures in Loci A (64 percent) and C (77 percent). These data imply that, relative to the inhabitants of Loci A and C, the inhabitants of Locus D used a higher proportion of plain wares than painted wares during the Middle Formative B period. But the sample of one structure is insufficient to infer broader patterns of pottery consumption and use. Moreover, the percentage was likely skewed because of mixing of ceramic materials in Locus D from the Middle Formative A and Late Formative B period occupations, during which unpainted wares composed a higher proportion of ceramic artifacts than painted wares. Unfortunately, we were unable to control for subsurface mixing.

Tucson Basin brown wares dominated the painted collections in Feature 4768 (see Table 56), accounting for 33 of 42 painted ceramics (79 percent), excluding indeterminate and split categories. Identifiable painted wares also included 8 Phoenix Basin buff wares and 1 Dragoon Red-on-brown sherd. No San Simon brown wares or other low-frequency painted-ware classes were recovered from Feature 4768.

A total of 19 rims or vessels from Feature 4768 (a structure) were identified by form class (see Table 57). The bowl-to-jar ratio was 3.8 to 1, well above the ratios for most of the structures assigned to the Middle Formative A period but consistent with the generally higher bowl-to-jar ratios associated with Middle Formative B period structures from Loci A and C. The average ratios among the Middle Formative B period structures with at least 20 identifiable forms in Loci A and C were 3.1 to 1 (five structures) and 5.3 to 1 (five structures), respectively.

Middle Formative/Late Formative A Period

Only two features—both roasting pits—were assigned to this period, only one of which included a collection size greater than 30 ceramics (Feature 4871) (see Table 55). Thirty-five of 40 ceramics from Feature 4871 were plain wares. Four of the 5 painted ceramics were Phoenix Basin buff wares (see Table 56), although the sample size was too small to evaluate a definite preference for buff wares over other painted wares. One other painted type was a Tucson Basin red-on-brown sherd. Only 5 form classes were identified from Feature 4871: 4 bowls and 1 jar (see Table 57).

Late Formative B Period

Four structures and one nonthermal extramural pit assigned to the Late Formative B period were excavated in Locus D. The four structures excavated in Locus D yielded a total of 2,641 ceramic remains. In contrast with the Middle Formative A period component, the ware percentages among the four Late Formative B period structures were relatively consistent (see Table 55). The plain ware percentages per structure ranged from 81 to 87 percent, with a mean of 83.4 percent and a standard deviation of 2.9 percent. Red wares were slightly more prevalent than in Middle Formative period features, composing between 2 and 10 percent of all ceramics in the four structures, with a mean of 5.2 percent and a standard deviation of 3.3 percent. The higher percentage of red wares for this period was not surprising, considering that red wares became more prominent during the Classic period in the Phoenix and Tucson Basins.

The majority of painted ceramics from the four structures were Tucson Basin brown wares and Roosevelt Red Ware (see Table 56). Tucson Basin brown wares accounted for between 4 and 6 percent of all ceramics, with a mean of 4.2 percent and a standard deviation of 1.1 percent. They accounted for between 22 and 63 percent of all painted ceramics, with a mean of 40 percent and a standard deviation of 18 percent. Excluding indeterminate cases, the percentages ranged from 33 to 68 percent, with a mean of 49 percent. Roosevelt Red Ware accounted for between 23 and 58 percent (excluding indeterminate cases), with a mean of 43 percent and a standard deviation of 17 percent.

The frequencies of Tucson Basin wares and Roosevelt Red Ware were roughly similar among the four structures, but the majority of identified Tucson Basin painted types in the Late Formative B period features actually predated the Late Formative period (i.e., excluding indeterminate and split categories). In Feature 1575, for example, Tanque Verde Red-on-brown—the only definite Late Formative period Tucson Basin brown ware type—constituted only 6 of 14 identifiable Tucson Basin brown ware sherds (excluding 24 indeterminate Tucson Basin red-on-brown sherds); 8 others were Middle Formative period types. In Feature 4684, only 2 of 17 identifiable Tucson Basin brown ware sherds were Tanque Verde Red-on-brown types. Moreover, over all Late Formative B period features, Tanque Verde Red-on-brown types (including the indeterminate Rincon or Tanque Verde Red-on-brown category) accounted for only 16 of 53 (30 percent) of the Tucson Basin brown ware sherds. Only one structure (Feature 4729) contained a higher number of Tanque Verde Red-on-brown sherds (n = 5) than Middle Formative brown ware types (n = 1). Assuming that these types were correctly identified, we must assume that most of the Tucson Basin brown wares in these features were mixed in from earlier components.

Roosevelt Red Ware outnumbered Tanque Verde Red-on-brown types by 101 to 16. This difference was probably somewhat exaggerated by the exclusion of the many indeterminate Tucson Basin red-on-brown wares (58 sherds), some of which were likely from Tanque

Verde Red-on-brown vessels. It is nonetheless clear that Roosevelt Red Ware was the predominant painted-ware class during the Late Formative B period, most likely by a sizable margin. As noted above, Clark and Lyons (2003) also found that the majority of painted sherds and vessels recovered from sites in the San Pedro Valley are Roosevelt Red Ware.

Phoenix Basin buff wares accounted for about 1 percent or less among the four structures. The buff wares recovered from the Late Formative B features also were likely from earlier deposits; no Casa Grande Red-on-buff sherds—the only buff ware type that dates to Late Formative period—were recognized in the collection. Only one Dragoon ware and no San Simon or other low-frequency painted wares were recovered from the four Late Formative B period structures. Clearly, by the Late Formative B period, communities in the Phoenix Basin and San Pedro River valley were no longer important suppliers of (or inspirations for) painted pottery at Mescal Wash.

Three of the structures included at least 20 identifiable form classes (Features 1575, 4683, and 4684) (see Table 57). The bowl-to-jar ratios among the features ranged from 0.6 to 2.1 bowls per jar, with an average of 1.4 to 1. So, the bowl-to-jar ratios declined among the Late Formative B period structures, relative to earlier occupations, for which the ratio for most structures was 2 to 1 or greater. One possible reason for this concerns the greater prevalence of painted vessels in the Middle Formative period deposits, the overwhelming majority of which were bowls.

Modified Sherds

A total of 133 recycled sherds were recovered from Locus D, which amounts to only 0.4 per 100 ceramic artifacts, a very low frequency (Table 58). This frequency was more or less equal to the frequencies of recycled sherds in Loci A (0.4) and C (0.3). The type of recycling was not consistently recorded, but most of them were disks (some perforated) or pieces with worked edges. The analysts observed that some of the disks probably functioned as spindle whorls.

The number of recycled sherds per 100 ceramic artifacts varied considerably among the features in Locus D, but none of the features stood out as being conspicuously rich in recycled sherds. Most of the cases with ratios greater than 1 were from small collections and, therefore, were not reliable indicators of increased usage of worked sherds. With respect to raw counts, three features contained 10 or more recycled sherds. In each case, the high counts reflected the larger overall collection size. The frequency of recycled sherds also did not change significantly over time. The number of recycled sherds per 100 ceramic artifacts for the Middle Formative A, Middle Formative B, and Late Formative B periods were virtually identical: 0.32, 0.35, and 0.33, respectively.

The Principal Research Themes: Detailed Analyses

The following discussion focuses on the principal research themes posed at the beginning of this chapter: (1) regional exchange and interaction and (2) site function and subsistence practices. In this section, we present analyses that address both of these questions.

Regional Interaction and Exchange

As explained above, the ceramic collection from Mescal Wash included a diversity of painted-pottery types associated with various regional traditions. The majority pertained to the Phoenix and Tucson Basin Hohokam traditions of southern and central Arizona and the Dragoon and San Simon traditions of southeastern Arizona (Heckman et al. 2000). As explained above, the Mescal Wash site is located along the interstices of several regional traditions or culture areas (see Figure 20). The site appears to have been situated on a cultural frontier at which individuals from different cultural traditions came into frequent contact, possibly creating a heightened sense of identity and affiliation, which may have been partly expressed through use and display of painted pottery. Consequently, a careful analysis of painted type distributions over time and space may provide insights into processes of intercultural interaction and exchange.

We inferred patterns of interaction and exchange by analyzing changes in painted-ware distributions over time and space at Mescal Wash. For diachronic analyses, we analyzed ceramic changes at varying levels of detail. On a broader level, we compared ceramic collections assigned to the Middle Formative A, Middle Formative B, and Late Formative B periods. Where sample sizes permitted, we also included the Middle Formative/Late Formative A period. The Early Formative period collection was too small to support detailed analyses. On a more refined level, we analyzed ceramic changes among the features that Lengyel assigned to the contemporaneity groups for the Middle Formative period (see Chapter 2, this volume).

To address spatial variability, we concentrated on ceramic differences among contemporaneous loci. Interlocus spatial analysis was only feasible for the Middle Formative B period, as Loci A, C, and D each encompassed relatively robust Middle Formative B period ceramic collections, but only Locus D contained robust collections pertaining to both the Middle Formative A and B period components. At a more detailed level, we also analyzed collections from contemporaneous features or discrete groups of features within each locus—mainly structures—to evaluate ceramic

Table 58. Modified-Sherd Frequencies, by Age and Feature, Locus D

Feature No.	Feature Type	Recycled (n)	Total	Recycled, per 100 sherds (n)
	Middle Formative A Period			
438	structure	13	5,946	0.22
825	structure	2	727	0.28
834	structure	1	687	0.15
3501	multiple features	1	1,037	0.10
3582	structure	5	682	0.73
3595	multiple features	1	40	2.50
3617	structure	6	856	0.70
3668	roasting pit	1	86	1.16
3679	structure	3	411	0.73
3681	structure	10	2,077	0.48
3710	structure	6	961	0.62
3895	nonthermal extramural pit	1	149	0.67
5612	roasting pit	1	974	0.10
5994	structure	2	440	0.45
7697	multiple features	1	796	0.13
7880	structure	4	1,707	0.23
8644	structure	1	898	0.11
11342	surface feature (indeterminate)	2	803	0.25
	Middle Formative B Period			
3818	*horno*	1	168	0.60
4768	structure	2	671	0.30
	Late Formative B Period			
4683	structure	7	1,578	0.44
4684	structure	1	1,763	0.06
4729	structure	2	1,158	0.17
	Early/Middle Formative Period			
4642	structure	3	326	0.92
4895	multiple features	1	44	2.27
	Middle Formative Period			
3545	structure	13	2,147	0.61
3817	structure	3	395	0.76
3869	structure	1	303	0.33
3870	borrow pits	3	845	0.36
4097	borrow pits	1	19	5.26
4682	structure	2	632	0.32
8655	structure	9	478	1.88
	Other/Indeterminate Age			
3067	roasting pit	2	165	1.21
3366	roasting pit	1	31	3.23
3544	multiple features	1	49	2.04
3677	structure	1	15	6.67
3748	multiple features	6	532	1.13
4029	nonthermal extramural pit	1	36	2.78
4043	multiple features	1	72	1.39
	nonfeatures	10		

variability in ceramic provisioning practices among households or house groups (possibly courtyard groups or other kin units). Many features could not be included in these analyses, because of small collection sizes.

Note that we analyzed the entire painted-ceramic collections from the features assigned to a given period or contemporaneity group, even though some portions of sherds in these collections likely encompassed mixed occupational components. We were unable to directly control for mixing. Ideally, with a very large and robust collection of painted sherds, we would be able to analyze only types assigned to a specific time period—for example, we could analyze only Sacaton buff wares for the Middle Formative B period and exclude other buff ware types that predated or postdated this period. Unfortunately, that was not possible, as only a small handful of painted sherds could be identified to a specific type. So, including only the securely "typed" sherds would drastically reduce the sample sizes per collection (per feature or component). It also would have introduced a bias, because type designations are easier for some ware classes than for others.

In the two subsections that follow, we discuss our analyses of the ceramic data at the levels of the broad period designations and the more-refined contemporaneity groups. In the first subsection, we compare and discuss our analysis of changes in painted-ware distributions on a per-period basis. For the Middle Formative B period, we analyzed spatial variability among locus collections. In the second subsection, we discuss our analysis of diachronic changes in pottery provisioning practices, using the chronologically refined contemporaneity groups (Middle Formative period only). These refined temporal data provided a solid basis for evaluating changes in ceramic use and provisioning over the course of several relatively short-term occupational episodes.

Painted Pottery and Interaction Spheres in the Middle and Late Formative Periods

Table 59 lists the painted-ware percentages (regional traditions) per component from the Middle Formative A period through the Late Formative B period, excluding the indeterminate and "split" categories. Also excluded were features with less-specific age assignments that encompassed broad or ambiguous temporal spans. Consequently, only features assigned to one of four successive age designations were included in this analysis: Middle Formative A period, Middle Formative B period, Middle/Late Formative A period, and Late Formative B period. The majority of sherds or vessels were recovered from features assigned to the Middle Formative A and B periods, which receive the lion's share of discussion. The Middle/Late Formative A period collection was relatively small (33 specimens); therefore, patterns inferred from this collection should be considered tentative.

Only locus components with a minimum of 30 total painted specimens were included in the analysis. Figure 35 summarizes the changes over time for each regional painted-ware class; note that the Middle Formative B period percentage illustrated in Figure 35 is the average among the three locus components for this period designation (as shown in Table 59). We discuss the painted wares from the Middle and Late Formative period component collections separately.

Middle Formative Period

Tucson Basin brown wares composed the majority in all loci, but the percentages varied over time (see Figure 35). The percentages of Tucson Basin brown wares peaked during the Middle Formative B period at Mescal Wash, which matches the zenith of the Hohokam regional ballcourt system (Wilcox and Sternberg 1983); percentages ranged from 57 to 85 in the three loci, with an average of 70 percent. In contrast, Tucson Basin brown wares composed 40–50 percent of all identifiable painted types during the Middle Formative A, Middle/Late Formative A, and Late Formative B periods. In the Middle Formative B period component, the percentages of Tucson Basin types varied among the three loci, suggesting the possibility of different provisioning practices or cultural affiliations among contemporaneous residential communities during the Middle Formative B period occupation (see below). Below, we explore these differences in more detail, at the level of individual structures.

Use of Phoenix Basin buff wares peaked during the Middle Formative A period, as evidenced by the collection from Locus D; Tucson Basin brown wares slightly outnumbered Phoenix Basin buff wares by 1.4 to 1. By the Middle Formative B period, conversely, Tucson Basin brown wares outnumbered buff wares by about 3 to 1 in Loci C and D and by 25 to 1 in Locus A. The frequency of Phoenix Basin buff wares oscillated over time, as illustrated in Figure 35. The Middle Formative/Late Formative A period collection from Locus A suggests a possible resurgence in Phoenix Basin buff wares during that period, although this observation should be considered tentative, given the small sample size of painted sherds from features assigned to this period.

Dragoon brown wares were relatively infrequent in the Middle Formative A period component but increased proportionally during the subsequent Middle Formative B period. On average, the percentages of Dragoon and Phoenix Basin buff wares were roughly equal during the Middle Formative B period (see Figure 35), but Dragoon brown wares outnumbered Phoenix Basin buff wares by 1.2 to 1 in Locus C and by 3.5 to 1 in Locus A. The higher ratio of buff wares in Locus D (3.8 to 1) was probably related to mixing of earlier Middle Formative A period materials with features assigned to the Middle Formative B

Table 59. Regional Ware Percentages, by Locus and Component

Ware Category	Middle Formative A Period	Middle Formative B Period				Middle/Late Formative A Period	Late Formative B Period
	Locus D	Locus A	Locus C	Locus D	Mean	Locus A	Locus D
Tucson Basin	49.9	84.2	57.1	69.8	70.4	42.4	48.1
Phoenix Basin	36.2	3.4	19.2	23.8	15.5	30.3	7.4
Dragoon	7.5	11.7	22.2	6.3	13.4	27.3	0.9
San Simon	5.0	0.4	0.4		0.3		
Trincheras	0.7	0.2			0.1		
Mimbres			0.5		0.2		
Babocomari			0.2		0.1		
San Carlos			0.4		0.1		
Roosevelt Red	0.6						43.7
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Number of specimens	1,129	912	567	63	—	33	231

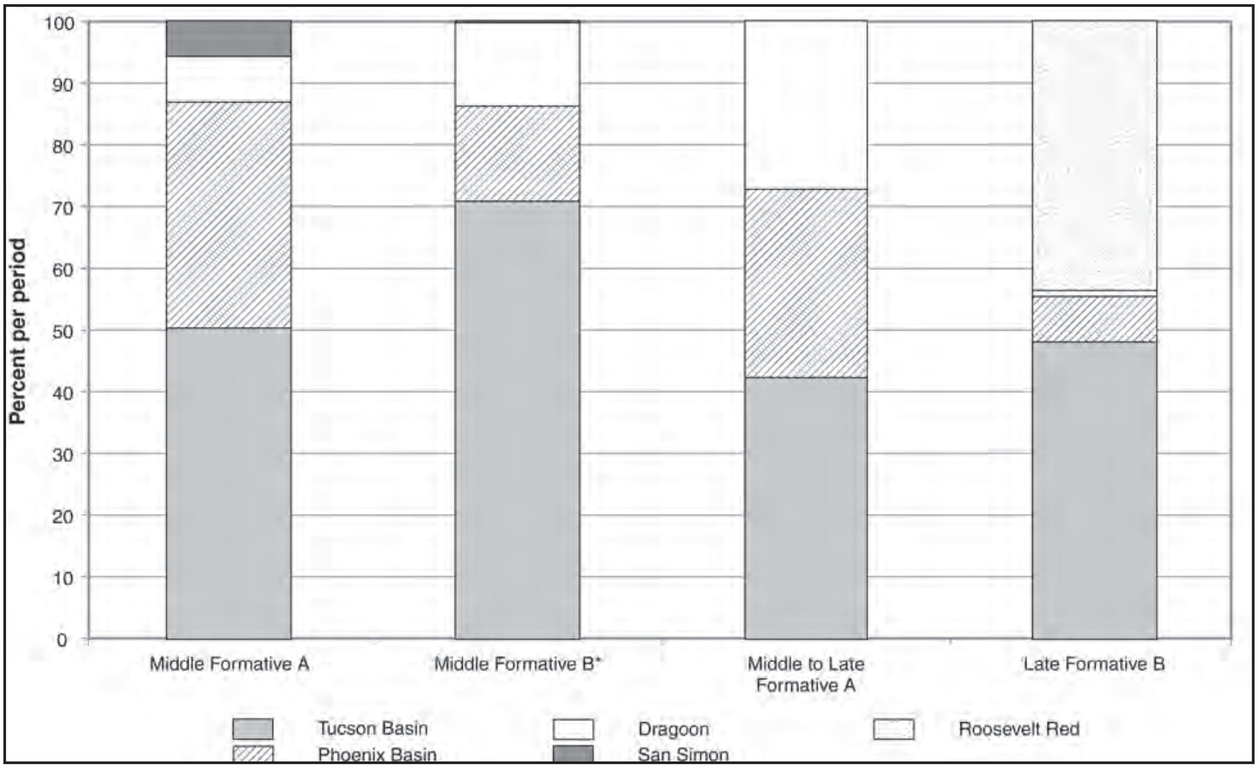


Figure 35. Bar graph showing the painted-ware-class percentages per period. The Middle Formative B period percentages were averaged for the three loci.

period. Dragoon brown ware peaked in the Middle/Late Formative A period, but again, the sherd collection for this period was very small.

San Simon brown wares peaked in the Middle Formative A period and were virtually nonexistent thereafter. A total of 57 San Simon brown ware sherds were recovered from features assigned to the Middle Formative A period component of Locus D, but only 6 sherds were recovered from features assigned to the Middle Formative B period over the three loci. The range of San Simon wares supports an early peak for this ware class. Excluding indeterminate cases, 88 percent (84 of 96) of San Simon brown ware sherds were Piñaleno and Galiuro Red-on-brown, which have date ranges that overlap the Middle Formative A period (A.D. 700–800 and A.D. 700–950, respectively). Only 9 percent (6 of 96) of the San Simon painted sherds identified by type overlapped with the Middle Formative B period, including a small number of Encinas Red-on-brown and Cerros Red-on-white sherds (both have date ranges of A.D. 950–1150). No San Simon painted types were recovered from later components.

It was difficult to infer significant diachronic patterns among the various low-frequency painted categories, given the very small sample sizes. One possible pattern concerns the peak frequency of Trincheras painted wares during the Middle Formative A period. A total of eight Trincheras painted sherds were collected from the Middle Formative A period component in Locus D (0.7 percent, mainly purple-on-red sherds), compared to only two sherds (0.1 percent) from the Middle Formative B components (both Nogales polychromes, from Locus A). The very low sherd frequency for this ware class provided insufficient evidence to infer a temporal trend.

The distribution of Middle Formative period painted wares presented in Table 59 can be analyzed from the perspective of different interaction spheres. As mentioned above, Mescal Wash is located on the cusp of the large Hohokam sphere to the west and the various smaller Mogollon areas to the east (e.g., Dragoon, San Simon, Mimbres). Viewed from this perspective, we can think of the site as being situated on the frontier of a western interaction sphere (Hohokam) and an eastern interaction sphere (western branch of the Mogollon in the San Pedro Valley). For the Middle Formative A period, 86 percent of painted sherds were associated with the western sphere, and 13 percent were associated with the eastern sphere. In the Middle Formative B period, the percentages were almost identical: 86 percent were associated with the western sphere, and 14 percent were associated with eastern sphere (using the average percentages among the three loci). These data illustrate that the level of participation in the eastern and western interaction spheres remained remarkably consistent through the Middle Formative period.

The percentages of painted wares within these spheres were not consistent. For the western sphere, the percentage of Tucson Basin brown wares increased from 50 percent in the Middle Formative A period component to 70 percent in Middle Formative B period component. This percentage increase matches the percentage decline in Phoenix Basin buff wares from 36 percent to 16 percent. In the eastern sphere, the percentages of Dragoon and San Simon painted wares were roughly equal in the Middle Formative A period component (7.5 and 5 percent, respectively). In the Late Formative B period component, San Simon wares were virtually absent. Dragoon painted pottery eclipsed San Simon painted pottery during this span, implying changes in exchange or migration patterns. This analysis provides testable hypotheses for future testing and research at Mescal Wash and other sites in the region.

Late Formative Period

Patterns of interregional interaction changed drastically throughout the greater Southwest during the Late Formative B period (see Crown 1994). Dragoon and San Simon painted-ware types generally fell into disuse by this time (see Heckman et al. 2000). Social interaction with buff ware producers in the Phoenix Basin also seems to have dissipated by this time; no Casa Grande Red-on-buff sherds have been recovered. Red wares were prevalent in the Phoenix Basin during the Late Formative (Classic) period; therefore, it is plausible that some of the red wares were exported from the Phoenix Basin, but without compositional data, we are unable to infer the provenance of red wares.

Figure 35 suggests roughly equal proportions of Roosevelt Red Ware and Tucson Basin brown wares in the Late Formative B period component, which is misleading. Roosevelt Red Ware was the dominant painted ware in the Late Formative B period collection, as explained above. The majority of Tucson Basin painted sherds recovered from Late Formative B period features (four structures) were probably mixed in from earlier depositional episodes, given the preponderance of Middle Formative period red-on-brown wares. Few of the identified Tucson Basin painted wares recovered from these features dated to the Late Formative period; Tanque Verde Red-on-brown, the sole Late Formative period type, was relatively rare. The inhabitants of Mescal Wash likely participated in the ritual-based regional integrative system focused on the use of Roosevelt Red Ware pottery during the Late Formative B period (see Crown 1994).

Cultural Affiliation and Pottery Consumption at the Mescal Wash Site

In this section, we discuss our analysis of variability in painted-ware distributions among individual features or spatially concentrated groups of features. Our objective was to detect patterns of variation that might indicate different cultural affiliations or exchange practices among contemporaneous residences or kin groups. To facilitate analysis, we grouped the structures into larger units, based on spatial proximity. Some of these contemporaneous structures may represent courtyard groups or other supraresidential kin groups. We restricted our analyses to features with collections containing at least 30 painted sherds.

Middle Formative A Period

The structures assigned to the Middle Formative A period in Locus D could be clustered in four discrete spatial groups. (We use the term "feature group" to discuss them, to avoid confusion with the temporal groups discussed below.) Feature Group 1 included a cluster of three structures in the south-central portion of the locus (Features 825, 834, and 8664). Feature Group 2 consisted of a single structure (Feature 7880) in the southwestern part of the locus. Feature Group 3 was composed of two adjacent structures in the north-central area of the locus (Features 438 and 3710). Feature Group 4 included four structures along the locus' eastern edge (Features 3582, 3617, 3679, and 3681) (Figure 36).

The four feature groups possessed distinct painted-ware compositions (Table 60). A chi-square contingency-table analysis showed that the frequencies of painted wares in the groups were significantly different at the 0.0001 level ($\chi^2 = 154.0$, $df = 9$, $p < .0001$). Put another way, this result indicates a less than 1 in 10,000 likelihood of observing this distribution of ware classes among the feature groups by random chance. Figure 37 illustrates the differences in ware-class percentages among the four main ware classes (i.e., excluding split, indeterminate, and low-frequency painted wares and types; see above).

Feature Group 1 was characterized by a low ratio of Tucson Basin to Phoenix Basin painted wares (0.5 to 1) (see Table 60 and Figure 37). This group also included a higher percentage of San Simon painted wares (8.7 percent) than did the other groups. No Dragoon brown ware ceramics were recovered from Feature Group 1, even though they constituted 20 percent of painted ceramics over all features. Overall, the residential or kin group that inhabited this portion of Locus D obtained painted pottery from both the western (Hohokam) and eastern interaction spheres. They appear to have preferred Phoenix Basin buff wares over Tucson Basin brown ware and San Simon painted pottery over Dragoon brown ware.

Feature Group 2 (Feature 7880), like Feature Group 1, included a low ratio of Tucson Basin to Phoenix Basin painted wares (0.8 to 1), but it had a high ratio of Dragoon to San Simon painted wares (7 to 1) (see Table 60; Figure 37). Phoenix Basin buff wares did not outnumber Tucson Basin painted wares to the same extent as in Feature Group 1. Dragoon brown wares constituted 8.8 percent of the Feature Group 2 collection, which was equal to the 8.7 percent of San Simon painted wares in Feature Group 1. So, whereas the locus inhabitants in the vicinity of Feature Group 1 preferred San Simon painted pottery from the eastern sphere, the residents of structure Feature 7880 preferred Dragoon brown ware.

The high proportion of Tucson Basin brown wares distinguished Feature Groups 3 and 4 from Feature Groups 1 and 2. Unlike the latter two groups, Tucson Basin brown wares outnumbered Phoenix Basin buff wares in Feature Groups 3 and 4 by a margin ranging from 1.1 to 1 (Feature 438) to 4.4 to 1 (Feature 3617) (see Table 60). Overall, Tucson Basin brown wares outnumbered Phoenix Basin buff wares to a much greater extent in Feature Group 4 (2.9 to 1) than in Feature Group 3 (1.2 to 1). Differing ratios of Dragoon and San Simon painted wares also distinguished Feature Groups 3 and 4. Dragoon brown wares outnumbered San Simon brown wares in Feature Group 3 by a considerable margin, and this was almost entirely attributable to the inclusion of Feature 438. In Feature Group 4, San Simon painted wares outnumbered Dragoon brown wares by more than 3 to 1 in three of the four features. The exception was Feature 3679, the only feature in Feature Group 4 that was not spatially contiguous with the others. It is possible that Feature 3679 was part of a different residential group or kin group.

On the whole, the feature groups in the west and central areas of Locus D seem to have favored Phoenix Basin buff wares (especially Feature Group 1). In contrast, in Feature Group 4, in the easternmost extent of the locus, Tucson Basin brown ware pottery was dominant. This pattern suggests an east-west distinction in painted-pottery preferences within Locus D. Also, the residents of Feature Groups 1 and 4 seem to have preferred San Simon brown wares, to the near exclusion of Dragoon brown wares. The opposite is true of Feature Groups 2 and 3, in which Dragoon brown wares outnumbered San Simon brown wares.

These results suggest the possibility of separate and independent provisioning practices for painted pottery among different residential and kin groups in Locus D. Different residential or kin groups might have separately and independently established trade connections to ceramic producers, kinsmen, or other social affines in various areas. Alternatively, these data may indicate variable cultural affiliations or identities among these residential groups. As has been stated, we were unable to infer whether these patterns of "affiliation" indicate migration from these other regions or local imitations of nonlocal painted-pottery styles. (We deliberately use the rather vague term "affiliation" here, to avoid implying any of these possibilities.) Additional lines of evidence—from architectural styles or other culturally sensitive artifact classes—will be needed to test the validity of this pattern.

Middle Formative B Period

In contrast with the Middle Formative A period features, intralocus clusters of structures were not definable for the Middle Formative B period, primarily because the

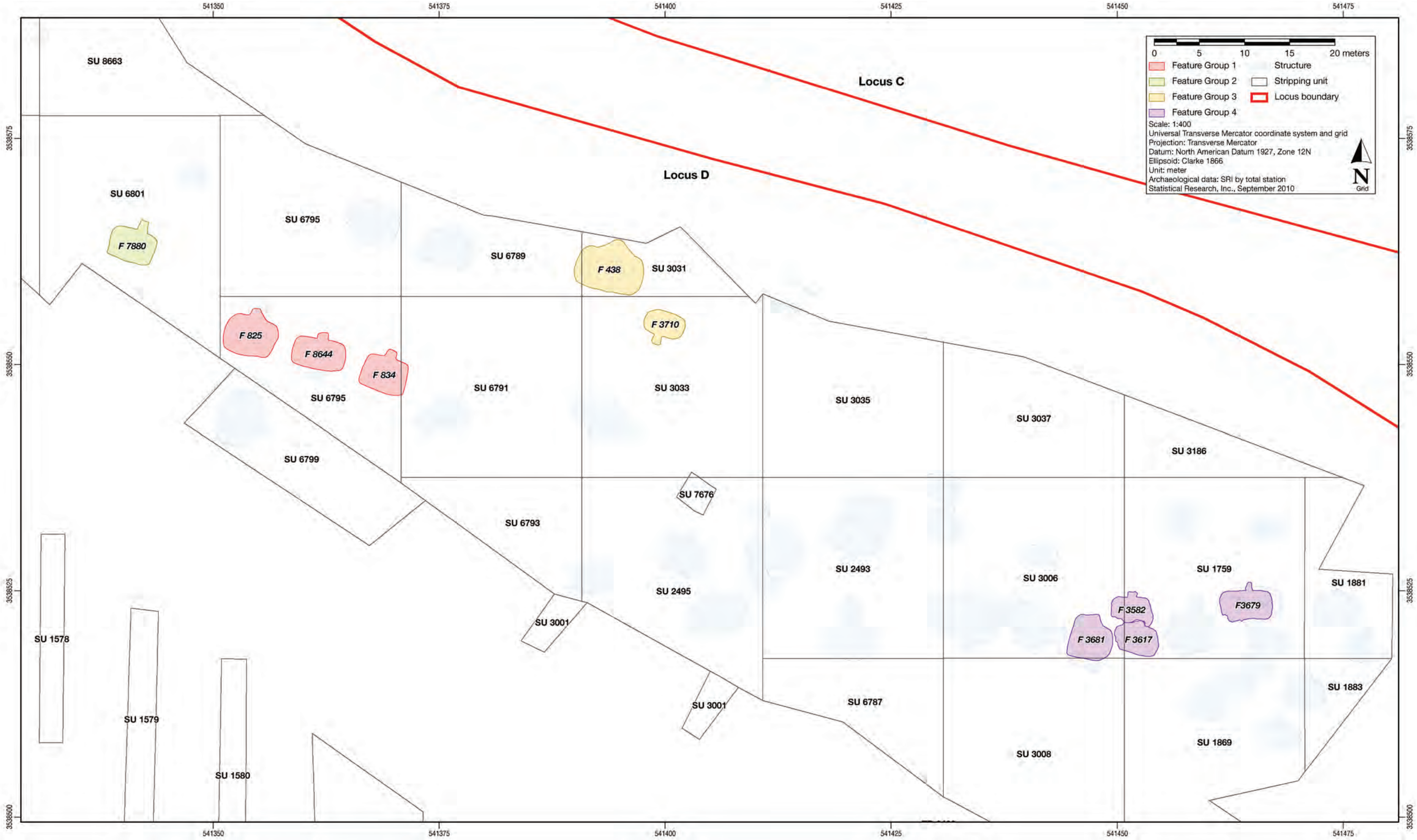


Figure 36. Map showing the locations of features assigned to Feature Groups 1–4 in Locus D, Middle Formative A period.

Table 60. Counts and Percentages of Painted Wares Assigned to the Middle Formative A Period, by Feature Group and Structure, Locus D

Feature No.	Western Sphere					Eastern Sphere					Other/Indeterminate				Total
	Tucson Basin		Phoenix Basin		Ratio	Dragoon		San Simon		Ratio	Other		Indeterminate Painted		
	n	%	n	%		n	%	n	%		n	%	n	%	
Feature Group 1															
825	12	24.5	15	30.6	0.8 to 1	—		7	14.3	0 to 7.0	—		15	30.6	49
834	6	11.3	26	49.1	0.2 to 1	—		4	7.5	0 to 4.0	—		17	32.1	53
8644	8	16.7	15	31.3	0.5 to 1	—		2	4.2	0 to 2.0	—		23	47.9	48
All	26	17.3	56	37.3	0.5 to 1	—		13	8.7	0 to 13.0	—		55	36.7	150
Feature Group 2															
7880	27	33.8	36	45.0	0.8 to 1	7	8.8	1	1.3	7.0 to 1	—		9	11.3	80
Feature Group 3															
438	85	31.1	79	28.9	1.1 to 1	39	14.3	—	—	39 to 0	—		70	25.6	273
3710	23	54.8	9	21.4	2.6 to 1	3	7.1	2	4.8	1.5 to 1	—		5	11.9	42
All	108	34.3	88	27.9	1.2 to 1	42	13.3	2	0.6	21 to 1	—		75	23.8	315
Feature Group 4															
3582	51	46.4	23	20.9	2.2 to 1	—		6	5.5	0 to 6.0	4	3.6	26	23.6	110
3617	75	58.6	17	13.3	4.4 to 1	—		14	10.9	0 to 14.0	—		22	17.2	128
3679	9	23.1	5	12.8	1.8 to 1	4	10.3	—		4.0 to 0	—		21	53.8	39
3681	131	47.8	47	17.2	2.8 to 1	4	1.5	13	4.7	0.3 to 1	2	0.7	77	28.1	274
All	266	48.3	92	16.7	2.9 to 1	8	1.5	33	6.0	0.2 to 1	6	1.1	146	26.5	551

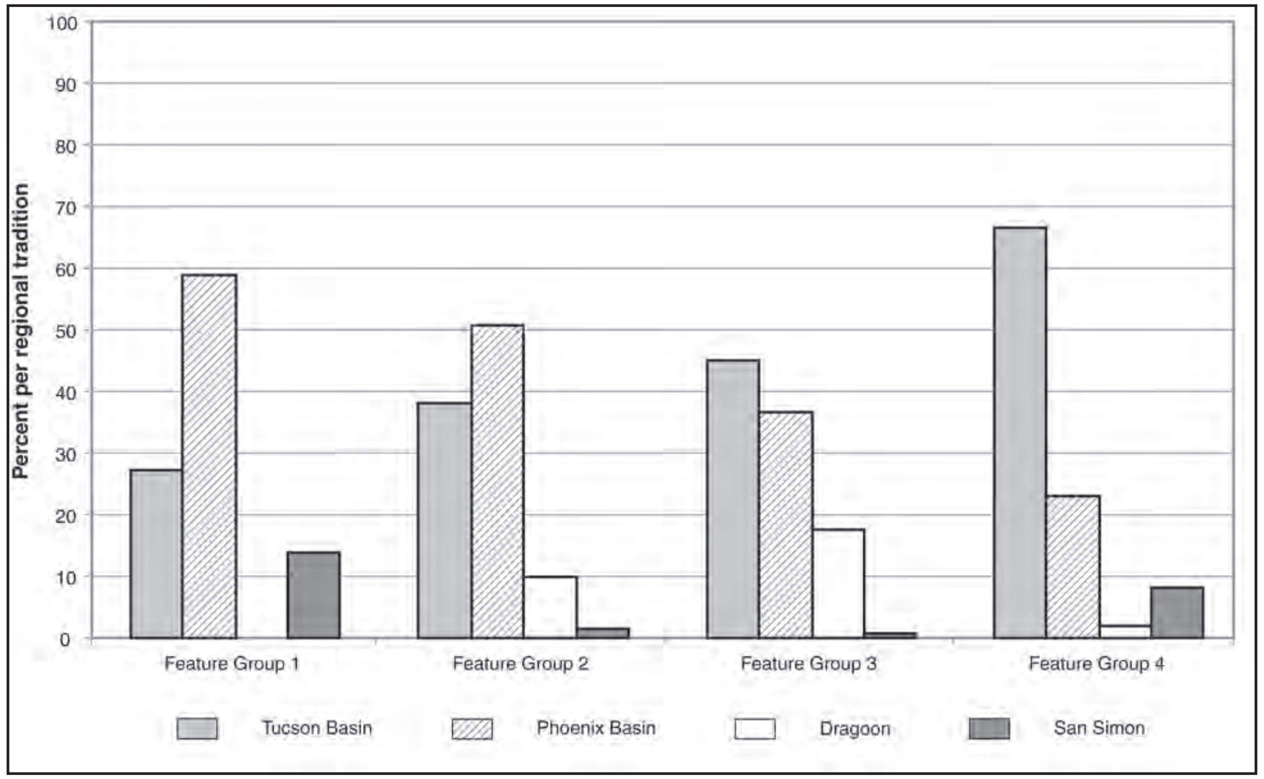


Figure 37. Bar graph showing the percentages of painted-ware classes per feature group, Middle Formative A period.

excavation blocks in Loci A and C were substantially smaller than the very large area exposed in Locus D. All but 1 of 14 structures assigned to the Middle Formative B period were located in Loci A and C (Figure 38). The excavated structures assigned to this period in these loci were located close to one another, with no obvious spatial groups. Three feature groups were defined for this analysis

Feature Group 1 consisted of 7 structures with robust painted-sherd collections excavated in Locus A (Features 200, 207, 290, 1189, 2157, 2160, and 2192). Feature Group 2 included 6 structures with robust collections in Locus C (Features 379, 995, 6098, 6129, 6154, and 7461). Feature Group 3 consisted of 1 structure in Locus D (Feature 4768). It is worth noting that 5 features were RHS structures, including Features 2160 and 2192 in Locus A and Features 379, 995, and 6098 in Locus C. One goal of our analysis was to determine whether this architectural style was associated with one or several painted-pottery traditions that could shed light on its cultural origin.

Table 61 lists the counts and percentages of painted wares for the three feature groups, which are shown graphically in Figure 39. A chi-square analysis showed that the compositional differences among the groups were statistically significant ($\chi^2 = 148.3$, $df = 4$, $p < .0001$). Again, this indicates a less than 1 in 10,000 likelihood of observing a distribution this variable by random chance. As explained above, frequencies of painted types associated with the Phoenix Basin buff ware and San Simon painted traditions declined considerably from the Middle Formative A to the Middle Formative B period. San Simon painted ceramics were virtually absent, and those recovered from Middle Formative B contexts may have been intrusive from previous occupations. Therefore, we do not list the ratios of Dragoon to San Simon wares for the groups and features listed in Table 61, nor do we graphically depict the frequencies of San Simon painted wares in Figure 39 (they are included in the "Other" category).

Feature Group 1 (Locus A) was marked by a very high frequency of Tucson Basin brown wares and very low frequencies of other ware classes. On average, Tucson Basin brown wares outnumbered Phoenix Basin buff ware sherds by about 23 to 1, and they outnumbered Dragoon brown wares by about 7 to 1. Phoenix Basin buff wares composed no more than 6 percent of the painted collection in any of the Feature Group 1 features and composed less than 3 percent of the combined group collection. Dragoon wares, the second-most-frequent ware class, composed roughly 9 percent of the combined Feature Group 1 collection.

Phoenix Basin buff wares and Dragoon brown wares were substantially more frequent in Feature Group 2 (Locus C). On average, the ratio of Tucson Basin brown

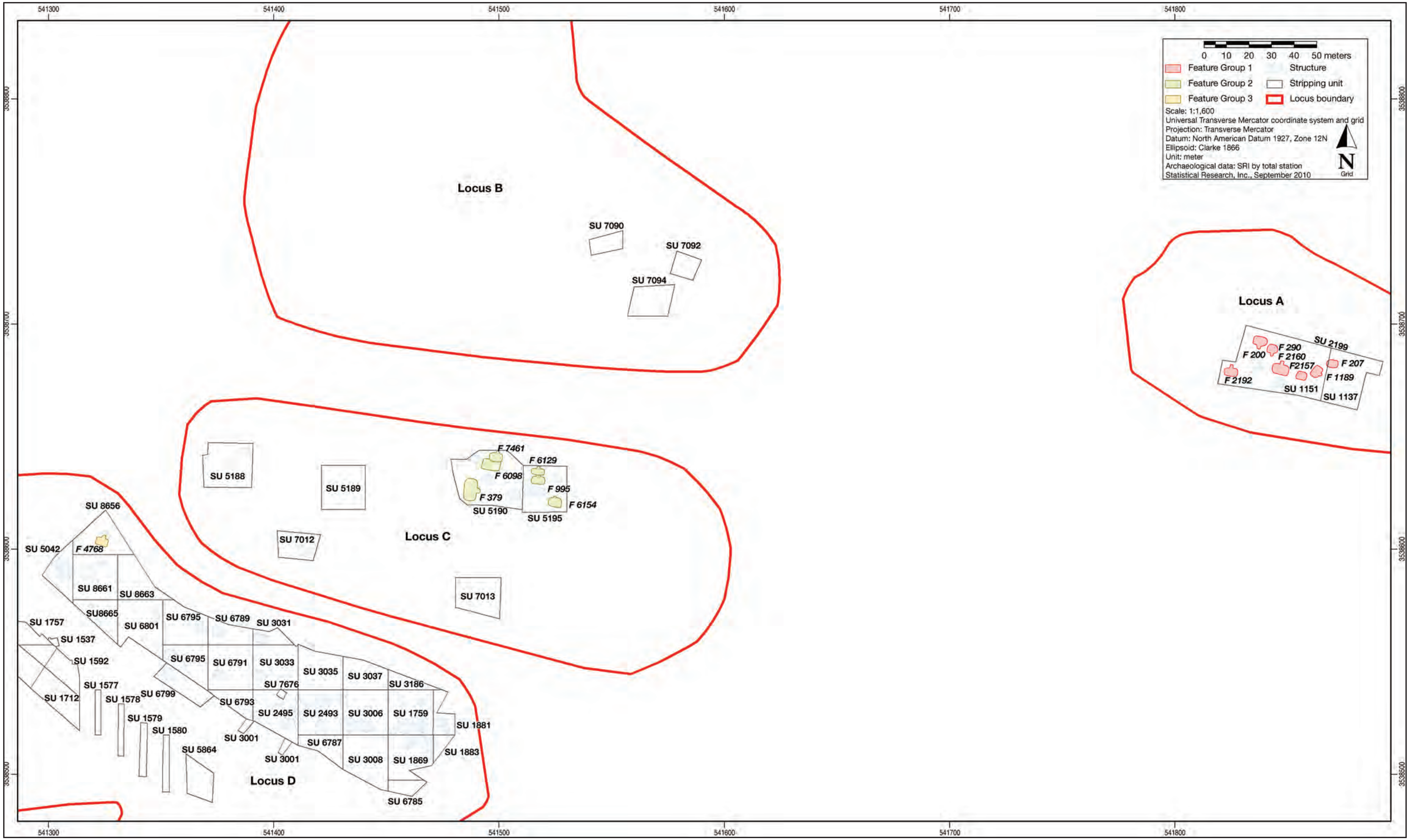


Figure 38. Map showing the locations of features assigned to Feature Groups 1-3 in Loci A, C, and D, Middle Formative B period.

Table 61. Counts and Percentages of Painted Wares, by Structure Group/Locus, and Structures Assigned to the Middle Formative B Period, Loci A, C, and D

Feature No.	Western Sphere					Eastern Sphere				Other/Indeterminate				Total
	Tucson Basin		Phoenix Basin		Ratio	Dragoon		San Simon		Other		Indeterminate Painted		
	n	%	n	%		n	%	n	%	n	%	n	%	
Feature Group 1 (Locus A)														
200	75	45.2	3	1.8	25 to 1	13	7.8	1	0.6	2	1.2	72	43.4	166
207	70	51.9	1	0.7	70 to 1	11	8.1	2	1.5	—		51	37.8	135
290	45	60.0	1	1.3	45 to 1	—		—		—		29	38.7	75
1189	40	90.9	—		40 to 0	2	4.5	—		—		2	4.5	44
2157	30	63.8	2	4.3	15 to 1	3	6.4	—		—		12	25.5	47
2160[a]	95	56.9	10	6.0	9.5 to 1	3	1.8	—		—		59	35.3	167
2192[a]	365	63.8	14	2.4	26.1 to 1	72	12.6	1	0.2	2	0.3	118	20.6	572
Total	720	59.7	31	2.6	23.2 to 1	104	8.6	4	0.3	4	0.3	343	28.4	1,206
Feature Group 2 (Locus C)														
379[a]	179	33.6	66	12.4	2.7 to 1	27	5.1	—		2	0.4	258	48.5	532
995[a]	70	51.9	8	5.9	8.8 to 1	7	5.2	—		—		50	37.0	135
6098[a]	31	27.9	8	7.2	3.9 to 1	39	35.1	—		1	0.9	32	28.8	111
6129	2	5.1	1	2.6	2 to 1	8	20.5	—		—		28	71.8	39
6154	11	13.8	13	16.3	0.8 to 1	28	35.0	—		—		28	35.0	80
7461	15	11.4	12	9.1	1.3 to 1	8	6.1	—		—		97	73.5	132
Total	308	29.9	108	10.5	2.9 to 1	117	11.4	—		3	0.3	493	47.9	1,029
Feature Group 3 (Locus D)														
4768	33	47.8	8	11.6	4.1 to 1	1	1.4	—		—		27	39.1	69

[a] Recessed-hearth structures.

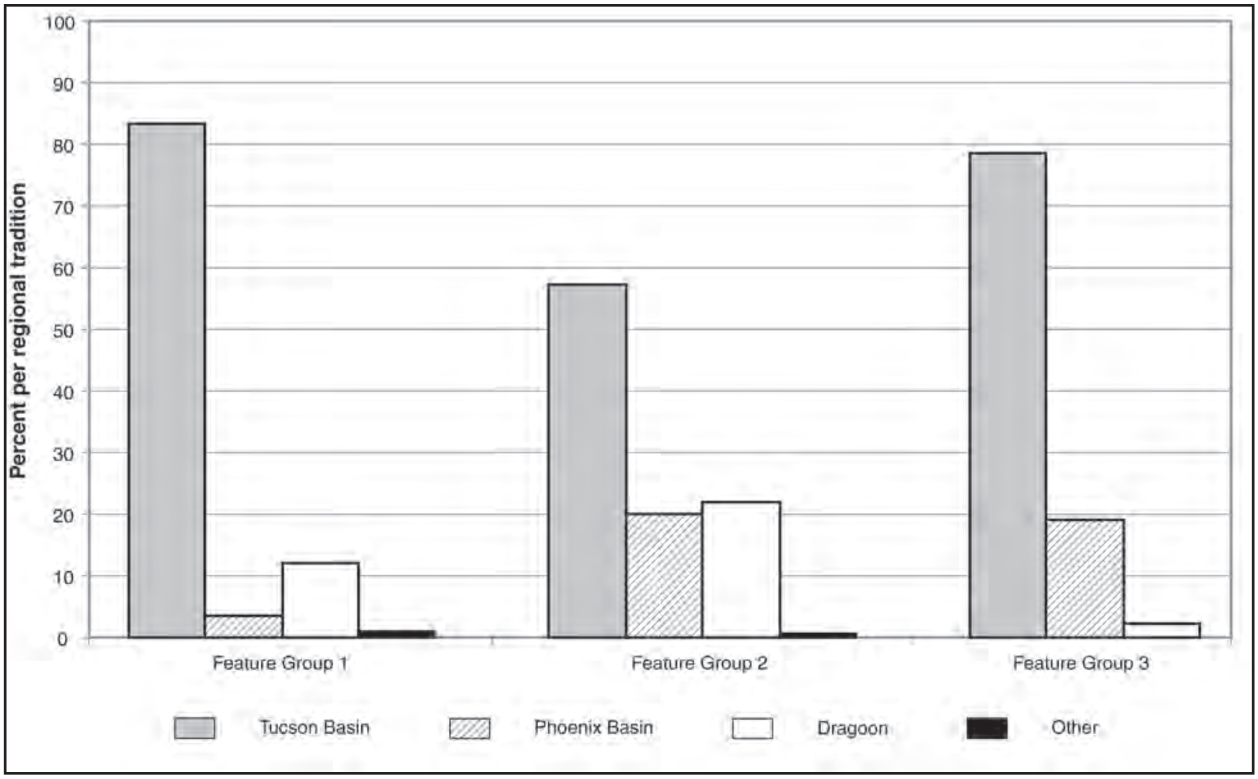


Figure 39. Bar graph showing the percentages of painted-ware classes per feature group, Middle Formative B period.

wares to both Phoenix Basin and Dragoon painted wares was about 3 to 1 in Feature Group 2 for both wares, compared to 23 to 1 and 7 to 1, respectively, in Feature Group 1 (see Table 61). Notably, the buff wares in Locus C did not appear to have been Middle Formative A period sherds mixed in with Middle Formative B period features; all of the buff wares identified by type in these features (n = 14) were classified as Sacaton Red-on-buff, a Middle Formative B period type (specific types could not be identified for 50 buff ware sherds). So, the very different frequencies of Phoenix Basin types in Feature Groups 1 and 2 are likely attributable to distinct preferences or affiliations and not to postdepositional formation processes.

In Feature Group 3 (Feature 4768 in Locus D), the ratio of Tucson Basin brown wares to Phoenix Basin buff wares (4 to 1) matched the ratio in Feature Group 2 (see Table 61), but Dragoon brown wares were virtually absent in Feature Group 3. Moreover, some of the Phoenix Basin buff ware sherds may have been mixed in from Middle Formative A period deposits, given the large Middle Formative A period occupation in Locus D. Only two buff wares were identified by type from Feature 4768, including one Sacaton Red-on-buff sherd and one earlier type (Santa Cruz Red-on-buff); six others were not identified by type. We suspect (but cannot prove) that many of the buff ware sherds in the Feature 4768 collection were mixed in from earlier deposits, and so the painted-pottery composition of Feature Group 3 probably more closely resembles that of Feature Group 1 than that of Feature Group 2.

Overall, the residents of the Middle Formative B period feature groups preferred Tucson Basin brown ware pottery, especially the residents of Feature Groups 1 and 3 (Loci A and D). The residents in Feature Group 2 (Locus C) also procured relatively higher frequencies of Phoenix Basin and Dragoon pottery than did the residents of Feature Groups 1 and 3. The Middle Formative B period residents in Locus C appear to have maintained slightly different, and more diversified, social and economic ties to populations outside the local area. In contrast, the Middle Formative B period residents in Loci A and D mainly maintained social and economic ties to populations in the Tucson Basin.

Importantly, the painted-pottery-ware percentages did not vary significantly between the RHS and non-RHS features (see Table 61). A chi-square comparison of the painted-pottery frequencies from the RHS and non-RHS structures—calculated using counts of Tucson Basin, Phoenix Basin, and Dragoon painted wares—indicated a roughly 40 percent likelihood of deriving the observed frequencies by chance ($\chi^2 = 1.82$, $df = 2$, $p = .402$). Therefore, no correlation was evident between the RHS structures and any of the three major pottery traditions. In other words, whereas the distribution of painted-pottery types varied spatially among the defined feature groups and loci, as defined above, they did not vary according to the presence or absence of a recessed hearth. The painted-pottery data, therefore, do not shed light on the question of whether RHS architecture was associated with a specific regional tradition. Vanderpot and Altschul (2007) noted that many of the RHS structures were later built over or remodeled without recessed hearths and that any distinctive deposits related to the occupation of the RHS structures may be obfuscated by mixing with later deposits from the "post-RHS" occupations.

Late Formative B Period

The Late Formative period painted-pottery traditions in southern Arizona varied considerably from the Middle Formative period traditions. As explained above, Roosevelt Red Ware was the most frequent painted-ware class in the Mescal Wash site collection for this period. The Dragoon tradition largely dissipated around A.D. 1100 (Heckman 2000b). No Late Formative period Phoenix Basin buff ware sherds (i.e., Casa Grande Red-on-buff) were recovered, although some may have been present among the many indeterminate buff wares. One Tucson Basin red-on-brown type also persisted into the Late Formative period—Tanque Verde Red-on-brown—but this clearly was eclipsed in popularity by Roosevelt Red Ware types (especially Gila Polychrome) at Mescal Wash. Use of unpainted red wares also peaked during the Late Formative B period.

Only the four structures assigned to the Late Formative B period possessed adequate collection sizes for this analysis, all of which were located in Locus D (Features 1575, 4683, 4684, and 4729). These structures were located in close proximity to Middle Formative period features and deposits; therefore, the probability of subsurface mixing was elevated, as evidenced by the high frequencies of Middle Formative period painted wares in these collections. For this reason, we only list the counts and percentages of three ware or type categories: Roosevelt Red Ware, Tanque Verde Red-on-brown, and unpainted red wares. We include the last type because it is associated with the Hohokam tradition and, like most painted pottery, was used frequently as serving vessels for food and drink (see Abbott 2000).

We defined three feature groups of structures based on their spatial distribution within Locus D, two of which included a single feature. Feature Group 1 consisted of Features 4683 and 4684, located adjacent to one another in the south-central portion of the locus. Feature Group 2 only included Feature 1575, located in an isolated excavation block in the southwestern corner of the locus. Feature Group 3 consisted of Feature 4729, located in the western edge of the locus. The locations of these features are shown in Figure 40.

The counts and percentages of the three ware and type categories per feature group are listed in Table 62 and illustrated in Figure 41. A chi-square analysis showed that the compositional differences among the groups were statistically significant ($\chi^2 = 37.5$, $df = 4$, $p < .001$). Among the three feature groups, Tanque Verde Red-on-brown sherds were consistently rare in the collections. The main source of variation, therefore, relates to the Roosevelt Red Ware and unpainted red ware sherds.

Feature Group 1 consisted of roughly equal frequencies of Roosevelt Red Ware and unpainted red ware sherds and a small number of Tanque Verde Red-on-brown sherds. Also notable are the different percentages between the two features that constituted Feature Group 1. Feature 4683 possessed a considerably higher percentage of Roosevelt Red Ware and fewer unpainted red wares than did Feature 4684. This pattern may suggest distinct pottery provisioning practices among these adjacent residences. Another possibility is that the two features were not occupied simultaneously and that the different ware frequencies may reflect varying patterns of interregional exchange during different time spans within the Late Formative B period. The ceramic composition of Feature Groups 2 and 3 also varied substantially, again mainly in the different percentages of Roosevelt Red Ware and unpainted red wares. Feature Group 2 contained a higher frequency of unpainted red wares and a comparatively low frequency of Roosevelt Red Ware than did Feature Group 3.

Overall, Feature Group 2 was dominated by unpainted red wares, and Feature Group 3 was dominated by Roosevelt Red Ware. In contrast, Feature Group 1 contained almost equal proportions of both. The variability among the three groups might indicate separate and independent pottery provisioning practices and trade relationships. Additional lines of evidence will be needed to test this hypothesis.

A Refined Chronology of Middle Formative Period Pottery Use

In this section, we discuss our analysis of changes over time in pottery consumption and use during the Middle Formative period, using the fine-grained occupational episodes outlined by Lengyel in Chapter 2 of this volume. She inferred contemporaneity groups of coeval occupations for Loci C and D, as well as for the site as a whole, based on careful inspections of AM data, stratigraphic relationships, and distributions of time-sensitive artifacts. The groups provided a means of analyzing ceramic trends at a far-more-refined level of detail than is possible using the broader period designations. In Locus D, for example, Lengyel defined seven contemporaneity groups that cover the entire Middle Formative period sequence.

We analyzed the ceramic data in these groups, starting with the site-wide scale, as discussed in the first subsection below. In the subsequent sections, we separately discuss our analyses of ceramic distributions among contemporaneity

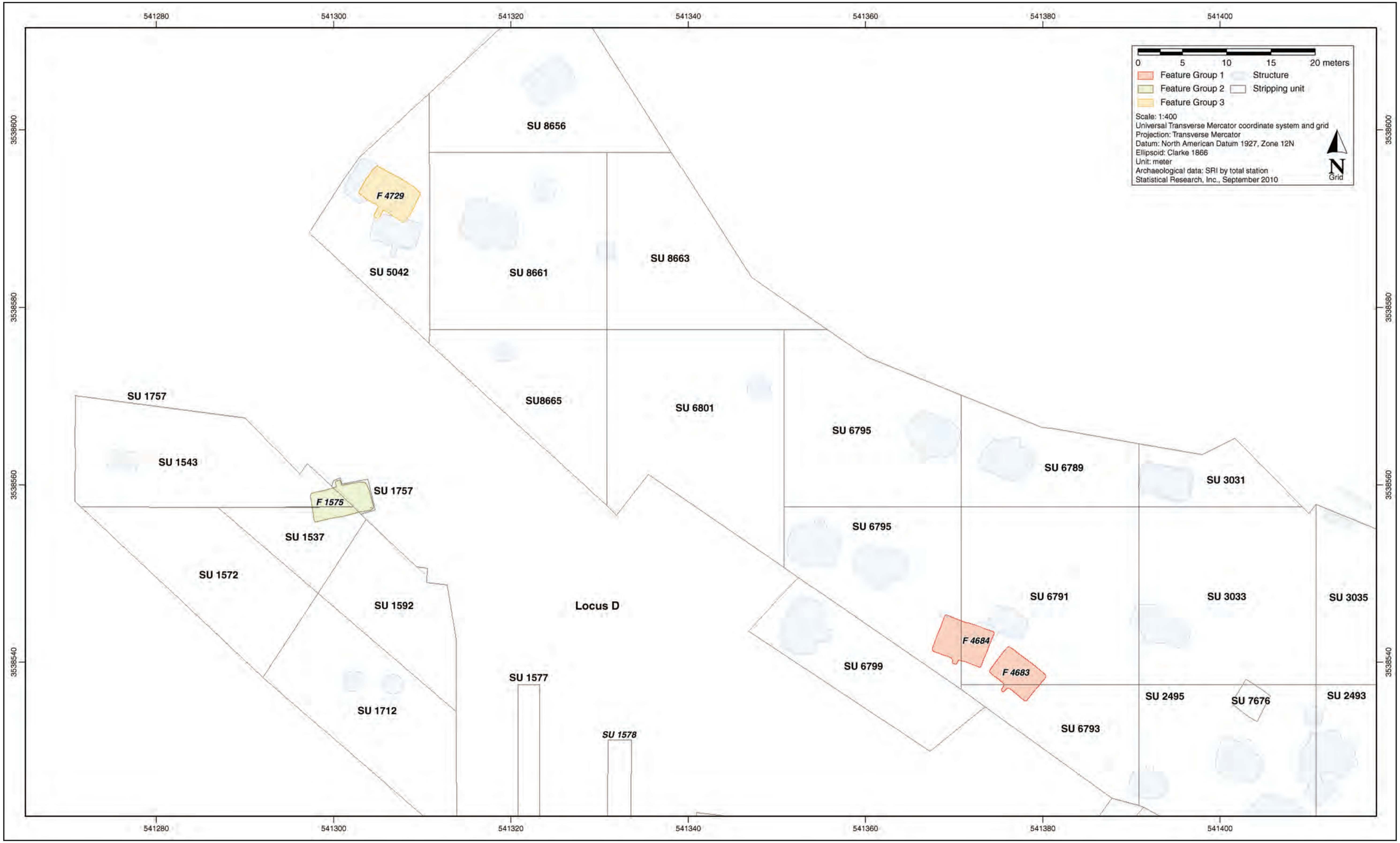


Figure 40. Map showing the locations of features assigned to Feature Groups 1-3 in Locus D, Late Formative B period.

Table 62. Counts and Percentages of Painted Wares Assigned to the Late Formative B Period, by Structure Groups, Locus D

Feature No.	Roosevelt Red Ware		Tanque Verde Red/ Brown		Unpainted Red Ware		Other Painted		Total
	n	%	n	%	n	%	n	%	
					Group 1				
4683	41	30.8	2	1.5	23	17.3	67	50.4	133
4684	17	15.9	3	2.8	41	38.3	46	43.0	107
Total	58	24.2	5	2.1	64	26.7	113	47.1	240
					Group 2				
1575	13	10.6	6	4.9	64	52.0	40	32.5	123
					Group 3				
4729	29	32.6	5	5.6	12	13.5	43	48.3	89

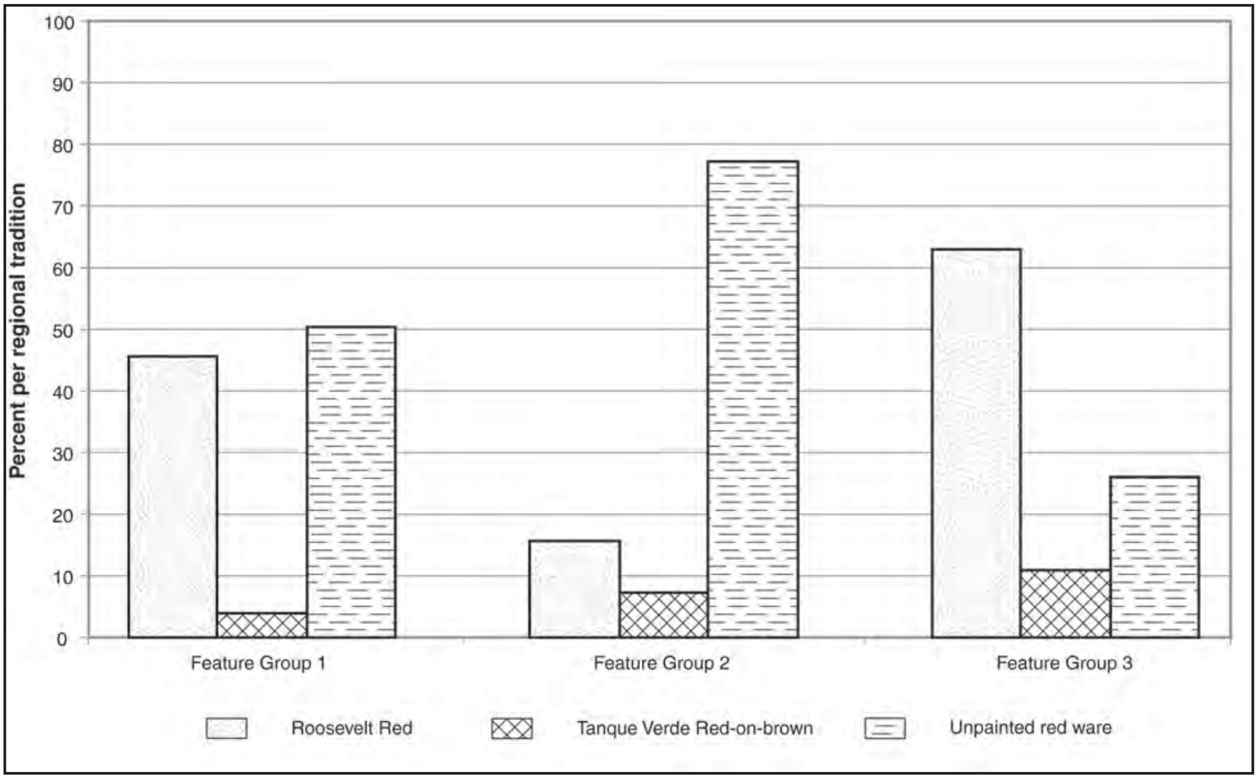


Figure 41. Bar graph showing the percentages of painted-ware classes per feature group, Late Formative B period.

groups in Loci C and D. Lengyel did not define contemporaneity groups for Locus A, which appeared to encompass a single continuous occupational span; stratigraphic breaks between features were not evident in Locus A, but note that, when Lengyel analyzed the AM data on a site-wide scale, the features from Locus A were assigned to two successive groups.

Site-Wide Changes in Pottery Use

The Contemporaneity Groups

Table 63 lists Lengyel's six site-wide contemporaneity groups and associated date ranges for the Middle Formative period. Note that the two earliest groups (Contemporaneity Groups 1 and 2), corresponding to the Middle Formative A period, included only features from Locus D. Contemporaneity Groups 3 and 4 were associated with the early part of the Middle Formative B period and included features from Loci C and D. Contemporaneity Groups 5 and 6 also dated to the Middle Formative B period and included features from Loci A and D.

The date ranges reported in Table 63 are not those proposed by Lengyel. Rather, we processed the chronological data in several ways, to maximize interpretability. The inclusive time ranges accommodate the dates assigned to each of the features in the contemporaneity groups, which Lengyel inferred from inspections of AM data and time-sensitive artifacts. These inclusive ranges span from the earliest to the latest dates reported among the individual feature date ranges. For example, if a group included two features with assigned date ranges of A.D. 700–850 and A.D. 750–900, then the inclusive date range for that group would be A.D. 700–900.

One problem with the inclusive date range is that each of the dated features was weighted equally in defining that range, but our analyses focused solely on the *ceramic components* from those features and not on the features themselves. Consequently, because we proposed to analyze ceramic data from the entire group as a single analytical unit, a bias could be introduced by assigning equal weight to date ranges from features with drastically different ceramic counts. Those with the larger ceramic collections—i.e., that contributed a greater weight to the ceramic patterns—also should be accorded greater weight in defining the date ranges. To weight the date ranges, we multiplied the beginning and ending dates for each feature by the ceramic totals for that feature. We then summed together the weighted beginning and ending dates and divided them by the total ceramic count over all features. This simple procedure produced date ranges that accorded greater weight to features with larger ceramic counts.

We also calculated dates ranges based on the proposed time spans for the temporally diagnostic painted ceramics. This followed the same procedure frequently used to calculate mean ceramic dates (MCDs) (see South 1978). MCD estimates are calculated as the mean of the midpoints of the date range for each type, weighted by the number of specimens of each diagnostic type. In our case, instead of using the midpoints of the date ranges, we calculated the means for the beginning and ending dates for each type. This approach can be biased by the presence of temporally diagnostic painted ceramics that predate or postdate the primary period of use for a given feature. It is also susceptible to sampling vagaries, given the generally smaller sample sizes of temporally diagnostic painted sherds in the group collections (compared to the sizes of overall ceramic

Table 63. Site-Wide Contemporaneity Groups and Inferred Date Ranges

Contemporaneity Group	Period	Locus A Features (n)	Locus C Features (n)	Locus D Features (n)	Inclusive Date Range	Weighted Date Range	Mean Ceramic Date Range	Diagnostic Painted Ceramics (n)
Group 1	Middle Formative A	—	—	11	A.D. 735–865[a]	A.D. 741–860	A.D. 793–956	115
Group 2	Middle Formative A	—	—	2	A.D. 825–1015	A.D. 827–991	A.D. 780–970	10
Group 3	Middle Formative B	—	1	3	A.D. 835–1015	A.D. 869–1015	A.D. 832–1036	95
Group 4	Middle Formative B	—	2	4	A.D. 935–1015	A.D. 935–1015	A.D. 929–1096	40
Group 5	Middle Formative B	1	2	2	A.D. 935–1040	A.D. 935–1031	A.D. 953–1133	103
Group 6	Middle Formative B	3	6	2	A.D. 935–1150[b]	A.D. 980–1105	A.D. 944–1140	213

[a] Excludes one very-broad inferred date range for Feature 8655 (A.D. 650–1190).

[b] Excludes two very-broad date ranges for Features 6138 and 4931 (both extend into the A.D. 1300s).

collections). In the case of Contemporaneity Group 2, for example, the very small sample of 10 temporally diagnostic painted specimens generated a dubious date range. For this reason, we placed less interpretive weight on the mean ceramic date ranges than on the weighted date ranges listed in Table 63.

It would clearly be wrongheaded to assign concrete time spans to the six contemporaneity groups, but broad approximations are feasible. Contemporaneity Group 1 likely pertained to the first half of the Middle Formative A period, roughly A.D. 750–850. The date ranges for Contemporaneity Group 2 adhered more closely to the latter half of the Middle Formative A period, ca. A.D. 850–950. Contemporaneity Group 3 probably encompassed the period of transition between the Middle Formative A and B periods, around the mid-A.D. 900s. Contemporaneity Group 4 appeared to indicate occupation during the mid- to late A.D. 900s. Contemporaneity Group 5 likely pertained to the late A.D. 900s and early 1000s. Finally, the inferred date ranges for Contemporaneity Group 6 suggested a period of occupation in the mid- to late A.D. 1000s and possibly the early 1100s. Note that Contemporaneity Groups 3, 4, and 5 seemed to encompass briefer time spans than did Contemporaneity Groups 1, 2, and 6, which may suggest a period of frequent abandonment and short-lived occupations during the late Middle Formative A period and early Middle Formative B period (see Lengyel, Chapter 2, this volume).

Painted and Unpainted Pottery

Figure 42 illustrates changes in the proportions of painted and unpainted ceramics among the six contemporaneity groups. The proportional increase in painted ceramics from the Middle Formative A period (Contemporaneity Groups 1 and 2) to the Middle Formative B period (Contemporaneity Groups 3–6) was striking. Painted pottery appeared to have become proportionally more frequent around the mid-A.D. 900s. Painted pottery, especially serving vessels, likely was used in connection with feasting and other communal or public events, and so the higher frequency may suggest a ramping up of feasting activities and public ceremonies at the site around the time of the early Middle Formative A–B period transition.

Commensal feasts and ritual gatherings likely were frequent events during the pre-Classic period among the Hohokam, especially in villages with ball courts (Wilcox and Sternberg 1983). According to Bayman (2002:77), ball courts offered prime venues for the consumption, display, and possible exchange of painted-pottery vessels and other high-value craft goods. Regardless of the absence of any known ball court at the site or at sites in the vicinity, Mescal Wash may have become a prominent locus of communal feasting and ritual activities during the late A.D. 900s and 1000s. It also was located within about 25–30 km of several known ball-court villages (see Vanderpot and Altschul 2007). It is also possible that a

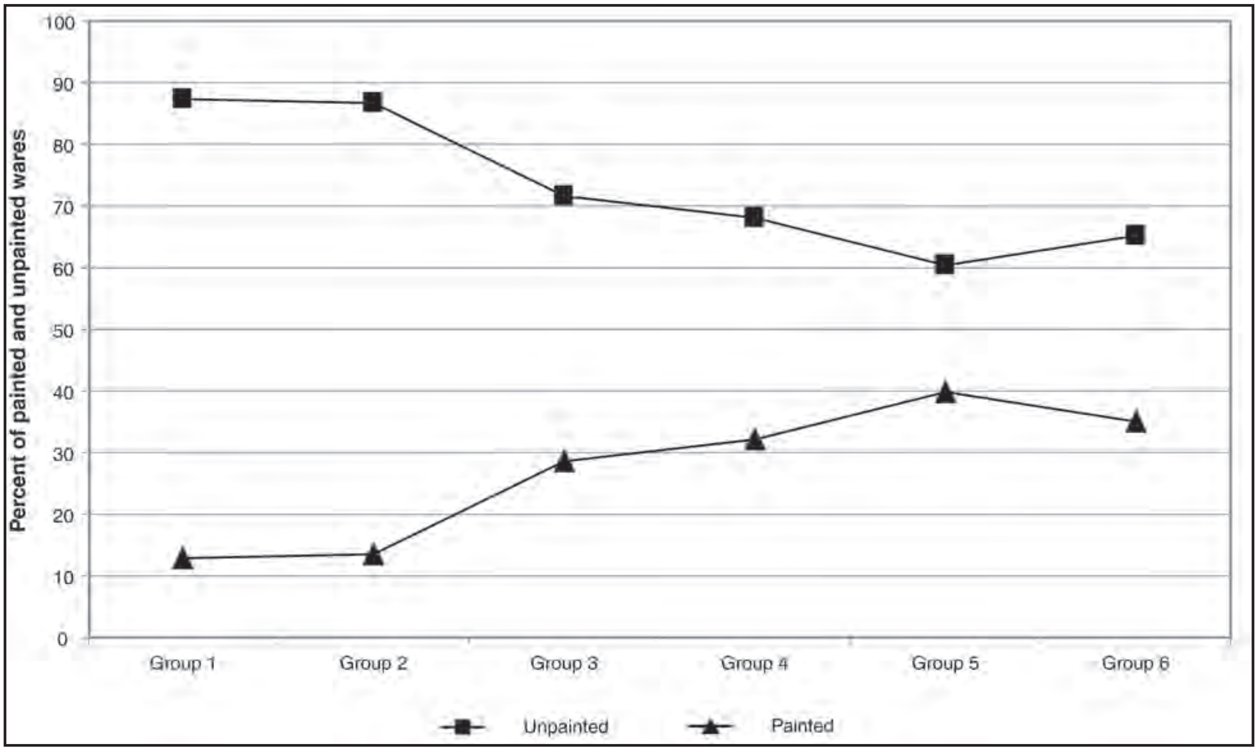


Figure 42. Line graph showing changes in the percentages of painted and unpainted wares, based on site-wide Contemporaneity Groups 1-6.

ball court had been constructed at the site but has since been destroyed as a result of modern or historical-period construction. We also cannot rule out the possibility that feasting and communal events were commonplace at settlements without ball courts.

Changes in Painted-Pottery Use

Analysis of ceramic trends among contemporaneity groups provided a refined perspective concerning changes in interregional interaction and affiliation. Figure 43 shows the changes in percentages of painted-ware classes among the six groups, excluding the indeterminate and split categories. We have previously discussed the greater prevalence of Phoenix Basin buff wares during the Middle Formative A period than during the Middle Formative B period. As shown in Figure 43, the declining use of buff wares in the Mescal Wash site appears to have been a gradual process, which might indicate that the site inhabitants interacted increasingly less frequently with populations in the Phoenix Basin during the course of the Middle Formative period.

Variation in the frequencies of Tucson Basin brown wares showed a bimodal pattern of change, with peaks during the late A.D. 800s and early 900s (Contemporaneity Groups 2 and 3) and again in the late A.D. 900s and 1000s (Contemporaneity Groups 5 and 6). The use of Dragoon brown ware pottery also exhibited a bimodal pattern, with an early peak in the early Middle Formative A period (Contemporaneity Group 1) and in the middle to late A.D. 900s (Contemporaneity Groups 3 and 4). Also evident was that San Simon painted wares were used almost exclusively during the middle A.D. 900s, as evidenced by the unimodal peaks in Contemporaneity Group 3. The percentage of "other" painted ceramics also peaked in Contemporaneity Group 3. Most of the "other" wares were associated with the Trincheras tradition (Nogales Polychrome and Trincheras Purple-on-red). These trends suggest that the inhabitants of Mescal Wash maintained low-level exchange relationships with several culture groups, including the San Simon and Trincheras cultures, during the mid-A.D. 900s (Contemporaneity Group 3).

Above, we suggested that Contemporaneity Groups 3–6 indicate a succession of relatively short-term occupations and rapid abandonment during the Middle Formative B period. If this interpretation is correct, then differences in the ware proportions may be instructive of the rapidity of changes in interaction and exchange during this span. Frequent changes in the percentages of painted ceramics associated with different traditions over a short span of time, for instance, might indicate a period of social or economic instability and upheaval. Rapid changes in the frequencies of regional painted-pottery wares could indicate

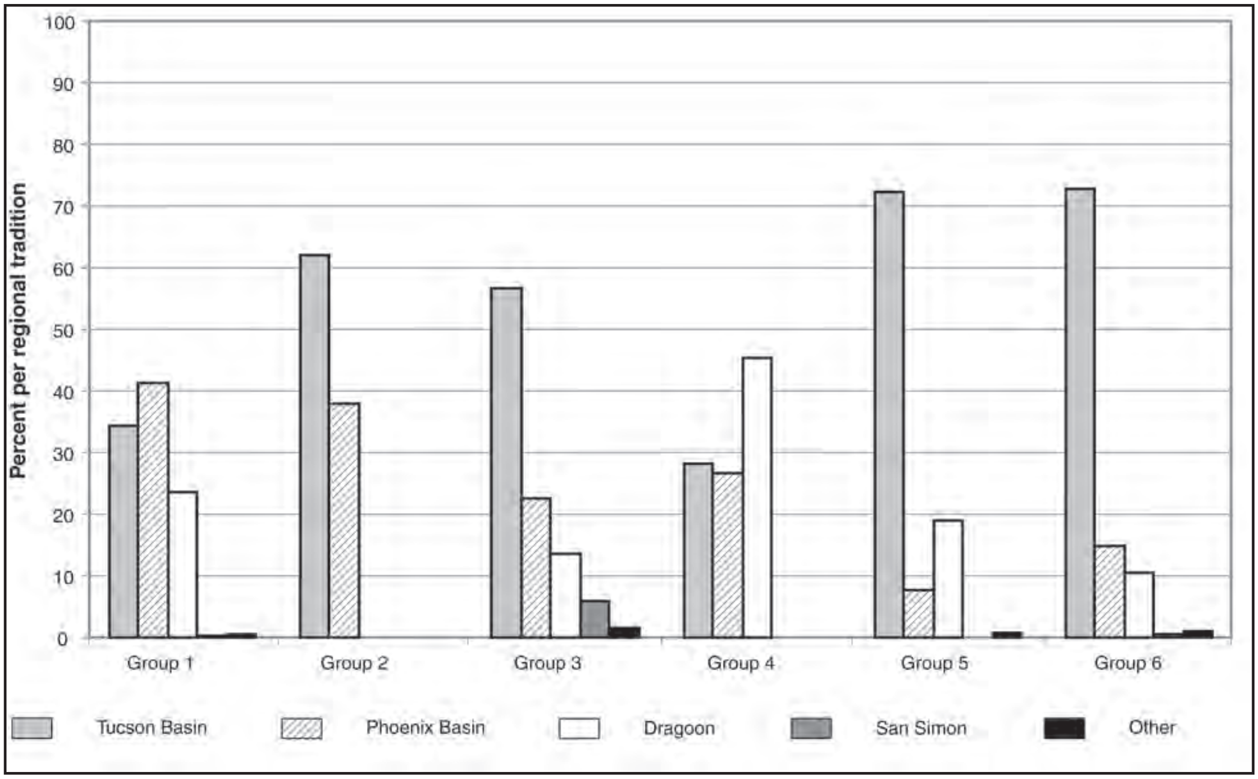


Figure 43. Bar graph showing the percentages of painted-ware classes for site-wide Contemporaneity Groups 1-6.

economic instability and frequent reorientations of social and economic relationships, regardless of whether these perturbations are based on variability in extralocal affiliations by a local population or occupations by migrating groups from different areas. One caveat is that the smaller sample sizes in the refined temporal groups increased the possibility of sampling vagaries and generated more-tentative patterns and results. Our inability to control for variability in sherd size and breakage also was a factor, given the smaller sample sizes. For this reason, we present our interpretations as tentative hypotheses amenable to empirical testing using additional data.

One way of inferring changes in interregional interactions is to evaluate similarities in the percentages of painted-ware classes among the contemporaneity groups (e.g., between Contemporaneity Groups 1 and 2, Contemporaneity Groups 2 and 3, Contemporaneity Groups 3 and 4, and so on). We evaluated between-group similarities using Brainerd-Robinson (BR) coefficients of similarity (Brainerd 1951; Robinson 1951), which measure similarities between pairs of collections, calculated as percentage values. The BR calculation was 200 minus the sum of the differences in type percentages between two collections, so that a score of 200 indicated maximum similarity (possibly indicating a common provisioning source), and a score of 0 indicated maximum difference (possibly indicating participation in entirely separate pottery provisioning networks). For ease of interpretation, we scaled the BR score as proportional values between 0 and 1, with a value of 1 indicating identical type percentages between the two collections.

The BR coefficients for successive groups are illustrated in Figure 44 (lower line marked with circles). The transitions from Contemporaneity Group 1 to Contemporaneity Group 2 and Contemporaneity Group 2 to Contemporaneity Group 3 do not suggest considerable changes in the use of painted pottery. The more-pronounced changes occurred between Contemporaneity Groups 3 and 4 and between Contemporaneity Groups 4 and 5, especially the latter. These patterns suggest drastic changes in painted-pottery use during relatively short-term, successive occupations in the A.D. 900s. Contemporaneity Group 3 also included the most-diverse painted-ceramic collection, including wares affiliated with the Tucson Basin, Phoenix Basin, Dragoon, San Simon, and Trincheras traditions, which may suggest an expansion of interregional relationships and social interactions, perhaps indicating conditions of social upheaval and rapid change. The early years of the Middle Formative B period could have been an era of social and economic instability during which the inhabitants of Mescal Wash attempted to establish relationships with a variety of nonlocal groups and/or received migrating

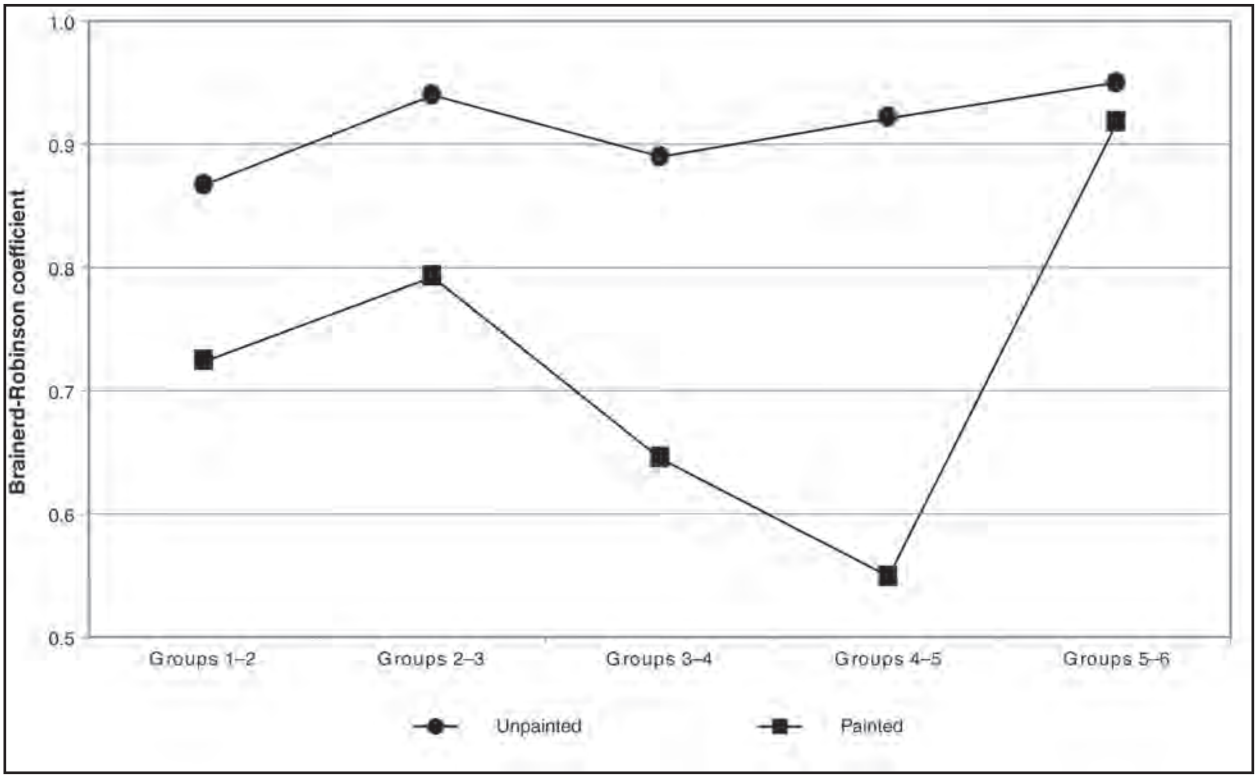


Figure 44. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for site-wide Contemporaneity Groups 1–6.

populations from various areas of the southern deserts who were looking for a new place to settle. In contrast, the high BR score between Contemporaneity Groups 5 and 6 may suggest the continuity in painted-pottery use in the A.D. 1000s, possibly indicating greater stability in interregional exchange, interactions, and migration patterns.

In sum, the ceramic data suggest the possibility that Mescal Wash witnessed a period of rapid fluctuations in regional patterns of interaction and/or migration during the A.D. 900s. These changes may be attributable to a brief era of social or economic instability or turmoil, perhaps followed by a more social climate accompanying the establishment of the interregional ball-court network. Climate or environmental changes or social changes (e.g., conflict and warfare) could have provoked instability in the early or mid-A.D. 900s, followed by a period of climatic and environmental stability and favorable conditions for food production in the A.D. 1000s. Additional data will be needed to test these hypotheses.

Changes in Unpainted-Pottery Use

Temporal trends for the unpainted ceramics contrasted sharply with the trends for the painted wares. As shown in Figure 45, the percentages of unpainted wares and types changed relatively little during the Middle Formative period. Type II plain wares (sand-tempered) consistently composed 70–80 percent of all unpainted ceramics, and Type III plain wares (abundant micaceous-schist inclusions) composed about 10–25 percent throughout the sequence. The BR coefficients for the unpainted wares for successive groups are shown in Figure 44 (higher line marked with squares). These data support the general similarity in unpainted-ware and -type compositions among the five groups. Moreover, the score range of 0.87–0.95 contrasts with the range of 0.55–0.92 for painted wares. Notably, the BR score for both painted and unpainted wares peaked in Contemporaneity Group 6, which underscores the above suggestion of greater social and economic stability in the A.D. 1000s.

It is difficult to truly evaluate changes in the unpainted types, because we are unable to infer their production sources or regional affiliations. If we assume that each unpainted type corresponds to a discrete production source—presumably local, such as a local potter or community of potters—then the data presented in Figures 44 and 45 underscore a stable and consistent pattern of exchange and provisioning for unpainted-pottery vessels during the Middle Formative period. The painted vessels, in contrast, suggest substantial variability over time in patterns of exchange or affiliation. The unpainted-pottery results further emphasize the different economic spheres of exchange or interaction for painted- and unpainted-pottery vessels.

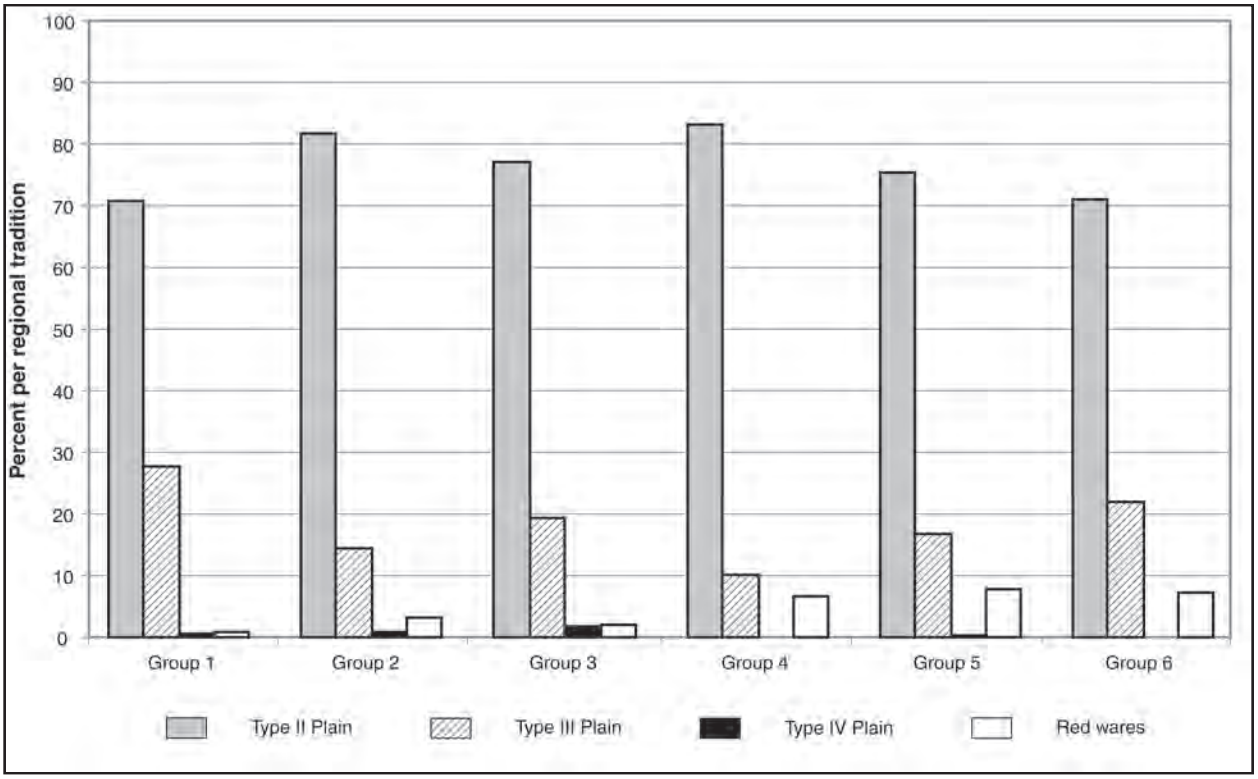


Figure 45. Bar graph showing the percentages of unpainted types for site-wide Contemporaneity Groups 1-6.

Again, it is unclear whether the variability in painted-ware classes is suggestive of the movement of pottery (exchange), the movement of people (migrants that made pottery using the styles of their homelands), or local imitations of foreign pottery styles.

Changes in Pottery Use in Loci C and D

In this subsection, we discuss the same analysis employed in the analyses discussed in the previous section to analyze changes in pottery use on a site-wide scale, but here, we separately focus on the variability among contemporaneity groups in Loci C and D. As explained above, contemporaneity groups were not defined for Locus A.

Locus C

Table 64 lists the inclusive, weighted, and mean ceramic date ranges for the four contemporaneity groups from Locus C (see above for calculation details). In general, Contemporaneity Groups 1–3 likely indicate relatively short-term and successive occupational episodes during the mid- to late A.D. 900s, comparable to those discussed above for the site as a whole; the weighted date ranges were nearly identical to those of Contemporaneity Groups 3–5 in the site-wide sequence. Contemporaneity Group 4 in Locus C probably likely indicates an occupational episode during the A.D. 1000s, comparable to Contemporaneity Group 6 in the site-wide sequence.

Figure 46 illustrates changes in the percentages of painted and unpainted wares among the four groups. Contemporaneity Group 1 contained a slightly lower percentage of unpainted wares, which may indicate occupation during the early decades of the Middle Formative B period. As explained above, percentages of painted wares increased site-wide during the onset of the Middle Formative B period. The percentages of painted and unpainted wares were generally consistent in Contemporaneity Groups 2–4.

The percentages of painted wares changed considerably during the Middle Formative B period in Locus C, as shown in Figure 47. Each group included a robust collection of painted sherds, with the exception of Contemporaneity Group 1, in which painted-ware classes were identifiable for only 12 painted ceramics. We report the percentages for Contemporaneity Group 1 in Figure 47, but these data should be considered suspect. Tucson Basin brown wares became increasingly prevalent over time in Locus C; their percentages increased in increments of about 10–20 percent in each successive contemporaneity group and peaked in Contemporaneity Groups 3 and 4. Simultaneously, Dragoon brown wares peaked in Contemporaneity Groups 1 and 2 but declined in later Contemporaneity Groups 3 and 4. The percentages of Phoenix Basin buff wares varied relatively little among the groups. The percentage of other painted-ware classes peaked in Contemporaneity Group 3, but only 2 sherds were included in this group: 1 Babocomari Bichrome sherd and 1 Mimbres Black-on-white sherd.

These patterns suggest that the Middle Formative B period inhabitants of Locus C replaced Dragoon brown wares with Tucson Basin brown wares during the A.D. 900s and early 1000s. This pattern of change may suggest a gradual shift in extralocal economic and social interaction or patterns of migration during this time span. In ether case, these results suggest a shift from an eastward orientation (Dragoon) to a westward orientation (Tucson Basin), which may underscore the expansion of the Hohokam ball-court network and ritual system into the Mescal Wash area.

Figure 48 illustrates the variation in unpainted types and ware classes among the four groups. In contrast with the painted wares, unpainted wares and types varied relatively little over time. Type II plain wares composed between 79 and 93 percent of unpainted wares in each group, and Type III plain wares consistently composed 5–10 percent.

The BR coefficients for paired groups are shown graphically in Figure 49. The BR results showed that patterns of use and provisioning for unpainted wares again changed relatively little during the Middle Formative B period. The between-group scores ranged from 0.85 to 0.93, suggesting stable provisioning relationships over time (but see caveat

Table 64. Contemporaneity Groups and Inferred Date Ranges, Locus C

Contemporaneity Group	Features (n)	Age Designation	Inclusive Date Range	Weighted Date Range	Mean Ceramic Date Range	Diagnostic Painted Ceramics (n)
Group 1	2	Middle Formative B period	A.D. 825–1015	A.D. 929–1015	A.D. 929–1104	12
Group 2	4	Middle Formative B period	A.D. 935–1040	A.D. 935–1016	A.D. 949–1113	88
Group 3	2	Middle Formative B period	A.D. 935–1040	A.D. 943–1016	A.D. 950–1137	19
Group 4	3	Middle Formative B period	A.D. 935–1140	A.D. 1010–1140	A.D. 953–1147	86

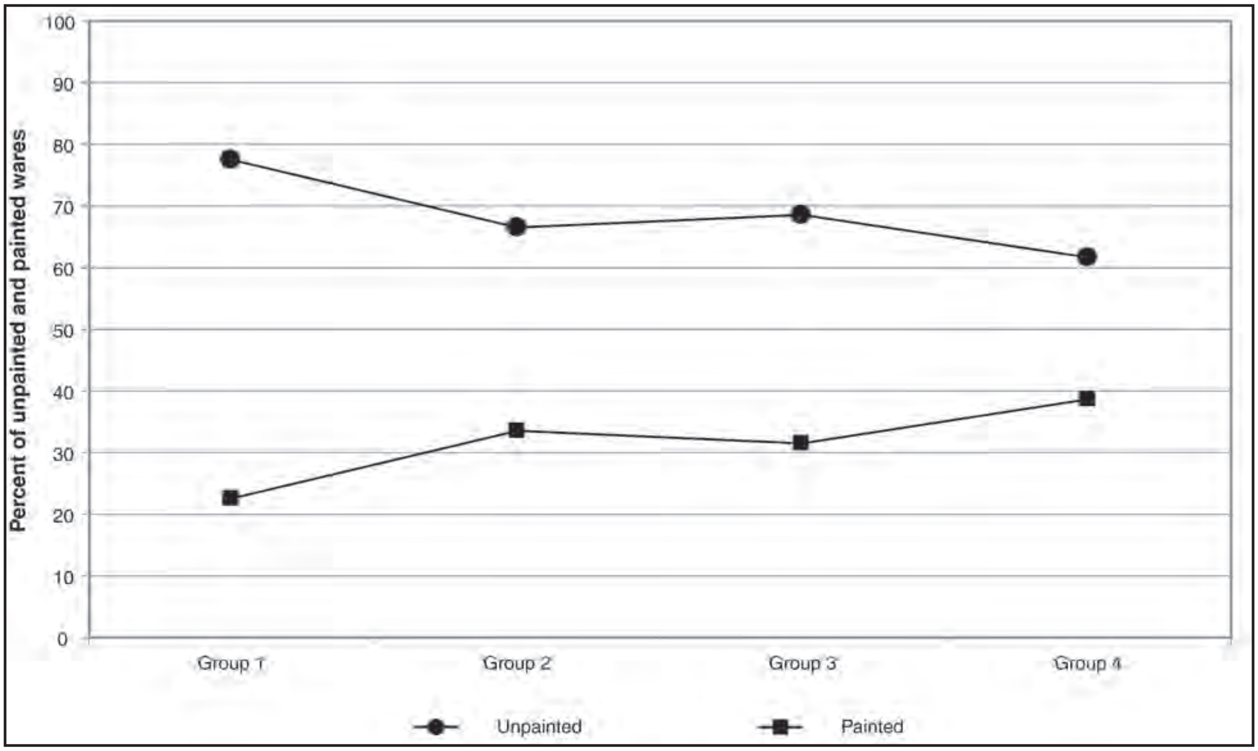


Figure 46. Line graph showing changes in the percentages of painted and unpainted wares in Contemporaneity Groups 1-4, in Locus C.

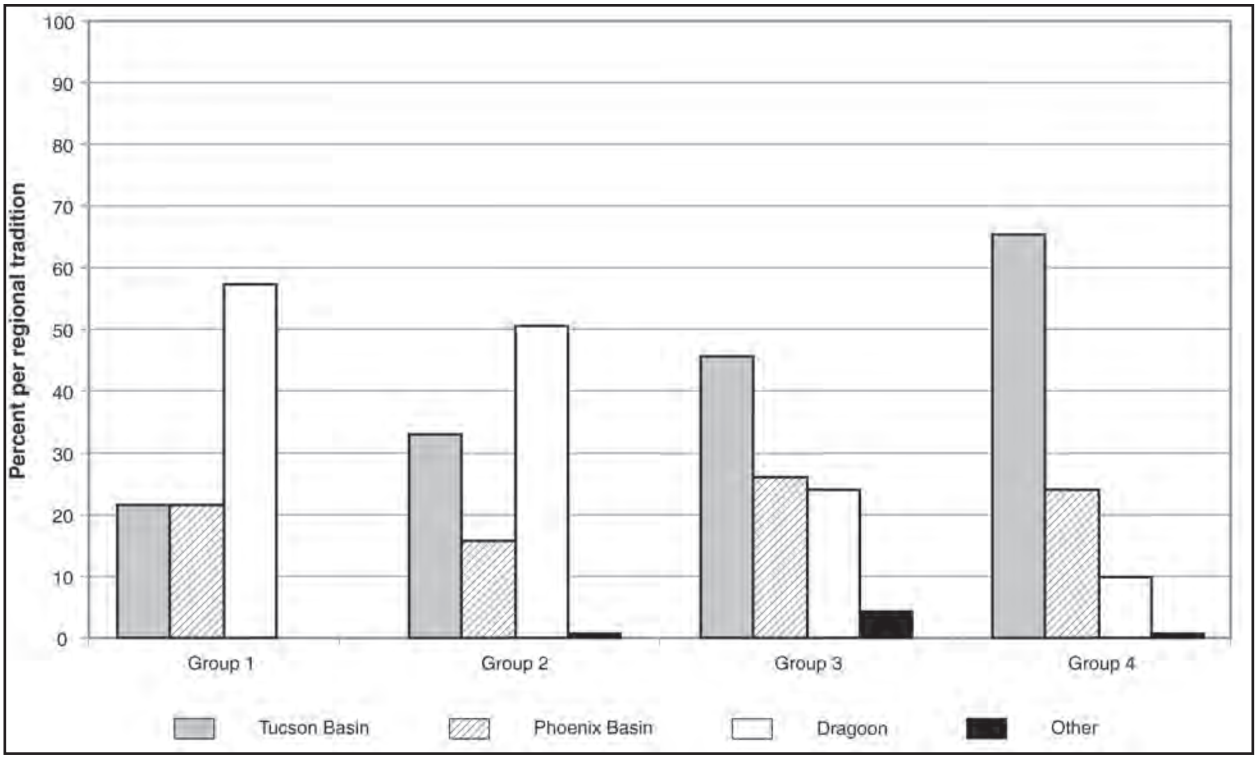


Figure 47. Bar graph showing the percentages of painted-ware classes for Contemporaneity Groups 1-4, in Locus C.

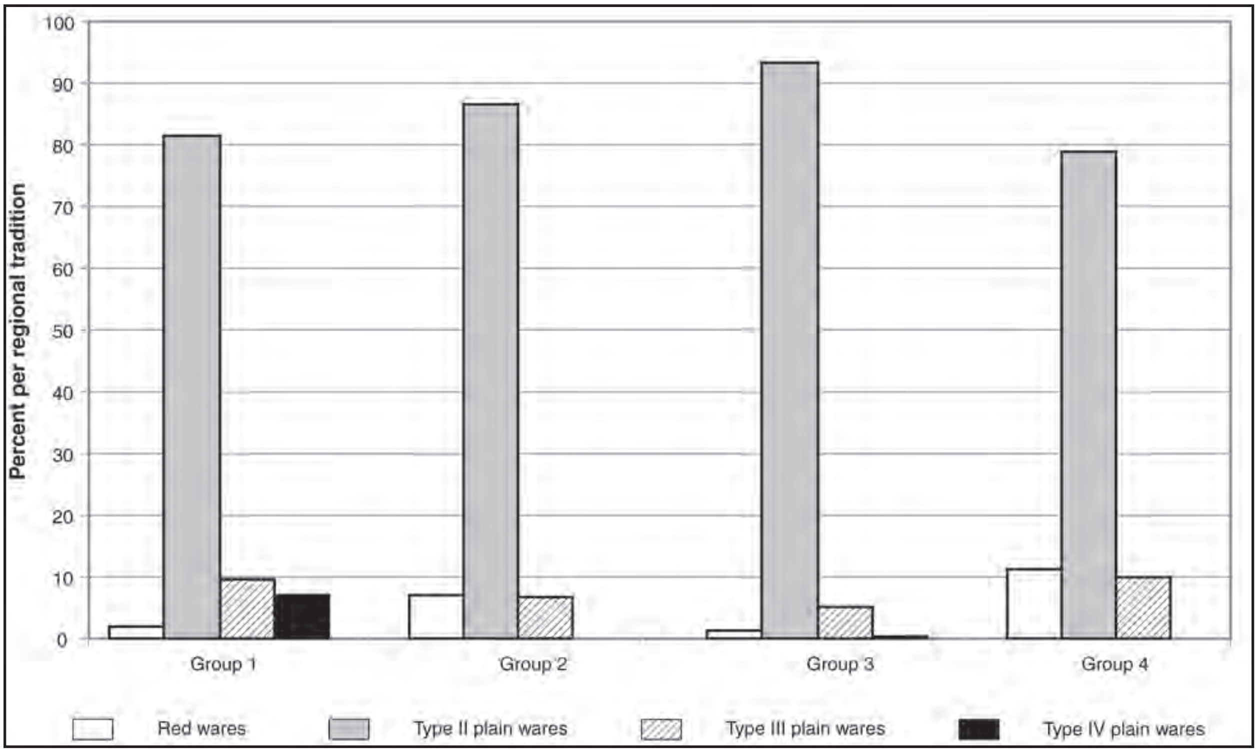


Figure 48. Bar graph showing the percentages of unpainted types for Contemporaneity Groups 1-4, in Locus C.

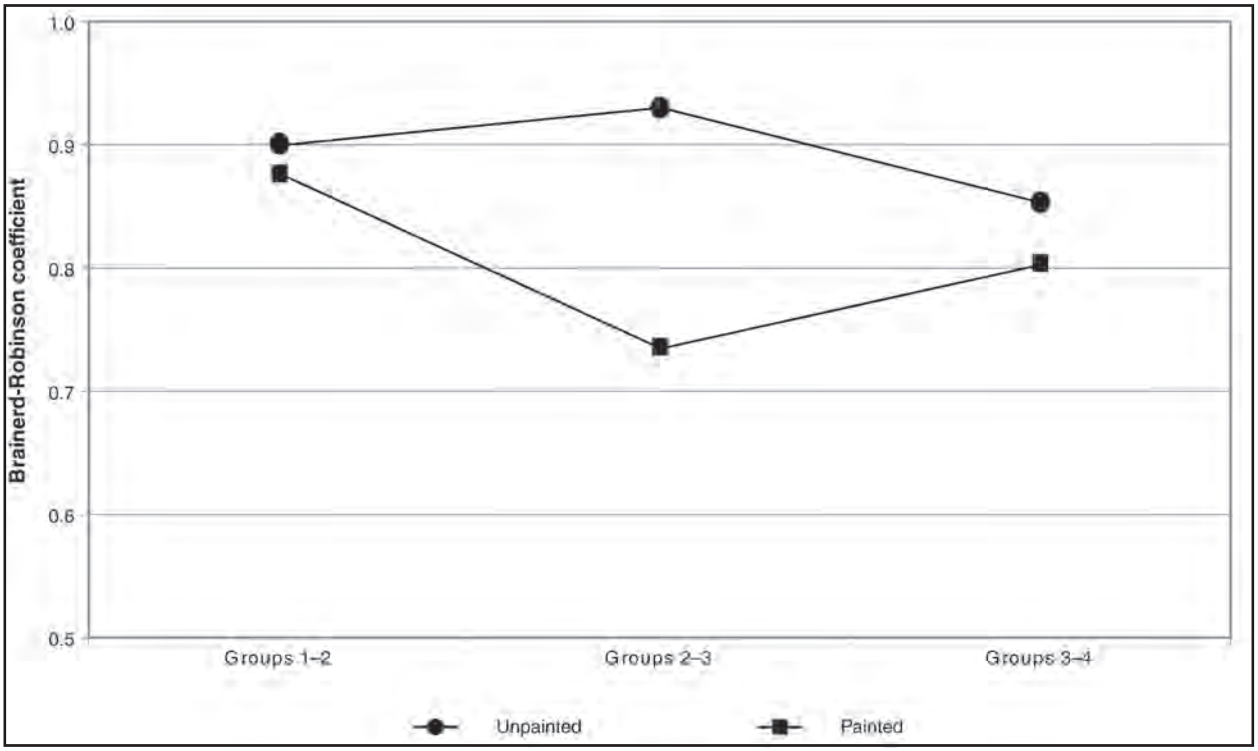


Figure 49. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for Contemporaneity Groups 1-4, in Locus C.

above, regarding whether different types indicate discrete production locales). The between-group BR scores for painted wares were slightly lower. The most salient difference concerned the Contemporaneity Group 2–3 transition. This period of transition, likely in the late A.D. 900s, may indicate a major disruption in patterns of interregional interaction and/or migration, possibly indicating a period of social or economic upheaval. This change was mainly evidenced by the shift from higher percentages of Dragoon brown wares in Contemporaneity Group 2 to a greater prevalence of Tucson Basin brown wares (and, to a lesser extent, Phoenix Basin buff wares) in Contemporaneity Group 3, as explained above.

Locus D

Lengyel identified seven contemporaneity groups for Locus D that span the Middle Formative A and B periods. Table 65 lists the inferred date ranges for these groups. Note that the mean ceramic date ranges were not calculable for Contemporaneity Groups 1, 2, 4, and 6, because of a very small number of temporally diagnostic painted ceramics (10 or fewer). The first four groups were assigned to the Middle Formative A period, and the latter three were assigned to the Middle Formative B period, although the date ranges for Contemporaneity Groups 1 and 2 might suggest occupational episodes during the late Early Formative period in the late A.D. 600s and early A.D. 700s. A relatively small number of ceramics were recovered from features assigned to these groups, in any case, and they did not figure heavily into our analyses. Contemporaneity Group 3 appeared to have been a substantial occupation (associated with 11 features) dating to the first half of the Middle Formative A period, roughly A.D. 750–850. Contemporaneity Group 4 was probably associated with a less substantial occupation during the latter half of the Middle Formative A period. Contemporaneity Group 5 likely correlates with the era of transition between the Middle Formative A and B periods, in the early and mid-A.D. 900s. Contemporaneity Groups 6 and 7 probably indicate occupations during the mid- to late A.D. 900s and 1000s, respectively.

Figure 50 illustrates the variability in percentages of painted and unpainted ceramics among the seven groups. We excluded Contemporaneity Group 2 because of a small collection size of only 20 sherds. The trend in Locus D paralleled that observed in the site-wide analysis discussed above. The percentage of painted ceramics increased, relative to unpainted ceramics, in Contemporaneity Group 5, which corresponded to the Middle Formative A–B period transition in the mid-A.D. 900s. Above, we argued that this change possibly relates to the development of the regional ball-court network in southern and central Arizona, which may have effected an increase in the prominence and prestige value of painted pottery as indicators of status and cultural affiliation (see Bayman 2002).

We excluded Contemporaneity Groups 1, 2, and 6 in calculating the percentages of painted wares (Figure 51) because of the very small number of identifiable ware classes in these collections. The remaining groups represented the principal spans of occupation in Locus D, including the first half of the Middle Formative A period (Contemporaneity Groups 3 and 4), the transition to the Middle Formative B period (Contemporaneity Group 5), and the Middle Formative B period occupation, indicating the height of the regional ball-court system in the A.D. 1000s (Contemporaneity Group 7).

Table 65. Contemporaneity Groups and Inferred Date Ranges, Locus D

Contemporaneity Group	Features (n)	Age Designation	Inclusive Date Range	Weighted Date Range	Mean Ceramic Date Range	Diagnostic Painted Ceramics (n)
Group 1	1	Middle Formative A period	A.D. 685–740	A.D. 685–741		1
Group 2	1	Middle Formative A period	A.D. 710–740	A.D. 710–741		2
Group 3	11	Middle Formative A period	A.D. 735–865[a]	A.D. 737–880	A.D. 793–956	115
Group 4	3	Middle Formative A period	A.D. 825–1015	A.D. 827–991		10
Group 5	2	Middle Formative B period	A.D. 860–1015	A.D. 860–1015	A.D. 821–1029	85
Group 6	4	Middle Formative B period	A.D. 935–1015	A.D. 935–1015		4
Group 7	3	Middle Formative B period	A.D. 935–1315	A.D. 1009–1092	A.D. 886–1073	22

[a] Excludes one very broad-inferred date range for Feature 8655 (A.D. 650–1190).

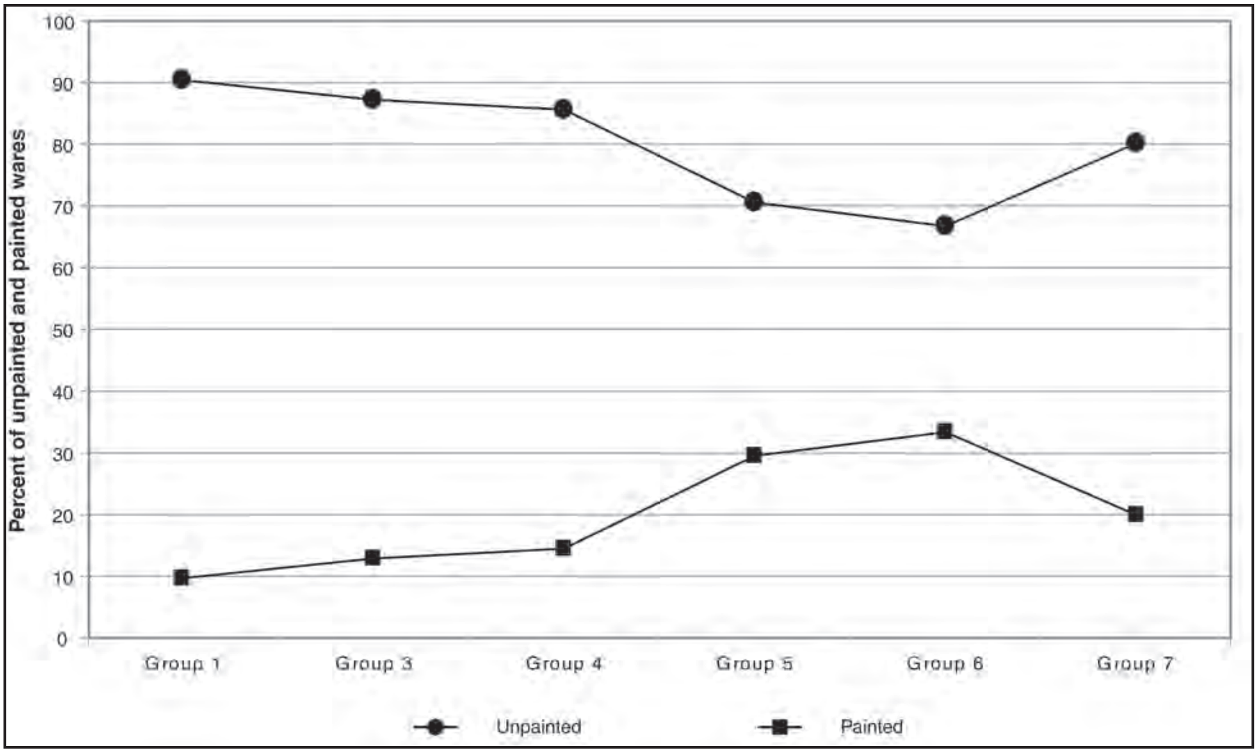


Figure 50. Line graph showing changes in the percentages of painted and unpainted wares for Contemporaneity Groups 1-7, in Locus D.

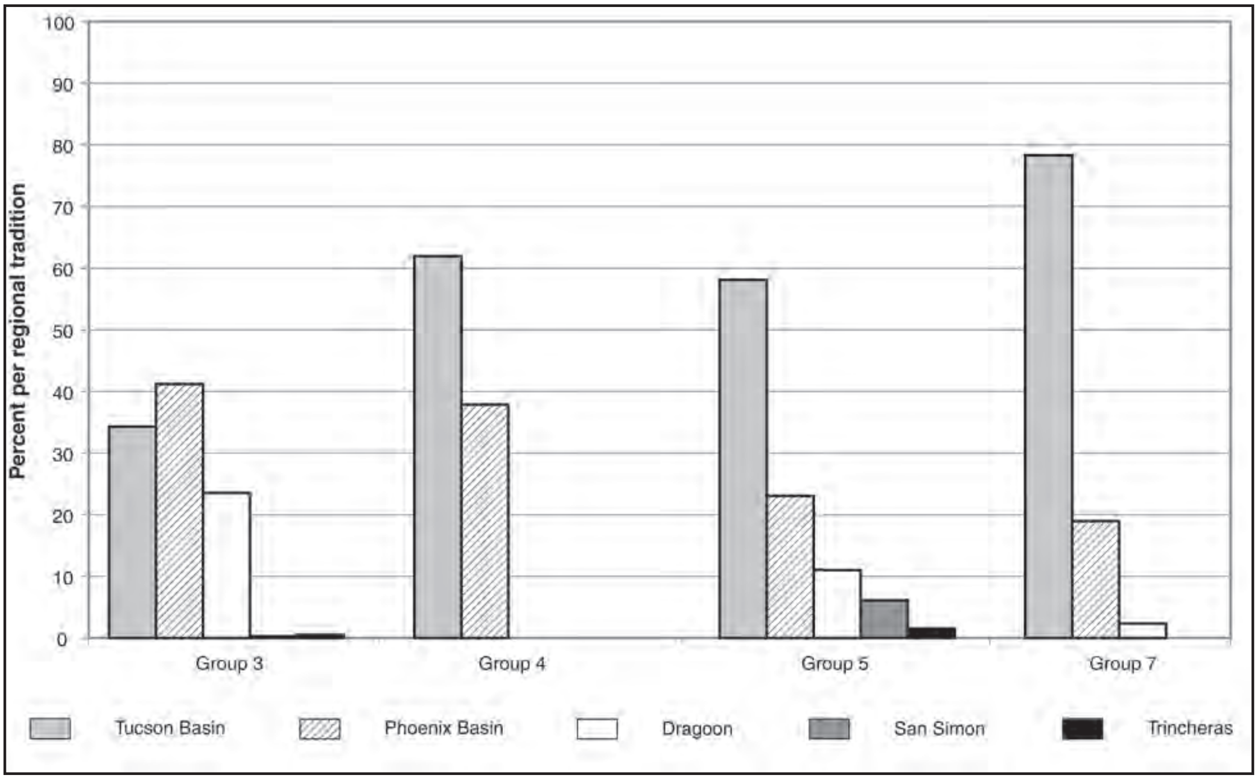


Figure 51. Bar graph showing the percentages of painted-ware classes for Contemporaneity Group 1-7, in Locus D.

The percentage of Tucson Basin brown wares increased over time, as was also observed in Locus C (see Figure 51). Concurrent with this change was a steady decline in percentages of Phoenix Basin buff wares. Tucson Basin brown ware pottery may have replaced Phoenix Basin buff ware pottery as the preferred painted vessels over this span. The different patterns of change in Loci C and D are worth noting in this regard. In Locus C, Tucson Basin brown wares appeared to have gradually replaced Dragoon brown wares as the preferred painted ware at roughly the same time as they replaced Phoenix Basin buff wares in Locus D. Dragoon brown wares peaked in Contemporaneity Group 3, with a second peak in Contemporaneity Group 5. San Simon and Trincheras painted wares also peaked in Contemporaneity Group 3. This period also exhibited the most diverse array of painted wares, which, as argued above, might indicate a period of social and economic upheaval during the Middle Formative A–B period transition.

Figure 52 shows changes in percentages of unpainted types among the contemporaneity groups, excluding Contemporaneity Group 2, which included only 12 unpainted sherds. More variation over time was evident among groups in Locus D than among groups in Locus C, probably because of the longer time span encompassed by the Locus D occupation. Type II plain wares dominated the Contemporaneity Group 1 collection (92 percent) and remained the most prevalent type throughout the occupational sequence (75–82 percent). Type III plain wares constituted only 5 percent of the Contemporaneity Group 1 collection but increased to between 14 and 28 percent in the other groups. Type IV plain wares and red wares were generally rare in these collections and may represent Late Formative period sherds mixed in with the Middle Formative period features.

We illustrate the between-group BR coefficient for unpainted and painted wares in separate graphs because different groups are included in the BR calculations for each ware category (Figures 53 and 54). As explained above, too few identifiable painted sherds were collected from Contemporaneity Groups 1, 2, and 6 to produce reliable percentage calculations, but we were able to calculate reliable percentages of unpainted types for Contemporaneity Groups 4 and 6. For painted wares, Figure 54 illustrates the between-group BR scores for Contemporaneity Groups 3, 4, 5, and 7. Contemporaneity Groups 3 and 4 exhibited the least-similar collections, suggesting a more pronounced change in provisioning practices for painted wares during the Middle Formative A–B period transition. The Contemporaneity Group 3–4 transition might correspond to the Contemporaneity Group 2–3 transition in Locus C, again suggesting a possible disruption

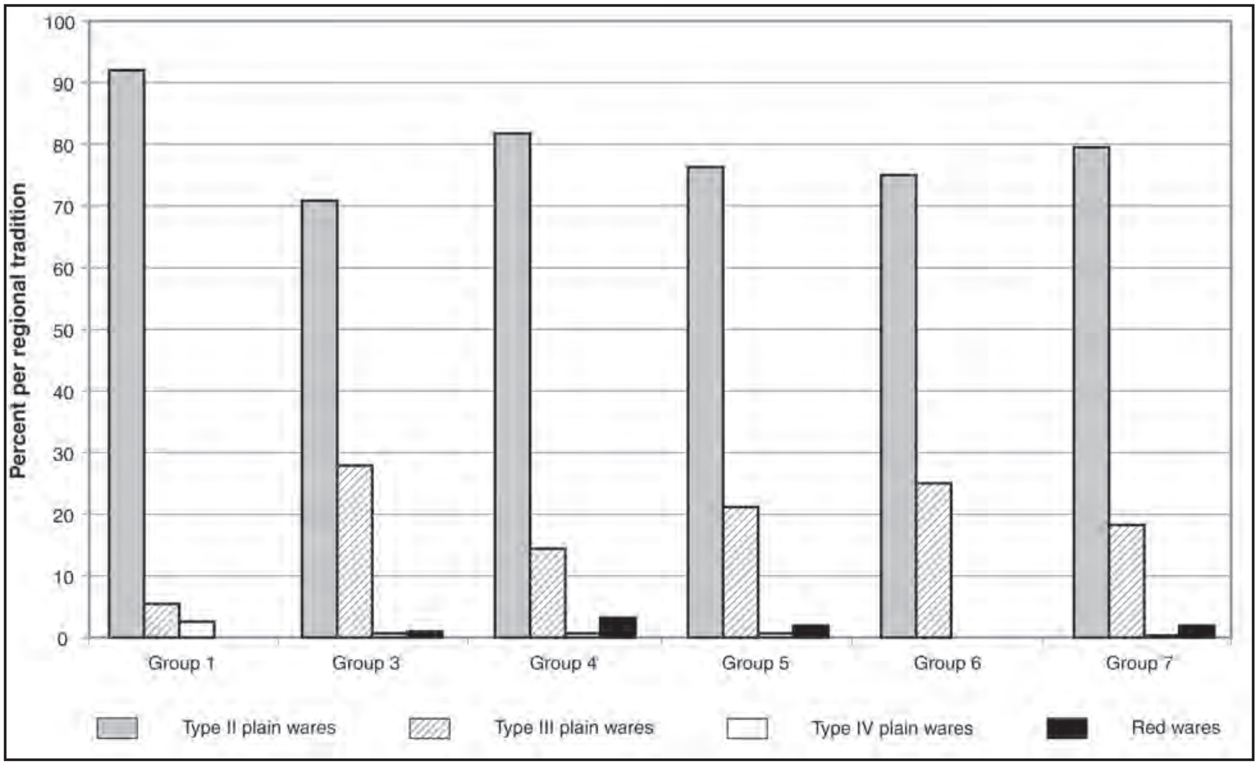


Figure 52. Bar graphs showing the percentages of unpainted types for Contemporaneity Groups 1-7, in Locus D.

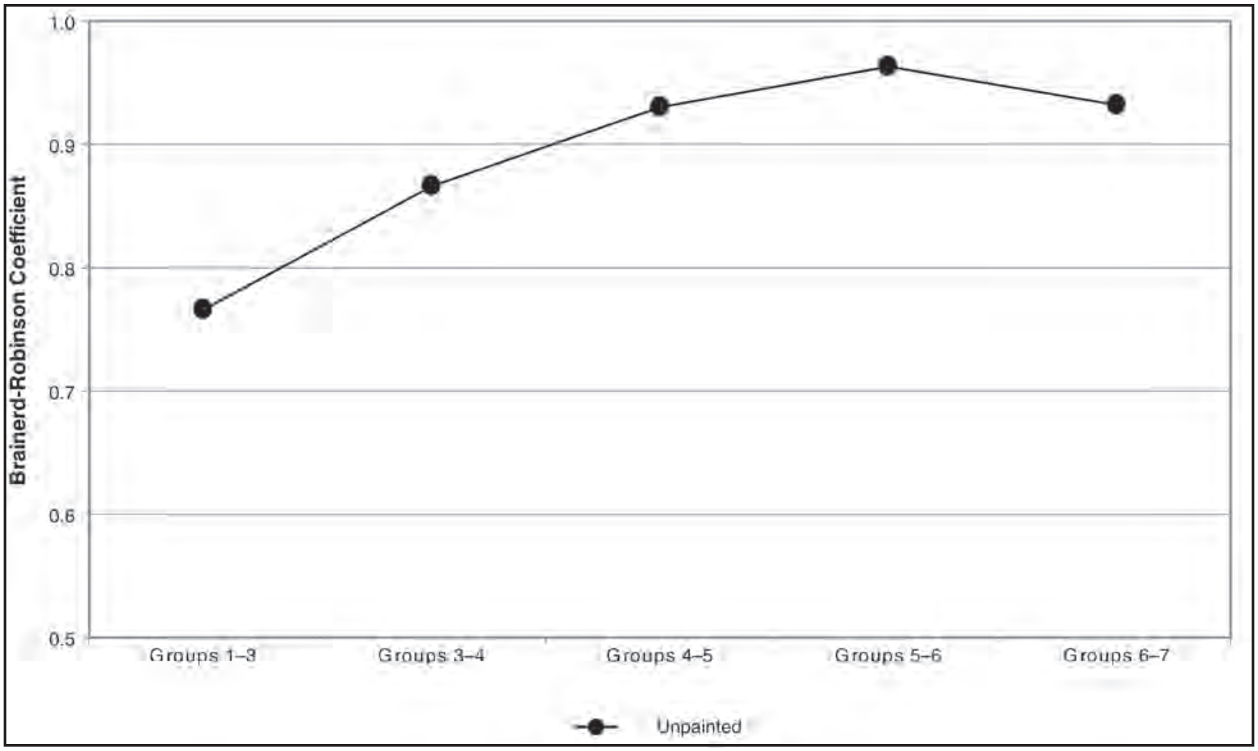


Figure 53. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for unpainted types in Contemporaneity Groups 1-7, in Locus D.

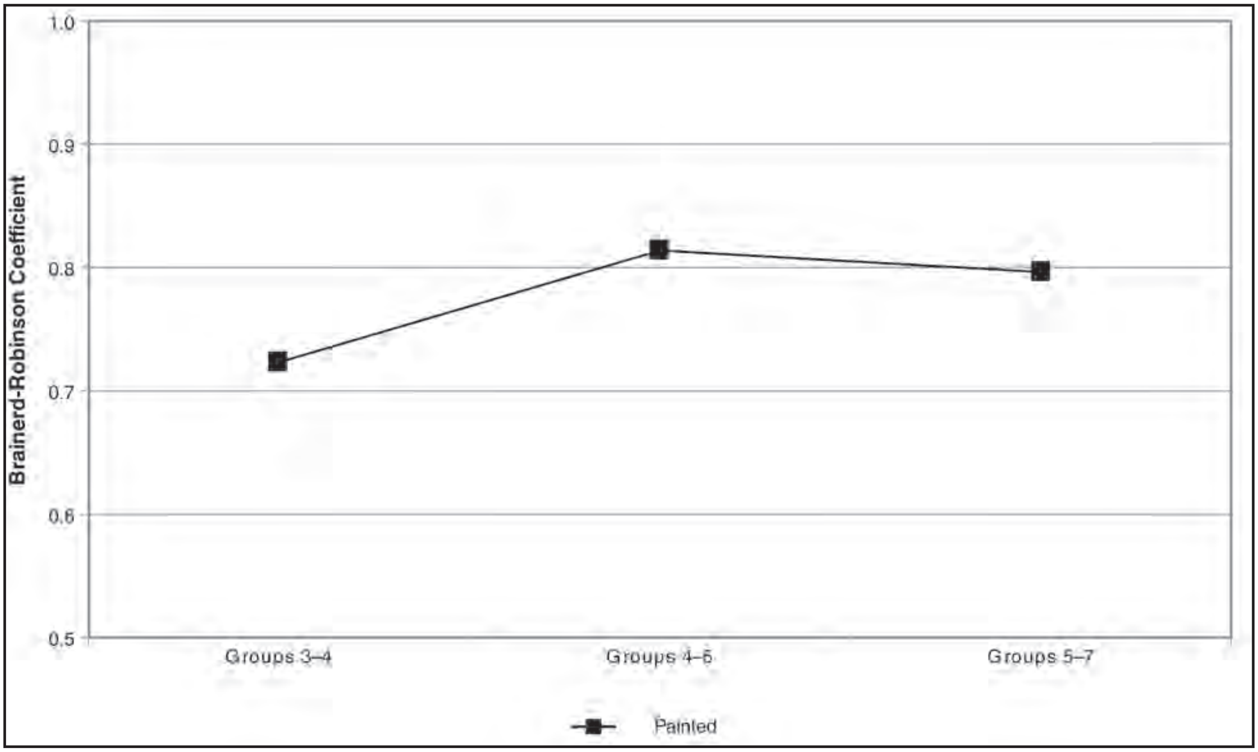


Figure 54. Line graph showing the between-group Brainerd-Robinson coefficients of similarity for painted types in Contemporaneity Groups 1-7, in Locus D.

of interregional interaction and exchange networks during the mid-A.D. 900s. For unpainted wares, the biggest change was between Contemporaneity Groups 1 and 2, suggesting a shift in plain ware provisioning practices from the Early to Middle Formative period, as discussed above (see Figure 53). The percentages of unpainted types and wares were relatively consistent among the other groups; the between-group BR scores for Contemporaneity Groups 3–7 ranged from 0.87 to 0.96, compared to 0.77 for the Contemporaneity Group 1–3 transition. These results complement the Locus C and site-wide results in indicating frequent changes in painted-pottery provisioning practices during the Middle Formative period. They also suggest relative stability in provisioning patterns for unpainted wares during the Middle Formative period. Again, the more volatile pattern of change for painted wares relative to unpainted wares underscores the probable social and cultural significance of painted pottery for expressing social information, such as identity, status, or cultural origin.

Discussion: Interaction, Exchange, and Social Transformation

The analyses discussed above underscore changes in painted-pottery frequencies during the Middle Formative period. The inhabitants of Mescal Wash obtained and used painted pottery affiliated with pottery traditions in the Hohokam "heartlands" to the west (Phoenix and Tucson Basins) and in the San Pedro Valley to the east (Dragoon and San Simon areas). The social and economic connections between the inhabitants of the Mescal Wash site and populations in these eastern and western interaction spheres remained remarkably consistent during the Middle Formative period, although the pattern of exchange or interaction *within* those spheres changed substantially.

In the western sphere, Tucson Basin brown wares were prevalent throughout the Middle Formative period, but Phoenix Basin buff wares were nearly as prevalent in the Middle Formative A period. Similarly, both Dragoon and San Simon painted wares were popular during the Middle Formative A period, but Dragoon brown wares eclipsed San Simon wares in the Middle Formative B period. By the end of the Middle Formative period, Tucson Basin brown wares clearly dominated the painted-ware collection, suggesting a possible stabilization of affiliations and/or extralocal interaction by about the A.D. 1000s. Our analyses of specific loci and residential features (or clusters of features) further suggest variability in painted-ware use among contemporaneous households, kin groups, or communities during the Middle Formative period. Different kin units and communities appear to have separately and independently established social or trade connections to nonlocal regional communities to the east and west.

The refined chronological study highlights a series of rapid changes in painted-pottery frequencies over a relatively short time span in the A.D. 900s. Painted-ware frequencies shifted erratically over several seemingly short-lived occupational episodes, implying shifting social alliances and affiliations. The site inhabitants appear to have maintained a diversity of social connections (either real or fictive) with nonlocal groups in various areas of southern Arizona during this transitional period. The expansion of the ball-court system and "internationalization" of social interaction during the Middle Formative B period may have created a heightened consciousness of identity and cultural affiliation, especially in the frontier areas of the system, such as the Mescal Wash vicinity. Interaction among peoples of different cultural and ethnic backgrounds may have been frequent, especially if social or economic upheaval promoted frequent migration and resettlement. As a result, identities and affiliations may have been fluid and ephemeral during this span, as new interaction relationships replaced older ones.

If this interpretation is correct, then the Middle Formative A–B period transition at Mescal Wash may have been marked by social or economic instability, prompting site inhabitants to establish new extralocal connections and to realign social or economic ties. The precise causes of these changes are unclear and could be rooted in social relationships or economic provisioning practices, but a comparison of the painted- and unpainted-ceramic evidence suggests that a social cause is more likely. If both the painted- *and* the unpainted-sherd collections evidenced rapid changes in pottery use, then we would be inclined to attribute these changes to economic causes in household provisioning practices and trade connections. That the rapid changes are more evident with respect to painted wares indicates that the changes were more likely couched in issues of social identity and affiliation. Painted pottery provided a readily identified and salient medium for expressing social information, such as identity and status, during public gatherings and events. We further explore the question of public feasting and commensal gatherings in the following section.

Site Function and Activities: A Diachronic Perspective

As explained above, detailed analyses of vessel forms and attributes shed light on site function and human activities. For example, formal data can help archaeologists determine whether sites functioned as primary residences or field houses or as loci for other specialized activities. In this case, we focused on possible indicators of feasting behavior or communal activities at the site. This line of approach was appropriate in light of the high frequencies of painted wares, many of which presumably were used as serving vessels during communal events. If painted pottery provided a medium for expressing social information, as argued above, then it likely would have been prominently used during public events, such as feasts or communal activities.

Above, we discussed the analyses of the varying distributions of form classes and functional categories among the loci. We showed that Locus A contained higher-than-expected frequencies of bowls, painted vessels, and large serving vessels, all of which suggest that it may have functioned as a locus of communal feasting or ceremonial activities. Here, we focus on diachronic changes within and across the loci. One objective is to determine whether the patterns observed above regarding the high frequencies of serving vessels and bowls in Locus A persist when the data are chronologically controlled. We begin with a discussion of the analysis of changes in vessel-form and -functional-class frequencies.

Site-Wide Changes in Vessel Morphology

In this section, we discuss the analysis of diachronic changes in the vessel-form and -functional categories for the entire project area; in the following section, we focus narrowly on changes within loci. We explore patterns of change for both the general forms and the more-detailed functional classes explained above. We separately discuss the Middle Formative and Late Formative period results.

Given that form and functional classes were identified for a subset of the larger collections, our analyses of formal changes were limited by sample sizes, especially when the data were subset by time, locus, or feature. We report changes in form classes on both a broader level of time period (Middle Formative A, Middle Formative B, and Late Formative B periods) and on a more refined level of the contemporaneity group, but for the smaller sample of rims assigned to functional classes, we only analyzed changes over broadly defined time periods. Functional categories were identified for a small sample of 581 whole/reconstructible vessels and large rim sherds; of these, only 119 were recovered from features that were assigned to contemporaneity groups, which severely limited the number of identified classes per group.

Middle Formative Period

Changes in General Vessel-Form Classes

The diachronic patterns in vessel forms complement the patterns reported above concerning changing frequencies of painted and unpainted wares. Figure 55 illustrates the percentages of unpainted and painted bowls and jars per period. To enhance interpretability, we subdivided the form data according to whether the surface was painted or unpainted, an especially important distinction in light of our argument, above, that painted vessels conveyed important social information.

Most striking in Figure 55 is the increase in percentages of painted bowls from the Middle Formative A period to the Middle Formative B period. Painted and unpainted bowls were about equally prevalent in features assigned to the Middle Formative A period (ca. 30–35 percent). In contrast, painted bowls outnumbered unpainted bowls by roughly 2.6 to 1 in the features assigned to the Middle Formative B period. In addition, the percentage of painted jars roughly doubled during this span, although the percentages were still relatively small for both periods (under 10 percent). In the Middle Formative A period, painted jars outnumbered unpainted jars by about 9 to 1, but the ratio declined to about 2 to 1 in the Middle Formative B period.

Figure 56 shows the same trends, but using the more-refined site-wide contemporaneity groups as the chronological units of analysis. As explained above, Contemporaneity Groups 1 and 2 roughly correspond to the first and second halves of the Middle Formative A period, and Contemporaneity Groups 3–7 encompass the Middle Formative B period occupation. We use a line graph to show diachronic trends, because line graphs provide a strong medium for illustrating changes over successive occupations. Although the sample size for identified form classes in Contemporaneity Group 2 was small (n = 15), the percentages were consistent with those in the far-more-robust Contemporaneity Group 1 (n = 198). We report the Contemporaneity Group 2 results, but they should be considered tentative because of the small sample of identified forms. The number of identified form classes in Contemporaneity Groups 3–7 provided a more robust sample for inferring changes in pottery use (n = 63, 31, 81, and 252, respectively).

In both groups, unpainted bowls were dominant (roughly 45–50 percent), and the percentages of painted bowls and unpainted jars were about equal (roughly 20–25 percent each). Painted jars were virtually nonexistent in Contemporaneity Groups 1 and 2. Contemporaneity Group 3 (mid-A.D. 900s) revealed changes in pottery use and site activities concurrent with the Middle Formative A–B period transition. Painted bowls became more prevalent at this time and continued to compose half to two-thirds of the ware/form categories throughout the Middle Formative B period sequence (Contemporaneity Groups 4–6). In contrast, the percentages of unpainted bowls dropped to roughly 25–30 percent in Groups 3–6.

Notably, the overall proportion of bowls did not vary substantially among the six contemporaneity groups. The combined percentage of painted and unpainted bowls in Contemporaneity Groups 1 and 2 was 74; in combined Contemporaneity Groups 3–7, the percentage was 78. So, bowls did not appear to have been used more intensively

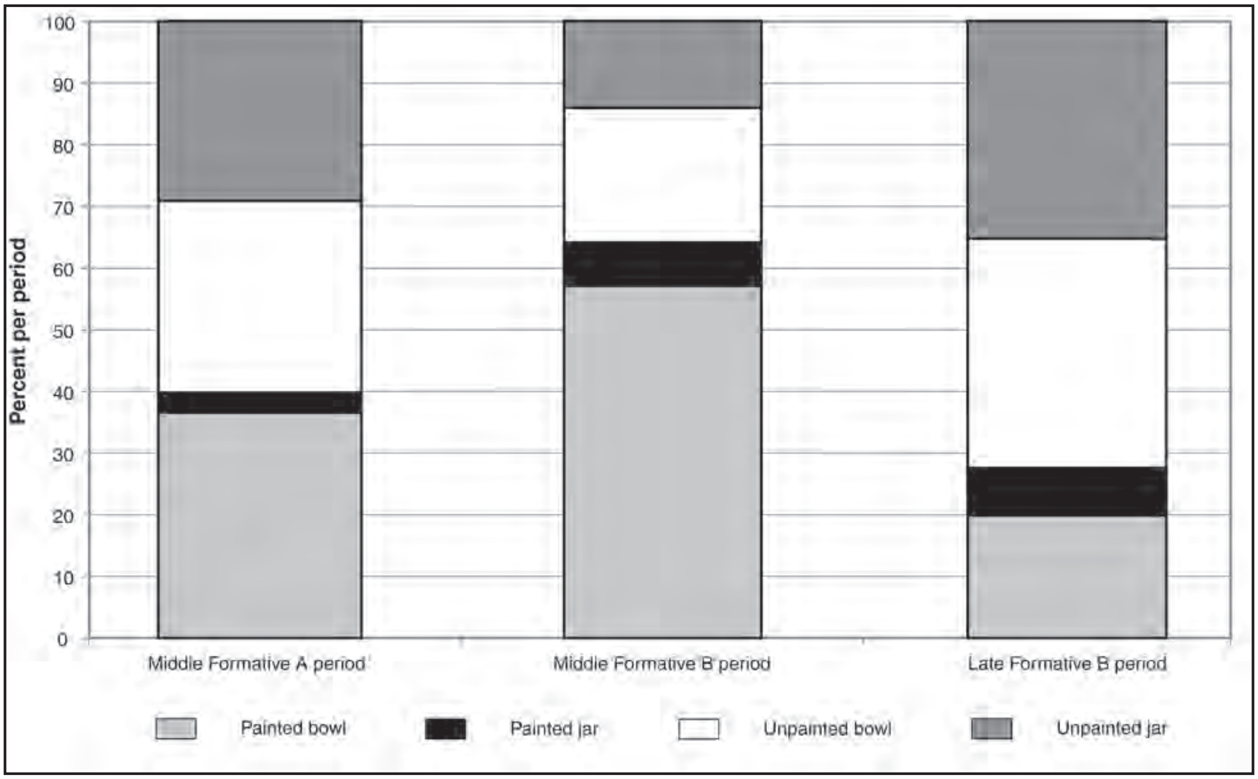


Figure 55. Bar graph showing the percentages of general form classes per period.

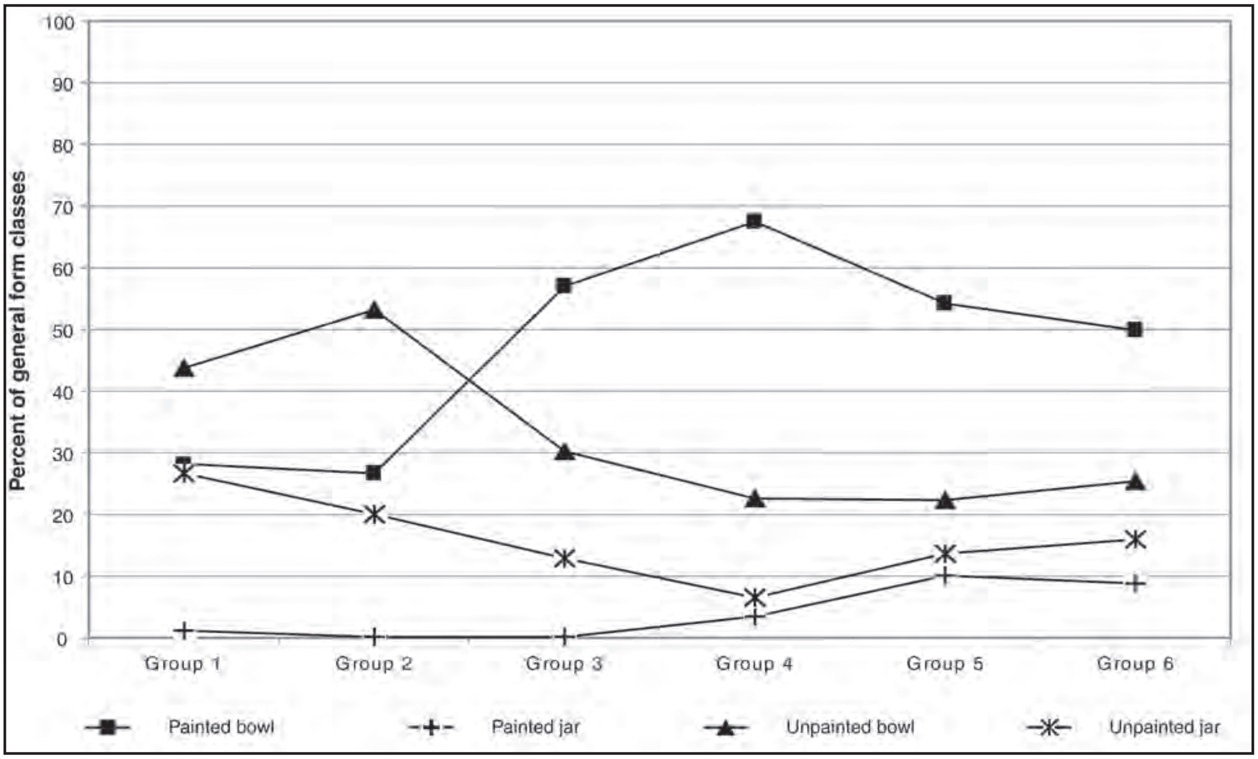


Figure 56. Line graph showing changes in the percentages of general form classes for site-wide Contemporaneity Groups 1-6.

during the Middle Formative B period than during the Middle Formative A period. Rather, painted bowls appear to have largely replaced unpainted bowls at that time. This result suggests continuity in the range of vessel forms used at the site but change in the frequency with which site inhabitants used painted and unpainted vessels.

Painted jars also became more prominent during the Middle Formative B period occupation (Contemporaneity Groups 5 and 6). In Contemporaneity Groups 4–6, especially, the frequencies of painted jars nearly matched the frequencies of unpainted jars. It is unclear why the inhabitants of Mescal Wash obtained and used decorated jars more frequently during the later part of the Middle Formative B period than during the earlier part. If we assume that the use of painted vessels reflects social communication, which may not necessarily be the only reason for using decorated pottery (see Smith 1999, 2007), then one possibility is that the site inhabitants increasingly desired painted vessels for various extrahousehold tasks besides the serving/processing of food, such as water carrying or outdoor food preparation. A heightened sense of cultural or social affiliation may have been pervasive at this time, resulting in the manufacture and use of painted pottery in a variety of forms and functions to communicate identity or affiliation. Also possible are changes in diet or food-serving practices that required jars to be used more frequently during feasting and public ceremonial events.

Changes in Vessel Size

We focused exclusively on unpainted ceramics to evaluate changes in vessel size because too few painted types were classified by functional category to support detailed analysis. In addition, the sample sizes of functional classes were attenuated when subset by period. The counts of unpainted storage and storage/transfer vessels per period were too small to support this analysis (mostly fewer than 10 rims per period); therefore, we concentrated exclusively on the processing/serving and storage/cooking vessels. The small sample size per functional class was particularly problematic for the Late Formative B period. (Note that our “small” category combined the cases classified as “small” and as “individual/small,” because of the very small number of cases classified in the latter category.) To illustrate the sample-size limitations, we list the numbers of cases per size class within the stacked bar graphs in Figure 57.

Figure 57 shows the changes in vessel sizes per period for unpainted processing/serving vessels (top graph) and storage/cooking vessels (bottom graph). Processing/serving vessels were made in a variety of sizes during the Middle Formative A period, but most (80 percent) were classified as individual, small, or small/medium in size. About the same percentage of processing/serving vessels from Middle Formative B period contexts (74 percent) were classified as individual, small, or small/medium. Medium- and large-sized processing/serving vessels accounted for only 20–25 percent during both periods. One difference is the absence of individual-sized vessels in the features assigned to the Middle Formative B period. Individual-sized processing/serving vessels were infrequent in the Middle Formative A deposits; therefore, this difference might be attributable to sampling error. For storage/cooking vessels, about 80–85 percent were classified as small and 15–20 percent as small/medium for both periods, suggesting consistency over time in the sizes of storage/cooking vessels.

Overall, these data suggest continuity in the distributions of size classes per functional category throughout the Middle Formative period. So, the probable functions of those vessels likely remained consistent, even as the proportions of painted wares changed. Processing/serving vessels were generally small in size and were likely intended for serving food or drink to an individual or a small group. Cooking/storage vessels were also generally small and probably functioned as storage or food-preparation vessels for a single family or small group. In sum, although painted wares changed considerably over time during the Middle Formative period, the sizes, shapes, and functions of unpainted wares appear to have been constant. This pattern complements the consistency in plain-ware-type distributions during this span (see above).

Late Formative B Period

Changes in Vessel Form and Decoration

Figure 55 illustrates the percentages of ware/form categories for the Late Formative B period and how they compare to the previous Middle Formative period occupations. A line graph would not have been appropriate to illustrate these changes, because the Middle Formative B and Late Formative B period occupations were not successive but separated by several centuries.

Compared to the Middle Formative period, the Late Formative B period features possessed smaller percentages of painted bowls and jars (28 percent). In contrast, the majority of identified forms were unpainted bowls and jars, which were about equally frequent (37 and 35 percent, respectively). Employing the same interpretive framework as above, this pattern indicates considerably less emphasis on the use of painted vessels than during the Middle Formative B period. This may indicate a lesser need to communicate social status, affiliation, or identity through the use and display of painted vessels during the Late Formative B period. Most household pottery inventories at this time probably consisted of undecorated vessels used for intramural domestic tasks.

In addition, a higher proportion of painted vessels were jars than in the Middle Formative period. In the Middle Formative A and B periods, painted bowls outnumbered painted jars by 11 to 1 and 8 to 1, respectively. In the

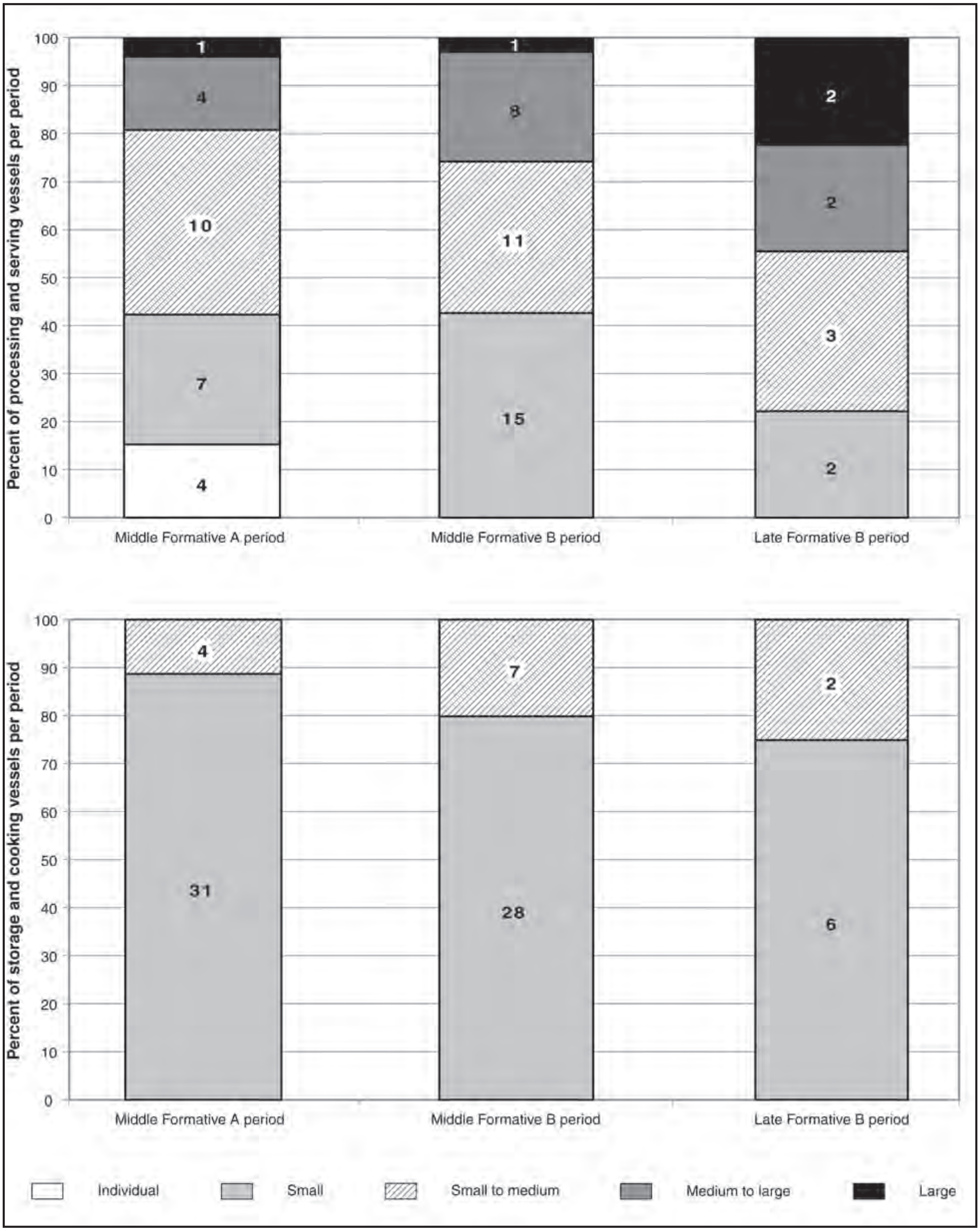


Figure 57. Bar graphs showing the percentages of vessel-size classes per period for unpainted processing/serving vessels (upper graph) and storage/cooking vessels (lower graph). Numbers indicate counts for each size class

Late Formative B period, painted bowls outnumbered painted jars by only 2.6 to 1. The higher frequency of painted jars in the Late Formative B period is difficult to interpret. Presumably, the jars were not used as serving vessels, although we cannot rule out the possibility that they were. As explained above, to facilitate interpretation, we have assumed that painted pottery was intended to transmit and communicate social information during communal gatherings, and serving vessels—mainly bowls—presumably were a staple of these events. But many archaeologists view jars as having been mainly used for domestic tasks, such as cooking, storage, or transport, limiting their effectiveness as media for communicating social information.

As is evident in our discussion, the higher frequency of painted jars relative to bowls in the Late Formative B collection depends on how one interprets the social meaning or function of ceramic decoration. On one hand, it is possible that the Late Formative B period inhabitants of Mescal Wash obtained painted pottery for reasons other than to communicate social information—perhaps to reinforce a sense of personal identity or to ritually consecrate an item (see Smith 1999, 2007). On the other hand, if we assume that decorated vessels were primarily intended to communicate social information to a broader audience than the immediate household, then we can conclude that painted jars were more frequently used in connection with social or communal activities during the Late Formative B period. As explained above, the most prevalent decorated ware during the Late Formative B period, Roosevelt Red Ware, was frequently manufactured as jar forms, although bowls were more prevalent (Crown 1994:46–47). Roosevelt Red Ware also may have functioned as part of a ritual tool kit (Crown 1994), and so their decoration may reflect a sense of personal devotion and ritual participation, rather than a mechanism for communicating social messages.

Changes in Vessel Size

Above, we suggested that the range of functions for the vessels recovered from Middle Formative period contexts remained consistent during the Middle Formative A and B periods (for processing/serving and storage/cooking vessels). The size and functional-class data for the Late Formative B period suggest different vessel functions from those of the Middle Formative period. The sample size of identified functional classes was very small for the Late Formative B period, and so the interpretation discussed below should be viewed as tentative, pending additional analysis using a larger data set.

As illustrated in Figure 57, the size classes for the storage/cooking vessels were roughly consistent for the Middle Formative A and B periods (but note that only eight storage/cooking vessels were recovered from Late Formative B contexts). As in the earlier period, storage/cooking vessels in the Late Formative B period tended to be small and probably functioned as utensils for storing and preparing food for a single family or small group. In contrast, the use and function of the processing/serving vessels may have changed from the Middle Formative period. The processing/serving vessels from the Late Formative B period contexts were generally larger in size; nearly 50 percent were classified as medium or large vessels, compared to 20–25 percent for the Middle Formative A and B periods. These data suggest that the Late Formative B period inhabitants of Mescal Wash made and served food and beverages using larger vessels than did the Middle Formative period inhabitants.

If valid, the latter pattern may suggest a change in eating habits from the Middle Formative period. In the Middle Formative period, the higher frequency of smaller processing/serving vessels suggests that most comestibles were apportioned as single servings for one or two individuals. During the Late Formative B period, conversely, food servings may have been apportioned to accommodate larger groups, such as nuclear families, who shared food from a single container. Additional data will be needed to test these hypotheses.

Intralocus and Interlocus Comparisons of Vessel Forms

The previous section compares changes over time in the project area. Here, we shift our focus to changes over time within loci. As explained above, diachronic studies were only possible for Loci C and D, as Locus A represented a temporally discrete occupation (see Lengyel, Chapter 2, this volume). We first discuss intralocus changes in Loci C and D using both the period designations and the contemporaneity groups. We then compare contemporaneous collections among the three loci for the Middle Formative B period component—the only component from which we have robust ceramic collections from more than one locus.

We should emphasize that the results reported below are probably not biased by feature variability, as explained above. Different vessel forms may have been used and discarded in different ways in relation to the various feature types, which could bias the diachronic patterns if the periods or contemporaneity groups encompassed differing feature types, but the vast majority of identified forms (91 percent) in Middle Formative A, Middle Formative B, and Late Formative B period contexts were collected from structures. Moreover, the combined ceramic composition of all structures compares favorably to the ceramic compositions of most of the other major feature types. We can reasonably conclude that the ceramic collections were minimally biased by the inclusion of varying mixes of feature types in the period and contemporaneity-group collections.

Changes in Pottery Form in Loci C and D

Locus C

Most of the ceramics from Locus C were collected from features assigned to the Middle Formative B period. Although the locus contained a small Middle Formative A period component, very few rims and vessels identified by form were collected from that component. We therefore concentrate on formal changes per contemporaneity group in Locus C, rather than per period. We exclude Contemporaneity Group 1 in Locus C—only 12 form classes were identified—and concentrate instead on formal variability in Contemporaneity Groups 2, 3, and 4. Again, Contemporaneity Groups 2 and 3 may represent ephemeral, successive occupational episodes during the mid- to late A.D. 900s. Contemporaneity Group 4 was likely a more stable occupational episode during the A.D. 1000s.

Figure 58 illustrates the changes in frequencies of unpainted and painted bowls and jars in Contemporaneity Groups 2–4. Painted bowls dominated in all three groups, which is consistent with the aforementioned pattern of higher painted-bowl frequencies during the Middle Formative B period. It may be notable that jars, in general, were more prominent in Contemporaneity Group 3 than in Contemporaneity Groups 2 and 4, which could represent a sampling bias. Surprising is the peak in the percentage of painted jars in Contemporaneity Group 3, which outnumbered both unpainted bowls and unpainted jars. The reason for this pattern, if statistically valid, is difficult to fathom. Perhaps the use of painted vessels, in general, peaked at this time because of a heightened need to express status or cultural affiliation. The time span associated with Contemporaneity Group 3, as explained above, may reflect disruption or rapid change in interregional interaction and exchange. If so, an unstable social environment may have produced a hyperawareness of social identity. In turn, the site inhabitants may have sought to express their affiliations through a variety of media beyond serving vessels, including via domestic jars.

Locus D

Figure 59 illustrates the variability in form classes among the contemporaneity groups in Locus D. Unfortunately, we were unable to include Contemporaneity Groups 1, 2, and 6 in our analysis, because of small sample sizes. Even so, Contemporaneity Groups 2–5 and 7 represent key occupation spans during the Middle Formative period. Contemporaneity Groups 3 and 4 likely relate, respectively, to occupations during the earlier and later portions of the Middle Formative A period; Contemporaneity Group 5 likely indicates a period of transition between the

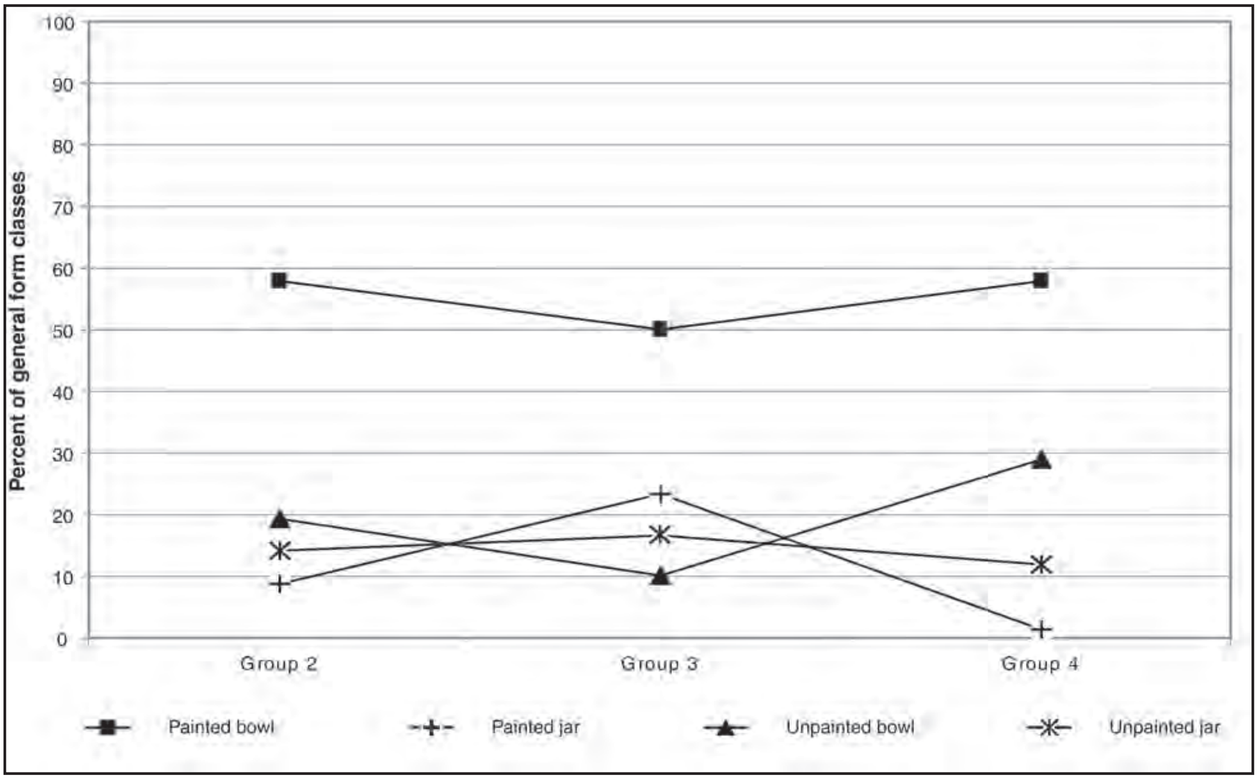


Figure 58. Line graph showing changes in the percentages of general form classes for Contemporaneity Groups 2-4, in Locus C.

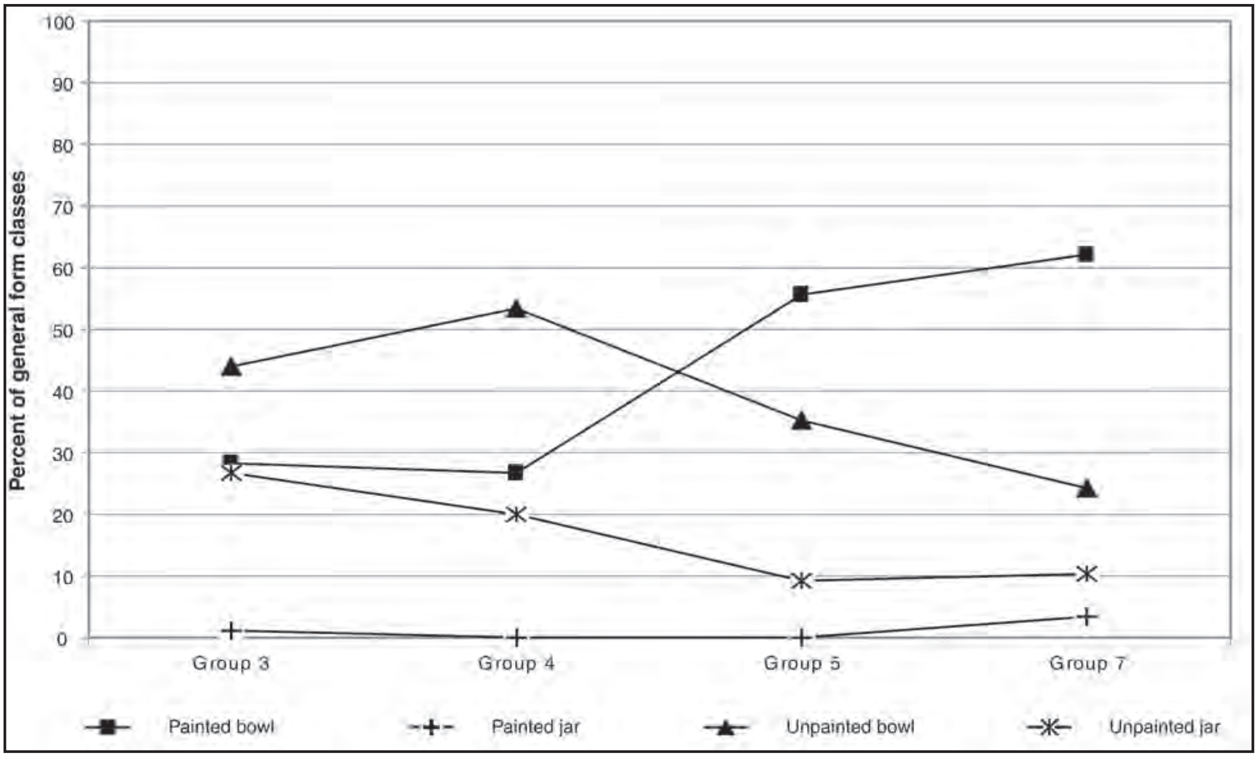


Figure 59. Line graph showing changes in the percentages of general form classes in Contemporaneity Groups 3, 4, 5, and 7, in Locus D.

Middle Formative A and B periods in the mid-A.D. 900s; and Contemporaneity Group 7 pertains to a later Middle Formative B period occupation in the A.D. 1000s.

The form percentages for Contemporaneity Groups 3 and 4 were roughly consistent. As observed above, unpainted bowls outnumbered painted bowls, and painted jars were virtually nonexistent. In Contemporaneity Group 5, a probable period of transition in extralocal social relationships, painted bowls eclipsed unpainted bowls. The proportion of bowls in general also increased in this group, relative to earlier groups: bowls composed 72 and 80 percent of identified forms in Contemporaneity Groups 3 and 4, respectively, which increased to 91 and 86 percent in Contemporaneity Groups 5 and 7, respectively. The Locus D collection differed from the Locus C collection in that painted jars were rare throughout the Middle Formative period sequence. In Locus C, the percentage of painted jars peaked during the early part of the Middle Formative B period. In Locus D, painted vessels peaked in Contemporaneity Group 7.

Unlike Locus C, the larger rim collection from Locus D permitted a diachronic analysis (per period) of the more-detailed functional classes, which are illustrated in Figure 60. Processing/serving vessels dominated the functional classes in the Middle Formative A and B period collections. They composed more than half of the Middle Formative A period collection and more than 80 percent of the Middle Formative B collection. No storage or storage/transfer vessels were collected from Middle Formative B period features, which could be attributable to sampling error (functional classes were identified for only 22 rims from Middle Formative B period features). In the Late Formative B period, painted pottery was less frequent, and most pottery was likely unpainted pottery used mainly for domestic tasks, such as cooking and storage. Overall, these results from Locus D do not vary much from the site-wide results reported above.

Interlocus Comparisons: The Middle Formative B Period

Above, we argued that Locus A might have frequently been used for feasting and public ceremonies, given the high frequencies of bowls and painted sherds. That analysis combined data for all periods into a single unit of analysis. One possibility, we proposed, is that the higher frequencies of bowls and painted ceramics relate to the more-limited occupation span at Locus A during the Middle Formative B period, when frequencies of bowls and painted vessels

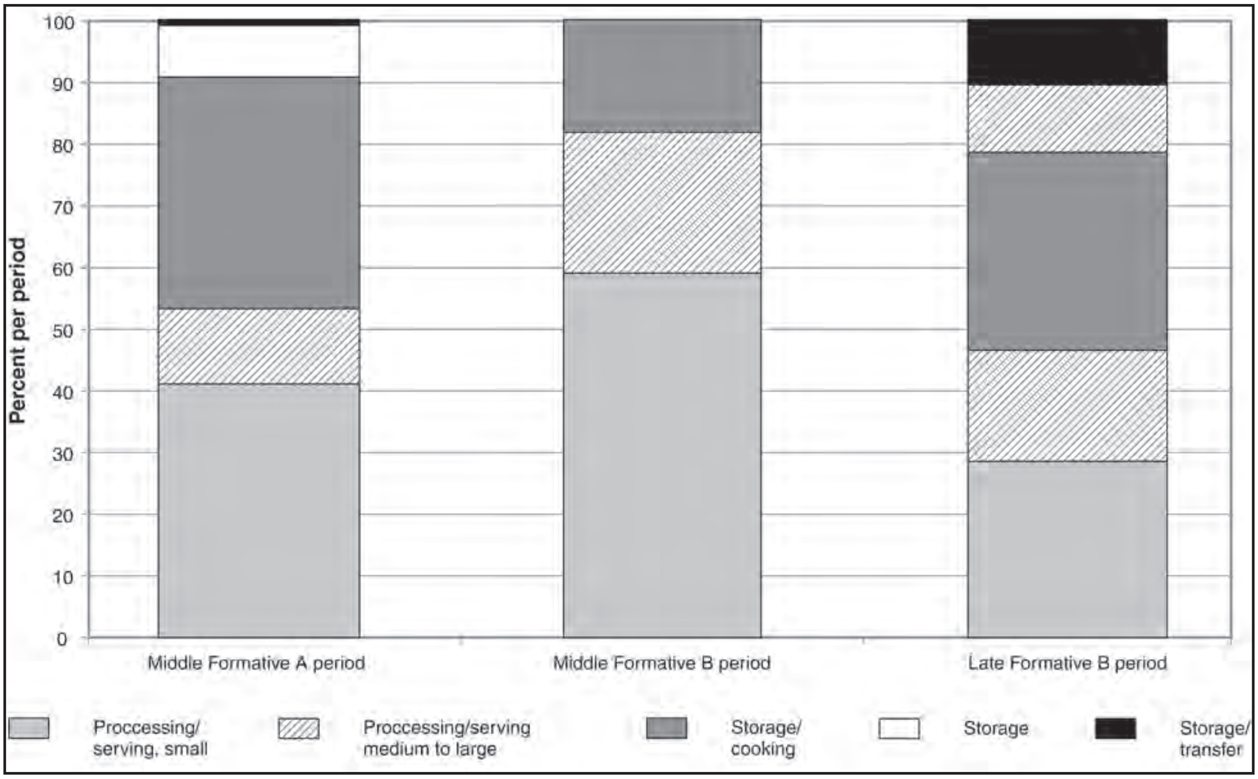


Figure 60. Bar graph showing the percentages of functional categories per period in Locus D.

peaked. In this section, we explore this hypothesis using chronologically more-refined data.

Figure 61 shows the proportional differences in the frequencies of painted and unpainted bowls and jars for Loci A, C, and D during the Middle Formative B period. Indeed, Locus A possessed the highest frequency of painted bowls (59 percent) among the loci, but this percentage was only slightly higher than the percentages in Loci C (55 percent) and D (52 percent). Moreover, both Loci C and D included slightly higher frequencies of bowls in general (80 and 84 percent, respectively) than did Locus A (78 percent). This indicates that a higher ratio of bowls from Locus A included painted decoration (2.9 to 1, versus 2.2 to 1 and 1.6 to 1 for Loci C and D, respectively). Frequencies of painted and unpainted jars varied little among the three loci. In all, these data do not support the above hypothesis that feasting and ceremonialism were more prevalent in Locus A than in the other two loci during the Middle Formative B period.

An inspection of the distribution of detailed functional classes also fails to corroborate the hypothesis. As shown in Figure 61, Locus D contained a higher frequency of processing/serving vessels (82 percent) than did either Locus A (66 percent) or Locus C (61 percent). But only 22 rims and vessels from Middle Formative B period features in Locus D were identified by functional class, and so the high percentage may be misleading. The percentages of storage/cooking vessels were comparable among the loci (18–26 percent), but the percentages of storage vessels differed slightly, especially between Loci A and C.

Overall, in light of the period-controlled data, we reject the hypothesis that Locus A was a special area that accommodated frequent feasting or communal events. A higher frequency of serving/processing vessels and painted vessels was characteristic of the Middle Formative B period in all loci, and the loci did not appear to vary substantially in this regard.

Discussion: Vessel Morphology, Decoration, and Social Change

These data show that, during the Middle Formative A period, most bowls and serving vessels were undecorated processing/serving vessels, mainly bowls. Painted bowls were less frequent and probably used during occasional domestic or communal feasts or ritual events. These activities might not have occurred frequently enough to warrant each household's maintaining a large inventory of painted vessels. Perhaps most food-serving and -preparation activities took place within the confines of each household or kin group, so that there was little need to maintain a large inventory of decorated serving vessels to communicate one's social affiliation or prestige. Other interpretations

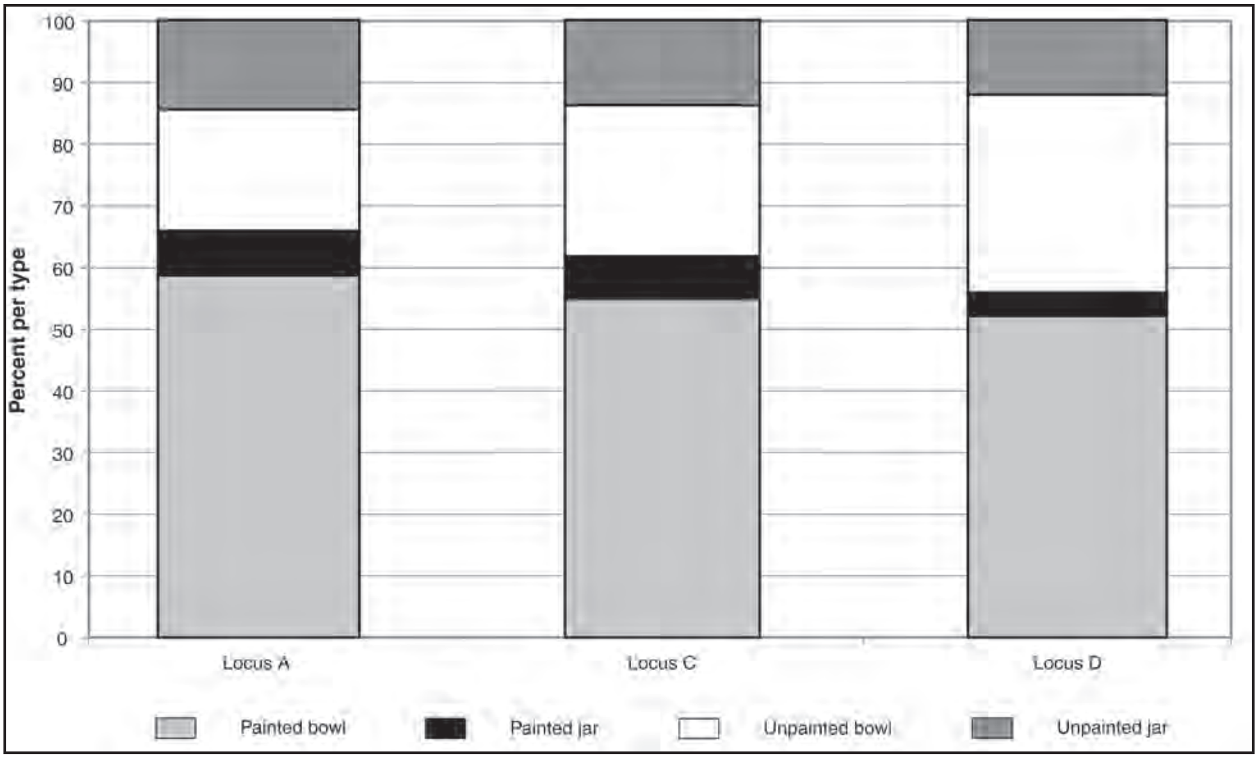


Figure 61. Bar graph showing the percentages of painted and unpainted bowls and jars per locus for the Middle Formative B period.

are possible. One possibility is that painted vessels did not yet possess the social prestige and value that they achieved during the ensuing Middle Formative B period.

The higher frequencies of painted serving vessels during the Middle Formative B period might suggest a change in site activities. According to some archaeologists (e.g., Dietler [1996]), high frequencies of serving vessels, especially painted wares, typically indicate commensal feasting or ceremonial behavior, during which large volumes of comestibles were served and shared among a larger group or community. This interpretation reinforces the above suggestion that feasting and public ceremonial activities occurred more frequently during the Middle Formative B period than during the previous period. Again, this change in site activities probably relates to the area's participation in the expanding interregional ball-court network during the A.D. 900s and 1000s (see Wilcox and Sternberg 1983).

A related possibility is that painted serving vessels became a primary medium for communicating social identity or affiliation during the Middle Formative B period. Interaction among peoples of different cultural and ethnic backgrounds may have been frequent during this span. As a result, identities and affiliations may have been fluid and ephemeral, as new interaction relationships replaced older ones. The seemingly rapid changes in occupations at the Mescal Wash site in the A.D. 900s and early 1000s—as suggested by the various identified episodes (see Lengyel, Chapter 2, this volume)—coupled with the changing proportions of painted ceramics associated with various regional traditions (e.g., Hohokam, Dragoon), suggest ephemeral and rapidly shifting patterns of social and economic interaction during this span (see above).

In the Late Formative B period, applying this same logic, the higher percentages of unpainted bowls and jars relative to the Middle Formative period suggest less emphasis on social interaction and communal activities. The relative dearth of painted wares further implies less concern with social displays of status or affiliation among the Late Formative B period inhabitants. The cessation of the interregional ball-court networks by the A.D. 1100s could have reduced the frequency and regularity of feasting and communal events. That nearly as many jars as bowls were decorated might indicate a decreased role for social displays and communal activities, compared to the Middle Formative B period. As noted above, painted pottery might have been used to enact cult rituals (*sensu* Crown 1994) rather than to express social affiliations or identity in public contexts. Overall, the majority of pottery vessels were unpainted, probably domestic wares used for mundane tasks, such as cooking, storage, transport, and small-scale serving of comestibles. The generally larger size of processing/

serving vessels may indicate a change in diet, eating habits, or food-serving practices.

Summary and Conclusion

Summary of Results

More than 54,000 ceramic artifacts were recovered during data recovery excavations at the Mescal Wash site, mostly from Loci A, C, and D. Almost half of the artifacts were too small for identification according to ware class or type; therefore, our analyses focused primarily on the roughly 28,000 larger artifacts that the analysts were able to identify. A study of the distributions of very-small sherds and vessels suggests that the ceramic materials discarded in Locus D were subjected to increased breakage, relative to Locus A and C, probably as a result of frequent trampling and disturbance over a long span of occupation and reuse (see Beck 2006). Locus A included a smaller percentage of very-small sherds and a higher percentage of vessels, suggesting that it was less frequently subjected to trampling and disturbance, likely because of its briefer occupation span than those of Loci C and D. Overall, the proportions of very-small sherds and vessels clearly correlate with the occupational intensity of the loci, which corroborates Beck's (2006) observation of high ceramic-breakage rates in areas of heavy pedestrian traffic and activity.

Table 66 summarizes the major findings and data patterns derived from the present study. The results suggest important changes in pottery use and exchange during the Middle Formative and Late Formative periods. The earliest pottery vessels were mostly unpainted wares that likely were used for a variety of common domestic tasks, such as cooking, storage, serving, and transport. The ceramic data suggest increased usage of painted serving vessels by the Middle Formative B period, possibly indicating a heightened emphasis on communal feasting or the use of painted decoration to communicate social information, such as identity or cultural affiliation. In the Late Formative B period contexts, painted pottery decreased in importance, and most pottery vessels were again used for a variety of common domestic tasks. These interpretations of diachronic changes require additional testing using other lines of evidence and should be regarded as hypotheses.

Community History and Social Change in Mescal Wash

One of the principal research objectives of the project was to better understand the "community history" of Mescal Wash (Altschul et al. 2000:8) in light of the evidence of cultural diversity of prehistoric period sites in southeastern Arizona (Altschul et al. 2000:8–9). Altschul et al. (2000:13; Vanderpot and Altschul 2007) characterized the site as a "persistent place" (after Schlanger 1992) with "repeated, intensive occupation, often by several different populations" (Atlschul et al. 2000:9). Our analyses of the ceramic data collected during the Phase 2 data recovery phase of the project, especially the large painted-sherd and -vessel collection, contribute to an assessment of the social composition of the Mescal Wash occupation and how it changed over time during the Middle and Late Formative periods. Unfortunately, very few ceramics were collected from Early Formative period contexts; therefore, they do not offer insights into the earlier occupations at the site. We therefore focus our discussion mainly on the Middle Formative period occupation.

Prior to the start of the data recovery project, SRI archaeologists were aware of the diversity of painted-ware classes present at the Mescal Wash site and at other sites in southeastern Arizona (Altschul et al. 2000; Vanderpot and Altschul 2007). During the Phase 1 investigations, they recorded painted sherds and vessels associated with the Tucson and Phoenix Basin Hohokam traditions, the Dragoon (Mogollon) tradition, the San Simon (Mogollon) tradition, the Roosevelt Red Ware tradition, and others (Vanderpot and Altschul 2000; see Heckman et al. 2000). The Phase 2 data recovery excavations certainly bore out the diversity of painted-pottery traditions associated with various regional communities. In addition to the above-mentioned traditions, the ceramic collection also included painted vessels/sherds associated with the Trincheras, Mimbres Mogollon, and Safford/San Carlos–area painted traditions.

Less clear are the roots of this ceramic diversity and how it relates to community history and social change at Mescal Wash. In this section, we explore the developmental implications of the diverse array of painted pottery wares, especially for the Middle Formative period—the main focus of our study—addressing three hypotheses: (1) that the painted ceramics from various regions indicate settlement by migrants from other areas of the greater Southwest; (2) that they indicate trade items acquired through exchange or other economic mechanisms; and (3) that the painted pottery represents mostly locally made imitations of foreign styles that expressed social affiliations or social relationships with peoples, cultural practices, or traditions in other "regional communities" (Altschul et al. 2000:13) of the Southwest. Of course, these hypotheses are not mutually exclusive, and aspects of each may be applicable in our interpretation, as we explain below.

We also want to be clear that, although we cite as much data as are available, our interpretations are largely speculative. Much more data than can be garnered here will be required to fully evaluate these hypotheses. Below, we separately evaluate the alternative hypotheses, based on

Table 66. Summary of Major Findings

Period	Ware and Typological Analyses	Formal Analyses
Early Formative period (pre-A.D. 750)	Only a small number of painted sherds were assigned to this period. The range of identifiable types suggests occupation during the latter part of the Early Formative period. Features dated to this period were dominated by unpainted wares, suggesting an emphasis on domestic pottery used for cooking, storage, and other mundane tasks.	Too few form classes were identified from features assigned to this period to infer patterning.
Middle Formative A period (A.D. 750–950)	Unpainted wares continued to dominate the collection (ca. 80 percent), but painted bowls became far more prevalent (ca. 20 percent). Tucson Basin brown wares and Phoenix Basin buff wares were the most-prevalent painted-ware classes. San Simon–style painted wares peaked at this time. Variability in painted-ware frequencies among structures or groups of structures suggests that households or kin groups separately and independently provisioned themselves with painted-pottery vessels.	Most identified vessels were unpainted bowls. Painted bowls and unpainted jars were roughly equal in number; painted jars were virtually nonexistent. Results suggest that most pottery was geared toward household use for common tasks, such as cooking and storage.
Middle Formative B period (A.D. 950–1150)	Painted wares increased in frequency, relative to the previous period, to ca. 40 percent of the collection, which suggests a possible increase in the use of painted pottery during feasts or public ceremonies. Tucson Basin brown wares became more prevalent, and Phoenix Basin buff wares decreased in prominence. Dragoon-style brown wares increased in prominence, and San Simon–style painted wares were virtually absent. Comparison among structures suggests a continuation of separate and independent provisioning practices among contemporaneous kin groups.	Frequencies of painted bowls increased substantially, relative to those of unpainted bowls, which may suggest more feasting and ceremonial behavior, as well as a heightened awareness of social identity and cultural affiliation. Painted jars were rare but became increasingly more frequent during the later portion of the occupation span.
Middle/Late Formative A period (A.D. 1100–1300?)	The ceramic collection for this period was very small but suggests continued high frequencies of painted vessels. Percentages of Dragoon- and Phoenix Basin–style painted wares increased, but many of these sherds and vessels may have been mixed in from earlier deposits.	Too few form classes were identified from features assigned to this period to infer patterning.
Late Formative B period (A.D. 1300–1450)	Painted pottery was less frequent overall, compared to the Middle Formative period collection. Roosevelt Red Ware dominated the painted collection. Tanque Verde brown wares also were collected from features assigned to this period.	Unpainted bowls and jars were almost three times as frequent as painted jars and bowls, possibly suggesting less emphasis on feasting and communal activities, relative to the Middle Formative period. Bowls tended to be larger in size than in the Middle Formative period, possibly indicating change in eating habits or apportioning.

ceramic evidence and, in so doing, arrive at some conclusions, but bear in mind that these conclusions and evaluations are based on one line of evidence among many; other material evidence put forward elsewhere in this volume does not support our conclusions regarding which is the best hypothesis. We make no pretense of deriving formal conclusions from our data.

Hypothesis 1: The Diverse Painted Pottery Indicates the Migration of Groups from Different Areas and Cultural Traditions in the Southern Deserts

This hypothesis is that the presence of the various regional ware traditions indicates the physical migration and settlement of peoples from other areas of the Southwest. The site population might have consisted of migrants who moved permanently or seasonally to the site to, for example, procure resources in the nearby Chihuahuan grasslands, which offered different resources from those available in their desert homelands. These migrants might have brought with them their own painted-pottery or pottery-making styles. As explained above, migration and movement of small groups (e.g., families) or even whole communities was a common practice in the prehistoric period Southwest (Cameron 1995); therefore, we should not be surprised to find evidence of large-scale habitation at the Mescal Wash site by migrants. Given the predominance of painted pottery associated with the Hohokam and Dragoon traditions, we could speculate that the migrants arrived from the Phoenix Basin, the Tucson Basin, the San Pedro Valley, and other areas.

One line of evidence reported above that addresses this issue is the distribution of forms and functional classes among the painted-ware categories. Virtually all of the Dragoon and San Simon painted wares were bowls that likely functioned as vessels for serving or processing food. Conversely, the painted rims associated with the Tucson Basin and Phoenix Basin Hohokam traditions included serving vessels as well as vessels used for storage, cooking, transport, and other domestic tasks. Painted serving bowls were typical of trade wares, as jars and nonserving vessels used for storage or cooking were less likely to have been acquired from foreign sources (unless they were technically superior in some way). If we assume that domestic ceramics were less likely to have been acquired from afar, then we can reasonably conclude that the Hohokam-style vessels were not obtained through trade but, rather, were brought to the site or manufactured locally in the styles of the potters' homelands. Although San Simon painted wares were mostly manufactured as bowls (Heckman 2000c), Dragoon brown vessels were manufactured as both bowls and jars (Heckman 2000b); so, the dearth of Dragoon painted jars was not a consequence of regional manufacturing preferences or a lack of availability.

This evidence tentatively supports the argument that the site was inhabited by Hohokam peoples who migrated from the Tucson Basin and/or Phoenix Basin (or elsewhere in the Hohokam realm). This pattern also helps to explain the predominance of painted pottery associated with the Hohokam tradition, which outnumbered painted sherds associated with the Mogollon (Dragoon and San Simon) traditions by about 4 to 1. Moreover, as noted above, most of the Phoenix Basin buff ware rims recovered from Mescal Wash were from small vessels, which is consistent with the expectations for long-distance exchange, given the logistical challenge posed by transporting large vessels over long distances. These data suggest at least two possibilities regarding the buff wares: (1) they entered the Mescal Wash area through trade, albeit on a large scale, or (2) migrants from the Phoenix Basin brought only small vessels with them, possibly to lessen transport costs, and obtained larger vessels after they arrived. In either case, we could speculate from these data that Hohokam peoples inhabited the site on a permanent or seasonal basis, again possibly to procure grassland resources or to facilitate exchange with populations to the east or south of the Hohokam region.

We do not find this explanation to be entirely satisfactory, though, largely because we are unsure of how to unequivocally infer a migrant population based on the composition of ceramic artifact collections. We can reasonably assume that migrant communities, to some extent, brought in or made pottery in the styles of their homelands. This practice has been observed in the Mimbres region (Hegmon et al. 2000) and in the Zapotec (Oaxaca) barrio at Teotihuacan (Spence 1992, 1996), but in neither of these cases did the migrant populations exclusively use native-style pottery. In the case of the so-called Zapotec barrio in Teotihuacan, for example, Zapotec-style gray wares were more prevalent than in other areas of the city; nevertheless, local-style Teotihuacan ceramics far outnumbered Zapotec gray wares in collections from this area (George Cowgill, personal communication 1997). Perhaps the "homeland" pottery vessels in the Zapotec barrio were reserved for important social functions, such as communal ritual gatherings or comensal feasts.

In the case of Mescal Wash, certain regional-style painted wares were more prevalent in some features and loci than in others, but *all* of the feature collections with painted sherds contained a mix of wares and types associated with different regional traditions. Given the absence of any clear "local" tradition in the area, we might expect that any migrants may have been more inclined to use the native-style pottery of their homelands. If so, we would expect a more pronounced segregation of painted wares among contemporaneous features or loci, but such segregation was not evident. Of course, the feature artifact compositions were created by complex depositional processes, including the dumping of domestic refuse in abandoned structures. Reuse of house foundations and the superimpositions of later features over earlier ones also prompted mixing of painted-pottery types, further confounding our ability to interpret the ceramic variability. The ceramic data, therefore, provide no clear answers on the issue of migration.

One line of evidence that calls into question the migration hypothesis is that Dragoon brown wares matched or outnumbered the Hohokam-style wares in several structures (Features 6098, 6129, and 6154 in Locus C). This evidence is not consistent with the above suggestion that the site was occupied by Hohokam-region migrants and that Dragoon and San Simon brown wares entered the site as foreign trade wares. One possibility is that migrants from communities in the Hohokam region and from the San Pedro Valley migrated to and inhabited the site simultaneously or separately but within a short time frame. It also is plausible that Hohokam migrants inhabited the site and traded for Dragoon and San Simon painted wares, but it is hard to reconcile this scenario with the variable proportions of different painted-ware and -type classes. If that were the case, we would expect to see a consistent pattern of mostly Hohokam-style painted wares in the structures, mixed with low levels of trade wares from the San Pedro Valley and elsewhere, and less variability among the features. This evidence does not necessarily rule out the migration hypothesis, though.

Hypothesis 2: The Diverse Painted Pottery Indicates Extensive Exchange Relationships with Populations in Various Culture Areas

A second hypothesis for the diversity of painted sherds is that the local site inhabitants acquired painted pottery through trade with nonlocal ceramic producers in those regions. This is likely true to some extent. Abbott (2006, 2010; Abbott, Smith, and Gallaga 2007; Abbott, Watts, and Lack 2007) has convincingly argued that the regional ball-court system, which extended into southeastern Arizona, provided a venue for commercial exchanges of pottery vessels and other products through an interconnected network of ball-court villages. Abbott focused mainly on the trafficking of pottery in and near the Phoenix Basin, but as explained above, this system likely also provided a mechanism for commercial exchange of pottery vessels over long distances and could have produced large-scale disseminations of products throughout the area encompassed by the ball-court system. Abbott (2010) characterized the ball-court system as a noncentrally administered market network that facilitated interpersonal product exchange over a large area.

Above, we suggested that the prevalence of small vessels among the Phoenix Basin buff ware rims is consistent with the possibility of long-distance exchange. The ball-court system may have provided a venue for itinerant merchants to peddle small buff ware vessels on a large scale and over a large area. Movement over long distances would have been greatly facilitated by small vessels that could be more easily trafficked in bulk shipments.

But is this scale of product movement actually feasible? First, the sheer volume of nonlocal painted pottery recovered from the site would have required an enormous amount of investment in the trade and trafficking of pottery vessels. Painted sherds and vessels accounted for more than 6,000 ceramic artifacts and about 21 percent of the total ceramic collection; the percentage increased to about 40 percent for the Middle Formative B period component. It is not feasible to estimate the number of painted-pottery vessels that were in use at any given time based on the data recovery sample, but we can reasonably estimate that it was probably in the thousands (or tens of thousands) of painted vessels. Even if we consider Tucson Basin brown ware to be “local,” the other, nonlocal ware classes still accounted for about 12–15 percent of the collection and roughly 4,000 painted sherds (depending on how we reckon the many cases assigned to the indeterminate and split categories).

Pottery is bulky and heavy and probably not easily moved over long distances without substantial transport and energy costs (see Sluyter 1993). Moreover, the pottery vessels earmarked for exchange had to have been transported by human carriers over rough terrain and without the assistance of draft animals or wheeled technologies. Given the limitations of transport technology, access to riverine travel arteries, and high-volume-shipping costs, it is unlikely that pottery exchange in the Southwest could have occurred on a sufficiently large scale to supply such a large volume of painted pots to the Mescal Wash population, even with the connectivity advantage offered by the ball-court network. Some forms, such as bowls, were smaller and readily stacked for transport (see Zedeño 1994), but less-stackable jars and larger bowls likely presented severe logistical limitations for long-distance exchange. Admittedly, our inference is not grounded in empirical data, and a more rigorous approach may prove us wrong.

An important unknown aspect of this argument concerns the number of sherds that equate to a single pot. If each pot accounts for, say, 100 sherds on average, then the quantity of sherds does not seem daunting or limited, in regard to long-distance exchange, especially if it occurred within the context of an organized exchange system. But if the average is much lower (e.g., 10 sherds equals 1 pot), then the number of vessels represented in the site collection would seem to pose a serious logistical challenge. A rigorous means of quantifying the number of vessels represented in our sample will be required to better address this important question. Another unknown element is time. A detailed estimate of the accumulation rate for various vessel classes also would help approximate the rate at which vessels were obtained. In all, both of these estimates will be needed to assess our logistical reconstruction.

Second, a large proportion of the painted vessels associated with nonlocal traditions were from Middle Formative A period contexts that possibly predate the full florescence of the ball-court-based exchange network and its expansion into southeastern Arizona. In the Middle Formative A period component in Locus D, for example, Phoenix Basin buff wares composed more than one-third of the painted sherds and vessels, but the Middle Formative A period inhabitants of Locus D likely procured and used thousands of buff ware vessels during the occupational episode. Abbott (2006, 2010; Abbott, Smith, and Gallaga 2007) has argued that the ball-court system peaked as a venue for commerce during the A.D. 1000s (ca. A.D. 1000–1060, in his estimation), roughly 2 centuries after the main occupation in Locus D. As explained in the previous paragraph, it probably would have required a considerable investment in transport and energy to import buff ware vessels to Mescal Wash from the Phoenix Basin on such a large scale, especially in the absence of a formalized and regional exchange network, like the ball-court system. The Phoenix Basin lies more than 200 km from the Mescal Wash site, and direct river routes were not accessible.

On one hand, these data are consistent with the idea that the majority of painted-pottery vessels were made locally, possibly as local imitations of nonlocal-style vessels. On the other hand, the prevalence of small vessels among the buff wares implies long-distance exchange. To be sure, the collection might consist of a mix of locally made and imported painted wares. Provenance data based on compositional studies of the ceramic materials, such as chemical or petrographic analyses, will be needed to shed light on this issue.

Hypothesis 3: The Diverse Painted Pottery Indicates Differences in Social Identity and Cultural Affiliation among Local Site Inhabitants

The final hypothesis is that the diversity of painted-pottery styles resulted from local imitations of foreign styles, possibly indicating an acceptance or “buying into” of foreign ritual practices or ideologies (*sensu* Crown 1994). Bayman (2002) emphasized the importance of a communal ideology of corporate-group membership and identity among the pre-Classic period Hohokam. He concluded that marine-shell bracelets, a common adornment among the Hohokam, were insignia of group membership and a communal ideology during the pre-Classic (Middle Formative) period. He also interpreted marine-shell ornaments as paraphernalia used in connection with public ritual events. Like shell ornaments and adornments, painted-ceramic vessels also could have functioned as insignia of group membership and identity. Decorative patterns are readily identified with specific regional traditions and, therefore, would have been ideal for conveying such information. Serving vessels (mainly bowls) used during communal feasts or ritual ceremonies would have provided an ideal context for expressions of identity and group membership. Painted bowls would have been widely visible to community participants during ceremonies in which food, drink, and intoxicants were widely shared.

It is plausible that local potters manufactured pottery using foreign styles—mainly Hohokam styles (especially the Phoenix Basin styles)—as tokens of identity, affiliation, or ritual performance, but it is no less likely that the migrants entered the site and locally manufactured pottery in the styles of their homelands for the same reasons. This explanation accommodates the presumed large volume of painted pottery in the site collection. It also accounts for the variability in percentages of painted-pottery ware classes among contemporaneous feature groups and loci. During the A.D. 900s, furthermore, the seemingly rapid changes regarding which regional ware classes were most prevalent could indicate a period of shifting and unstable community identities, which may have led to social conflict, instability, and, in turn, short-lived occupations. Perhaps community leaders and kin groups experienced conflicts over matters of community identity and extralocal social affiliations.

But why would the site inhabitants have promoted foreign painted styles rather than developing their own “local” painted-pottery styles? One possibility is that an association with foreign traditions provided social and political capital to competing community leaders, as suggested in the previous paragraph. For example, the prevalence of Phoenix Basin buff wares in Middle Formative A period contexts in Locus D might reflect a common recognition of the Phoenix Basin as the homeland of Hohokam culture and spiritual power. Perhaps the inhabitants of Mescal Wash used the foreign styles to commemorate social connections to those foreign areas. In this scenario, the pervasiveness of buff wares in Locus D might recall ancestral migrations to the site from the Phoenix Basin. These are speculations, of course, but they do help explain the above evidence for rapid changes in painted-ware frequencies around the time of the Middle Formative A–B period transition in the A.D. 900s.

This hypothesis offers a parsimonious explanation concerning the diversity and abundance of painted pottery, but it does not consider other, nonceramic sources of evidence. More data will be needed to evaluate the pervasiveness of feasting and the extent to which increasing proportions of painted pottery during the Middle Formative B period reflect feasting behavior and shifting social identities. As Wills and Crown (2004) made clear, detecting evidence of feasting is a challenge that requires multiple lines of independent evidence. Moreover, what other processes and activities, besides feasting and social display, could have prompted such a pronounced increased in the use of painted-pottery vessels during the Middle Formative B period? These questions and issues will need to be resolved in order to disentangle the complex body of evidence from Mescal Wash.

Final Assessment

In sum, although we cannot unequivocally infer whether the diversity of painted-ware classes from the Middle Formative period reflects migration, exchange, or local imitation, the ceramic data offer tentative grounds for evaluating these hypotheses. We slightly favor Hypothesis 3 because it accounts for the logistical improbability of trafficking large loads of bulky pottery over long distances, but we acknowledge that more-detailed information will be needed to assess the logistical feasibility of long-distance exchange from the Phoenix Basin and other areas. Hypothesis 3 also accords well with the evidence presented above for possible instability and brief occupation spans during the Middle Formative A–B period transition. That the frequencies of various regional-style painted wares may have shifted in concert with these occupational changes suggests a possible connection between these changes, which we suggest are indicative of instability owing to conflict or competition over community identity or social affiliations with other regional communities.

We do not exclude the other hypotheses. We cannot discount migration, using the available data, mainly because it is not clear what the “ceramic signature” of a migrant community should look like. Also, it is possible that migrants to the site from the Hohokam region or the San Pedro Valley coexisted. Exchange also likely played a role in supplying painted vessels, but it seems logistically unlikely that exchange could have occurred on a sufficiently large scale to provision painted pottery to all of the site residents. We suspect that most of the painted pots were locally made imitations of foreign styles or, possibly, were made at the site by individuals trained in the traditions of their homelands in the Hohokam region and the San Pedro Valley. Provenance analysis using chemical or petrographic methods will be needed to address this issue.

Finally, although our main focus was on the Middle Formative period, the ceramic data also provide insights on community development during the Late Formative B period. During this period, the ceramic data suggest less of a focus on communal feasting and public displays of social affiliation, judging from the decreased proportions of painted serving vessels, although identity still may have been expressed through the use of Roosevelt Red Ware. Clark and Lyons (2003) suggested that Roosevelt Red Ware types were linked stylistically to Kayenta/Tusayan traditions of northeastern Arizona. They argued, on the basis of petrographic evidence, that Roosevelt Red Ware in the San Pedro Valley was manufactured by families who originated in the Kayenta/Tusayan region and exchanged their wares locally throughout southeastern Arizona. The same may be true of the Roosevelt Red Ware in the Mescal Wash collection. The Late Formative B period population may have consisted of migrants from the north or may have been a local population who established social affiliation with the ancestral Pueblo tradition in order to express ritual connection or shared religious ideology (see Crown 1994).

CHAPTER 4

Flaked Stone

Michael P. Heilen and John D. Hall

Some archaeologists have argued that in southern Arizona a full package of traits—the Formative period lifestyle—accompanied the adoption of agriculture. Prior to the discovery of Early Agricultural sites in the Tucson Basin, the transition to Formative period lifestyles was considered to have occurred during the Pioneer period (ca. A.D. 300–700) of the Hohokam chronology. More recently, the discovery of farming amongst Late Archaic groups pushed the starting point of this transition further back in time (Ezzo and Deaver 1998; Gregory ed. 2001; Herr 2009; Huckell 1990, 1995; Mabry 2006a, 2008; Mabry, ed. 1998 Whittlesey et al. 2007). According to one perspective, "the essentially Formative pattern of floodwater farming, maize dependency, and settled village life" was established shortly after agriculture appeared (Whittlesey and Ciolek-Torrello 1996:50). Whittlesey and Ciolek-Torrello (1996:50) argue, alternatively, "that the transition to maize dependency and sedentism, the Formative lifestyle, did not occur suddenly and at once in either the Late Archaic or early Pioneer periods. Instead, we argue that the transition took place gradually and in different stages that began around 800 B.C. and was completed by A.D. 600." Indeed, in many areas of the globe, sedentarization is considered to have been a gradual, directional process rather than a sudden change of state (Kelly 1992).

Mescal Wash was used during the Late Archaic and throughout much of the Formative period. As a result, Mescal Wash is a good site at which to test our assumptions about behaviors associated with development and change in Formative period lifestyles. Presumably, change in flaked stone technology should reflect the development of Formative period lifestyles. Principally, if shifting emphases on formal bifacial reduction and informal core reduction correlate with changes in residential mobility (Parry and Kelly 1987), and major changes in mobility are thought to accompany economic and social changes central to Formative period lifestyles, similar change should be reflected in the flaked stone assemblage at Mescal Wash. However, the rate and nature of change in flaked stone technology will likely have varied between sites and regions, based on regional differences in economy and settlement and differences in how individual sites were used in a settlement system. In the San Simon region of southeastern Arizona and southwestern New Mexico, for instance, flaked stone technology changed gradually over time from the Late Archaic to at least A.D. 1050 (Gilman et al. 1996).

This chapter is geared towards answering three interrelated questions. Can change over time in flaked stone technology be discerned at Mescal Wash? If so, was change gradual and cumulative or sudden and episodic? Finally, how can change in flaked stone technology (if it occurred) be used to interpret variation in how the site was used over time? Although investigating spatial variation in flaked stone technology and deposition is important, the highly complex overlapping of features from multiple periods across much of the site and the concentration of most flaked stone in a single locus (Locus D) restricts our ability to meaningfully interpret spatial variation in flaked stone artifact technology and deposition. Interpretation of spatial relationships is made where appropriate, however.

The Multiple Dimensions of Mobility

Much flaked-stone analysis is geared towards detecting and interpreting variation in mobility and land use. Although archaeologists often refer to prehistoric people as "mobile" or "sedentary," mobility is multidimensional and can be described and analyzed in multiple ways.

Binford (1980), for instance, construed mobility in terms of a continuum of behaviors that included foraging and collecting. Somewhat differently, Bettinger and Baumhoff (1982) modeled mobility in terms of travelers and processors. Discussants of mobility consistently warn against typologizing characteristics of mobility and stress that variation in mobility should be assessed along analytical continua. Classifying groups as sedentary, semisedentary, or mobile often overlooks important variation and causes us to interpret changes of kind where changes of degree may be more appropriate.

Mobility is often assessed in terms of sites as well as a property of social groups, rather than individuals. We tend to think of mobility in terms of site types, such as camps, hamlets, or villages. Ultimately, "mobility is a property of individuals" (Kelly 1992:44, see also Hewlett et al. 1982). Where possible, archaeologists should seek to develop models of mobility that account for individual variation. People move around landscapes in many different ways and according to multiple strategies for interacting with people and resources. When people "settle down," or become more "sedentary," they do not also stop moving between places. Sedentary peoples do not assume a lower energetic state as a result of maintaining long-term residences. As a result of sedentarization, people move around landscapes at different times, distances, and in different social configurations. People move as individuals, households, task groups, or villages, over a variety of distances and according to multiple schedules. In short, people move in a wide variety of ways for a wide variety of reasons and this variability is not captured by simplistic labels (Kelly 1992), such as "mobile" or "sedentary."

To Kelly (1992:60), "no society is sedentary, not even our own industrial one—people simply move in different ways." The goal of mobility studies should not be to classify societies as mobile or sedentary or even to place societies along a continuum between the two poles. Rather, it is our task to identify, disentangle, and explain the multiple dimensions of mobility (Berelov 2006). The expectation that individuals and households move around less as a consequence of decreased residential mobility fails to account for other dimensions of mobility. As Kelly argues, we should instead expect that people move around differently when residential mobility is reduced. With changes in technological or economic organization, people may move in different social configurations, at different times of the day, season, or year, different distances, and for similar or different reasons.

Binford (1980) argued that reduced residential mobility should result in increased logistical mobility. If people begin to reside at places for longer durations, they will probably need to make trips to other places in order to acquire resources and to maintain contacts with other groups (see also Kuhn 1995, 2004b). As Kelly (1992:60) argues, "there are no Gardens of Eden on earth, no single locales that can provide for all human needs." We should expect that people who are partly dependent on concentrated, predictable, and locationally stable resources such as agricultural foodstuffs move differently from people who depend on dispersed, less predictable, mobile resources, such as migrating game animals. Historically, much O'odham mobility, for instance, was logistically organized and patterns of O'odham logistical mobility were likely tied to patterns of O'odham residential mobility (Hackenberg 1964, 1974; Heilen 2005). Theoretically, how more residentially stable people move around, interact, and subsist is organized differently from how more residentially mobile people move around, interact, and subsist.

Bifacial Technology and Mobility

In North America, bifaces are often interpreted as the quintessential stone tools for mobile people. In other areas of the globe, bifacial technologies are not as common, despite wide variation in residential and logistic mobility. Nonetheless, decreased reliance on bifacial technologies in North America is often interpreted as a consequence of decreased residential mobility and increased "sedentism" (Andrefsky 1998; Kelly 1988; Odell 2004; Parry 1987; Parry and Kelly 1987).

Bifaces are highly versatile tools (M. Nelson 1991). Bifaces are relatively lightweight, can be used to cut or saw materials, can be used to produce usable flakes, and can be shaped into a variety of more specialized tools, such as projectile points or drills (Kelly 1988). Compared to other tool and raw-material configurations, bifaces are argued to provide high utility for limited mass. Biface users are argued to spend less energy transporting tools and potential tools. Because of the cost-effective properties of bifaces, they are argued to have been ideal forms for mobile individuals such as foragers or hunter-gatherers.

Kuhn's (1994; see also Surovell 2003, 2009) formal model of transported stone-tool-kit design forms an interesting contrast with Parry and Kelly's (1987) model of residential mobility and biface utility. Kuhn's (1994) simple model of artifact portability and potential utility predicts that in comparison to larger unfinished multifunctional tools (such as bifaces), small finished tools (such as flakes) are more cost-effective as components of transported tool kits. According to Kuhn's model, transported tool kits should consist of many smaller flake tools, rather than a few large bifacial cores. Parry and Kelly's model of mobility and flaked stone technology suggests alternatively that transported tool kits should consist of a few large, bifacial cores.

In comparison to flakes, bifaces are costly to produce. Bifaces take time to manufacture and, depending on the size and shape of unaltered nodules, expend potentially usable material in their initial production. Technological investment in biface manufacture may have required that the utility of bifaces as cores and tools outweighed the cost of their production and transport (Parry and Kelly 1987). In North America, investment in biface production appears to have decreased with decreased residential mobility. As people became more sedentary, bifacial reductions became relatively less common and expedient nonbifacial core reduction became relatively more common. By one line of argument, the technological costs (in time, labor, and material) of biface manufacture were no longer outweighed by the utility of bifaces as cores and tools. In more-sedentary contexts, more-expedient, simple, informal, flake-and-core technologies took the place of bifaces. Bifacial tools, such as projectile points and drills, were still produced and used, but the received wisdom of North American flaked-stone technology is that reliance on bifacial technologies declined with increased sedentism.

Explaining Change in Flaked Stone Technology

Different flaked-stone tool forms can be functionally equivalent. Depending on the specific task, a flake, a uniface, or a biface could be used to work materials in similar ways. In effect, different technological trajectories can ultimately fulfill similar goals. In some cases, a simple tool such as a flake may perform the same work as a complex tool. In comparison to a complex tool, a simple flake tool costs less in time, material, or energy to produce. A complex tool may cost more to build but cost less to maintain. Complex tools, also, may be more reliable in risky situations. A large initial investment in technological cost may pay off over the course of many uses. In contrast, a simple tool may cost little to build, but have a shorter use life, need to be manufactured more frequently, and may not be available in conditions of raw-material scarcity. Over many uses, more time, material, and labor may be expended in the production and use of simple tools. Ultimately, deciding to produce complex tools requires a justification for their cost, such as their cost-effectiveness in addressing anticipated future needs. Hence, there is a continued use of bifacial technologies in weapons systems despite an overall decline in the use of bifacial technologies through time as societies rely more on agriculture and storage. Among other things, flaked stone technologies change because people change how, when, and why they are moving around; what they are using stone tools for; and how much they rely on stone tools for success in particular activities.

Changes in flaked stone technology are often framed in energetic or economic terms (Kuhn 2004a). According to one line of argument, the use of bifaces enabled high mobility by enhancing utility with respect to portability. With decreased residential mobility, biface technology became less important in the everyday usage of stone. Many cutting or scraping activities could be performed with simple flakes that could be removed from locally available or stockpiled cores. Because usable flakes could be obtained by striking the closest knappable stone, ensuring the availability of raw material through more-formal reduction technologies became unnecessary. Of course, stone, like timber, is an expendable resource and most settlements probably do not have an endless supply of stone raw material nearby (Surovell 2003, 2009). Eventually, long-term settlements would have to import raw material from elsewhere, employ more conservative technologies, or rely on other materials for cutting or scraping tasks. At a regularly used site, raw material could be procured in the course of other activities and used to provision residential locales for future use (Kuhn 1992, 2004b).

As Parry and Kelly (1987) observe, biface technology did not disappear with the rise of expedient technology. Projectile points, drills, and other bifacial tools continued to be produced and used. It seems likely that, instead, the organization of bifacial technology changed with changes in the organization of settlements and land use. Rather than phase out, bifacial technology (1) may have become the domain of different, perhaps more restricted, sets of people; (2) may have been performed in different, nonresidential places (e.g., near quarries or in lithic workshops); and (3) may have been dedicated to somewhat different sets of activities, such as ritual disposal or logistically organized hunting trips.

Provisioning Strategies, Flaked Stone Technology, and Mobility

In order to understand the multiple pathways along which artifacts can be manufactured, used, and discarded, Kuhn (1992, 1995, 2004b) developed the concept of *provisioning strategies*. To Kuhn (2004b:432), “provisioning strategies are idealized systems for making finished tools and/or necessary raw material available when and where they are needed.” Three fundamentally different kinds of provisioning strategies are recognized: provisioning people, provisioning places, and provisioning activities. All three strategies can be exercised by the same groups or individuals. Variation in the implementation of these strategies reflects variation in emphasis rather than implementation of a singular strategy to the exclusion of all others.

Provisioning people “entails keeping *individuals* supplied with the artifacts and raw materials they are likely to use” (Kuhn 2004b:432, italics original). It is expected that provisioning people involves optimizing the utility of a set of transported artifacts relative to the technological costs (i.e., procurement, manufacture, and transport costs) of their production, use, and transport. Provisioning places, in contrast, “requires carrying artifacts or raw materials from the point of procurement to the specific place(s) being provisioned" (Kuhn 2004b:433). Because the stockpiling of raw materials and artifacts at places reduces the need to extract maximal use from artifacts, Kuhn (2004b:433) expects that provisioning of places "should be marked by less investment in artifact manufacture and less extensive reduction and reworking of tools than the strategy of provisioning individuals." Provisioning places and provisioning individuals require some degree of planning. Because planned strategies can result in overproduction, or wasted materials and energy, a third strategy is provisioning activities. Kuhn (2004b:433) conceptualized provisioning activities as essentially unplanned, situational, and conducted "in reaction to an immediate need." The immediate time constraints of provisioning activities require the provisioning of activities "to involve minimal investment in manufacture and to focus on locally plentiful materials" (Kuhn 2004b:433). In general, provisioning of people is advantageous for short occupations and provisioning of places is advantageous for long occupations or recurrent occupations that are anticipated and planned. Provisioning of activities is contingent on the local availability of stone, risk, and the suitability of local stone for meeting immediate needs. All three strategies could have been implemented at Mescal Wash. The degree to which different strategies were implemented, however, was likely dependent on occupation duration and the degree to which use of Mescal Wash was planned or anticipated.

Much theorizing regarding variation in technological investment has to do with raw-material availability (Andrefsky 1994; Brantingham 2003). When raw materials are anticipated to be available, people do not have to invest as much in technological strategies that conserve raw material or reduce the transportation costs of potential tools. Instead, more-expedient technologies may suffice in providing necessary tools. Raw-material availability is not simply a function of the natural distribution of usable tool stone. Cultural processes can also enhance the availability of raw material.

One method of enhancing the availability of raw material is stockpiling. To Kuhn (1995), highly mobile groups should focus on provisioning people. People who move around a lot should have a personal tool kit, such as a number of bifaces and usable flakes that will be available when tools are needed, particularly if they may be in areas where raw materials are unavailable. Groups that stay longer at places should instead focus on provisioning places. Kuhn (1991:78–79), for instance, suggests that the "longer people remain at a location, the more trips made out from it, the greater the opportunities to procure raw materials from the surrounding countryside." Other authors have also suggested that stockpiling is a benefit of occupations of long duration (Bamforth 1990; Parry and Kelly 1987). Taking the argument a step further, Surovell (2003) suggested that stockpiling of raw materials provides a surplus of raw materials that guards against periodic shortfalls and reduces the need for direct procurement forays in times of raw-material scarcity.

Patterns in raw-material consumption are linked to how people use landscapes. Jeske (1989) argued that for hunter-gatherers efficient technologies are organized in order to manage time stress and activity failure rates (see also Bamforth and Bleed 1997; Torrence 1983). Jeske (1989:35) defined time stress as "a measure of the temporal availability of resources" and activity failure rate as "the difficulty of obtaining resources for a given attempt." Berries may be available for short periods whereas deer are available year-round. As a resource, berries are not difficult to capture when encountered but may require the application of technologies to efficiently collect large numbers in a short period of time. In comparison to berries, deer are difficult to capture when encountered and may require the application of technologies to reduce the failure rate of deer hunting. Thus, according to Jeske's (1989) analogy, berry collection ranks high for time stress but has a low failure rate, and deer hunting ranks low for time stress, but has a high failure rate.

The risk associated with resource procurement can also affect technological organization. Bamforth and Bleed (1997) conceptualize risk as composed of two components: (1) the probability of failure and (2) the costs of failure. Conceptualizing risk as variance can result in the classification of both unpredictable shortfalls and unpredictable windfalls as "risky." As a result, Bamforth and Bleed (1997) suggest that behaviors often referred to as "risk-prone" and "risk-averse" should instead be labeled "variance-prone" and "variance-averse." To Bamforth and Bleed (1997:117), the argument that "hunting unpredictably mobile animals is necessarily riskier than gathering immobile plants" is incorrect. The cost of failure depends on the availability of other opportunities: "if there are abundant alternative resources available, this cost [of failure] is low; if there are no alternatives, this cost is high" (Bamforth and Bleed 1997:117). They also recommend that costs associated with technological choices factor into technological decisions and should be factored into considerations of risk. Making tools requires investment of time, energy, and materials, and thus the decision to make a particular tool involves a trade-off with other potential ways to budget time, energy, and materials (Bamforth and Bleed 1997). Understanding variation in technology involves understanding not only the "domain of application" but the "domains of procurement and production" as well (Bamforth and Bleed 1997:123). To Ugan et al. (2003), the total time (or cost) invested in technology is the sum of search time, handling time, and manufacturing and maintenance time. Investing time, energy, or materials in designing and manufacturing stone tools often requires that time, energy, or materials are taken away from other activities. Because of the costs of technological investment, humans may choose not to invest in particular technologies even though application of those technologies would reduce the probability of failure. Because of technological costs, complex tools requiring substantial technological investments tend to be produced when there are (1) predictable periods of downtime when people rely on stored foodstuffs or (2) when surplus allows some members of society to be supported by the labor of others (Bamforth and Bleed 1997).

Controlling for Time at Mescal Wash

Mescal Wash was a persistent place that experienced multiple abandonments and reoccupations across time. Mescal Wash was also a complicated site consisting of thousands of features and hundreds of thousands of artifacts. Features discovered at Mescal Wash included structures, pits, trash mounds, and burials. Many features intruded and disturbed other features, leading to a complex palimpsest of disturbances and deposits. To complicate matters further, only minimal stratification in natural or cultural deposits was encountered.

Nevertheless, occupations of Mescal Wash occurred over a long time frame, a time frame that encompassed the emergence, growth, and development of Formative period lifestyles in southeastern Arizona. Archaeomagnetic and radiocarbon dates indicate that Mescal Wash was used during the Late Archaic and at various times throughout the Formative period. Features date to Late Archaic (ca. 1500 B.C.–A.D. 1), Early Formative (ca. A.D. 1–750), Middle Formative A (ca. A.D. 750–950), Middle Formative B (ca. A.D. 950–1150), and Late Formative B (ca. A.D. 1300–1450). A major hiatus in use of the site occurred during Late Formative A, between ca. A.D. 1150 and 1300. Mescal Wash was again reoccupied during the Late Formative B. Along with this major Late Formative abandonment, there were probably multiple reoccupations and abandonments throughout the long history of occupation at Mescal Wash. The complex formation of Mescal Wash deposits presents a formidable obstacle to the spatial or temporal analysis of flaked stone artifacts at Mescal Wash. Still, some of the most interesting and important questions to ask about flaked stone technology at Mescal Wash involve change over time.

The complexity of site formation at Mescal Wash makes it difficult to control for time or to distinguish different components at Mescal Wash. The complex history of activities and disturbances at Mescal Wash likely contributed to the mixing of some artifact-bearing deposits, and it is difficult to associate the contents of trash deposits to discrete sets of activities other than secondary trash disposal. Artifacts discovered in individual deposits at Mescal Wash could relate to many different activities that occurred at many different times. Fill deposits in any particular feature could represent mixtures of multiple deposits and consist of artifacts dating to multiple periods. Reliance on flaked stone artifacts from the context of feature fill makes it difficult to clearly associate target materials with specific date ranges. Mixing of deposits could result in the incorrect association of materials from multiple periods with a single period. Aggregating materials from multiple deposits according to broad time periods may alleviate biases introduced by mixing of artifacts from multiple periods. Evidence from projectile points suggests that most Middle Formative projectile points were found in Middle Formative features and most Late Formative points were found in Late Formative features (see below). Projectile points that were "out-of-sync" with feature dates tended to be earlier projectile-point styles found in later features. This implies a certain kind of directionality in that early materials were more likely to become incorporated into later deposits (through either natural or cultural processes), but not vice versa. If mixing significantly biases patterns in flaked stone technology, changes observed could have occurred somewhat later than is implied by the data. Also, if behavioral changes were more abrupt than is apparent in the flaked stone data, the gradual nature of many changes as measured archaeologically could have partially resulted from the mixing of deposits instead of gradual behavioral change.

Fortunately, archaeomagnetic and radiocarbon dates were obtained for many features at Mescal Wash. Using multiple lines of evidence that included stratigraphic relationships, artifactual content, and chronometric dates, features and deposits within features could be assigned to general time periods (see Chapter 2). In addition, Lengyel completed a contemporaneity study using the archaeomagnetic determinations of features. Statistical comparisons of archaeomagnetic signatures for different features allowed Lengyel to determine the relative chronological relationships for some features (see Appendix 2A, this volume; see also Deaver 1988). The result of this study has provided further refinement of the temporal relationship of some features, particularly in Locus D where the density of features was greatest.

Radiocarbon dates were obtained on macrobotanical remains for a number of pit features interpreted in the field as Late Archaic in age. Radiocarbon dates verify a Late Archaic age range for radiocarbon-dated features as well as indicate that investigated Late Archaic features correspond to a brief period of recurrent occupations. Dated Late Archaic features formed within a period of perhaps 100 years or less, centered on 1000 B.C. Given the prevalence of projectile points and bifaces identified as San Pedro, it is possible that many Late Archaic pits correspond to use of the site by a few generations of people affiliated with San Pedro–style projectile points.

Archaeomagnetic dates were obtained for many Formative period (ca. A.D. 1–1450) features. Archaeomagnetic dates provide probable date ranges for the last use of archaeomagnetically dated features. As archaeomagnetic dates of the investigated features represent the last time a sample material (such as a plastered hearth) was heated, the dates correspond most closely to the abandonment of features, rather than earlier periods of structure construction or use. Archaeomagnetic dates indicate that the site was used during the Early Formative, Middle Formative, and Late Formative in addition to the Late Archaic. In cases where chronometric dates could not be obtained, stratigraphic relationships with chronometrically dated features were used to provide bounding dates for features. This was one benefit of the fact that many features at Mescal Wash overlapped or intruded upon one another.

Formation Processes at Mescal Wash

Cultural and natural transforms can cause the mixture of artifact-bearing deposits from multiple activities and periods (Schiffer 1987). Further, abandoned features used as trash receptacles could have remained open to deposition for long periods. Nonetheless, a reasonable assumption is that deposits within features (not necessarily the artifacts within deposits) more likely date to the period immediately following abandonment rather than a much later period. In the absence of postdepositional disturbance, earlier deposits are less likely to contain later materials. Artifacts within trash deposits could have been produced and discarded during multiple periods, but they may also be more likely to date to the period immediately following feature abandonment.

The law of stratigraphic superposition dictates that deposits above feature floors should postdate the use of feature floors. Abandoned features could be filled gradually, episodically, or suddenly. Presumably, different kinds and rates of deposition could register in specific properties of within-feature deposits. For instance, the accidental or deliberate burning of a structure is sometimes inferred from near-floor deposits with abundant structural material, burned wood, and large, refittable artifacts. Although earlier materials could become incorporated into later deposits, actual episodes of deposition within features postdate feature construction. Whether deposits are epi-abandonment or postabandonment could be used to infer abandonment processes.

Abandoned structures are convenient locations to dump secondary refuse or even to conduct waste-generating activities, such as flintknapping. Unless reopened and later refilled, there is only so much time before the interior of a structural feature is filled and is no longer open to deposition. Therefore, the capacity of a structure to receive trash deposits is a function of natural and cultural deposition rates and time since abandonment. As long as deposition rates are relatively fast, fill deposits within features may be more likely to date to the period immediately following structure abandonment.

As a result of complex formation processes and a long history of occupation at Mescal Wash, it is difficult to clearly distinguish occupational components because it is difficult to sort out how and when different feature-fill deposits formed. Many Middle Formative B features (ca. A.D. 950–1150) in Locus C, for instance, have few flaked-stone artifacts in either floor or fill deposits. There is considerably more artifactual material in the fill of Middle Formative A features (ca. A.D. 750–950). Is this because trash-generating and trash-depositing activities were more intense during the Middle Formative A or because Middle Formative B site occupants tended to dispose of their trash in Middle Formative A features? Other areas of the site, however, such as Locus D, have features dating to a wide variety of time periods. Features in densely occupied areas intrude upon each other, and it is difficult to discern when artifactual materials in fill deposits were used or discarded.

Most of the flaked stone artifacts at Mescal Wash were discovered in fill deposits. Many fill deposits at Mescal Wash were likely secondary trash deposits. Flaked stone artifacts, for the most part, were likely incorporated into secondary trash deposits and represent a mixture of discarded tools and debris from multiple episodes of core reduction, tool manufacture, and tool resharpening. In many cases, floor deposits were relatively free of artifacts and appear to represent planned abandonment processes involving the removal of tools with remnant use life. A few structures had evidence for catastrophic abandonment, but even catastrophically abandoned structures did not have large numbers of flaked stone artifacts in floor contexts. Catastrophically abandoned structures typically had fragments from small numbers of ceramic vessels, grinding tools, and flaked stone tools. Most of the flaked stone artifacts analyzed in this study were discovered in deposits that were close to floors or within subfloor features, a factor that minimizes the potential for artifacts to have been introduced long after feature abandonment.

One way to organize artifacts is in accordance with when open features were likely available for trash disposal. Mescal Wash appears to have been used intermittently during the Late Archaic and Formative periods but it was not used continuously over this long span. Mescal Wash appears to have been used mostly during the Late Archaic, Early Formative, the Middle Formative A and B, and Late Formative B. There appear to have been changes in the intensity of use between the Early and Middle Formative periods and between the Middle and Late Formative periods. Features abandoned during the Late Archaic and Early Formative periods were most likely to have been filled with trash before the Middle Formative. Features abandoned during the Middle Formative period were most likely to have been filled with trash before Late Formative B. Features abandoned during the Late Formative period were most likely to have been filled with trash during that period. In any period, materials from earlier deposits could become incorporated into trash deposits. Later materials could also become incorporated into deposits through disturbance.

When flaked stone artifacts are lumped according to fill deposits in features dating to one of these five general periods, interpretable trends begin to emerge. There is demonstrable change over time in flaked stone technology at Mescal Wash. In general, long-term change in flaked-stone-tool technology mirrors that observed elsewhere in the Southwest and throughout North America. The most obvious general trend is a change in emphasis from bifacial to core-reduction technologies. Paradoxically, this change is registered in flaked stone debitage but not in bifacial tools.

The Flaked Stone Artifact Sample

A total of over 50,000 flaked stone artifacts was collected in the field from many different feature contexts (Table 67). In the laboratory, these flaked stone artifacts were inventoried, identified according to general artifact class, and counted. Most of the flaked stone artifacts were recorded in the initial inventory simply as "flaked stone artifact," but others were given more detailed descriptions that were felt to be of particular interest to analysts, such as indicating whether an artifact was a tool or core, or made on a rare material type. In most cases, artifacts classed generically as "flaked stone artifact" were likely to have been flakes, flake fragments, shatter, or core fragments. However, some tool fragments or tools, as well as whole cores, could have conceivably been classed simply and generically as "flaked stone artifact" in the initial inventory. Because these were initial identifications made by laboratory technicians without specialized training in flaked stone technology and mainly for the purpose of sorting collected materials for future analysis, it is not prudent to place too much stock in an initial laboratory-sorting identification.

Keeping these factors in mind, the basic inventory data indicate that the percentage of all flaked stone artifacts that were tools was lowest for Late Archaic period contexts, roughly equivalent for Early Formative and Late Formative contexts, and highest for Middle Formative contexts. Remarkably, the percentage of all flaked stone artifacts that were cores was several times lower than the percentage for tools for the Late Archaic, Middle Formative, and Late Formative contexts, with no cores being recognized in the initial sort for Early Formative contexts. These data suggest that cores were deposited outside of excavated areas, or were not often specifically identified as cores in the initial sort, and instead were entered in the database according to more generic categories.

The basic inventory data do have some value in allowing us to assess the characteristics and adequacy of the sample of flaked stone artifacts that were analyzed in greater depth and which are discussed in greater depth in this chapter. These data also allow us to assess the overall production and deposition of flaked stone artifacts at Mescal Wash. Based purely on raw counts of flaked stone artifacts per temporal context, it is clear that more than half of the flaked stone artifacts at Mescal Wash were deposited in features dated to the Middle Formative period, and most of those were deposited within features dated to the Middle Formative A period. Around three-quarters of flaked stone artifacts were in deposits within features that dated to a discrete period (i.e., the Late Archaic, Early Formative, Middle Formative, or Late Formative), and the remaining artifacts were in deposits associated with less securely dated features. Around 2 percent of flaked stone artifacts were discovered in deposits that could only be associated with broader periods (e.g., Middle-Late Formative, Formative). Approximately 6 percent of the sample could be assigned only a terminus post quem (TPQ) or terminus ante quem (TAQ). The TAQ and TPQ include broader, and relative, chronological determinations that are collapsed into these two categories in order to present the data in a more concise manner. For example, a structure in Locus D (Feature 3680) was not directly dated, but artifactual and stratigraphic evidence provided a relative date of pre-A.D. 950. Because Feature 3680 has a terminal date of A.D. 950, it was assigned the TAQ. Similarly, another structure in Locus D (Feature 4733) was not directly dated, but ceramic evidence provided a date of post-A.D. 500. Because the structure is considered to have been occupied after A.D. 500, it was assigned the TPQ. The remaining percentages of flaked stone artifacts were in contexts that could not be dated (Figure 62).

In a similar fashion, ca. 85 percent of flaked stone artifacts were discovered in Locus D, with smaller percentages in Loci C (7 percent) and A (4 percent), and percentages around 1 percent or less in Loci B, E, and F (Figure 63). Flaked stone artifacts in Locus D dated to all periods, whereas at least half of flaked stone artifacts in Locus A dated to the Middle Formative B, with most of the rest dating more generally to the Middle Formative period. Two-thirds of flaked stone artifacts in Locus C dated to Middle Formative B, with the rest dating to broader periods. The few flaked-stone artifacts in Loci B, E, and F were not associated with dated deposits. Ultimately, the skewed representation of artifacts according to time and space make comparisons between loci difficult. Comparisons between Loci A, C, and D for the Middle Formative B period may be legitimately made, but are somewhat restricted. Locus D appears to have been the focus of much residential activity and artifact deposition throughout the period of site use, and this is the area where most of the flaked stone artifacts were discovered.

Table 67. Number of Flaked Stone Artifacts Recovered from Mescal Wash

Recovery Context	Late Archaic	Formative	Early Formative	Early/ Middle Formative	Middle Formative	Middle Formative A	Middle Formative B	Middle/Late Formative	Late Formative B	TAQ^a Only	TPQ^b Only	Undetermined	Total
Nonfeature contexts	—	—	—	—	12	247	—	—	1	24	—	4,720	5,004
Animal burial	—	—	—	—	—	—	—	—	—	—	20	—	20
Ash-filled pit	—	—	—	—	11	5	—	—	—	—	—	—	16
Burial	—	—	54	—	—	—	8	—	—	—	110	—	172
Cache	—	—	—	—	—	—	—	—	—	—	—	—	—
Disturbance	—	—	—	—	—	72	2	—	—	—	—	49	123
Entry	—	—	—	—	222	58	162	—	76	—	—	24	542
Erosional depression	—	—	—	—	—	—	—	—	—	—	—	648	648
Floor groove	—	—	57	4	65	441	196	—	—	42	9	—	814
Hearth	—	—	—	13	9	48	30	—	2	—	4	1	107
Midden	—	—	—	—	—	—	27	—	—	—	—	—	27
Multiple features	—	—	—	—	—	592	—	—	—	—	—	1,982	2,574
Pit	1,796	4	1,185	606	2,276	1,796	654	29	95	281	2,314	1,319	12,355
Posthole	—	23	16	31	382	525	266	—	127	8	—	181	1,559
Recessed hearth area	—	—	—	—	23	—	343	—	—	—	—	—	366
Rock alignment	—	—	—	—	—	—	—	—	—	—	—	—	—
Rock cluster/hearth	—	—	—	—	—	—	16	—	—	—	—	—	16
Rock pile	—	—	—	—	—	—	—	—	—	—	4	12	16
Structure, general	—	—	—	—	—	85	23	—	2	—	—	42	152
Structure, cultural deposit	—	—	—	—	—	95	—	—	—	—	—	—	95
Structure floor fill	—	71	11	155	2,997	6,162	1,050	—	374	281	26	7	11,134
Structure fill	—	47	114	188	1,176	4,599	802	—	837	—	1	1	7,765
Structure floor	—	1	—	15	57	286	38	—	158	2	12	—	569
Structure, mixed deposits	—	—	—	—	—	288	35	—	29	—	—	—	352

Recovery Context	Late Archaic	Formative	Early Formative	Early/ Middle Formative	Middle Formative	Middle Formative A	Middle Formative B	Middle/Late Formative	Late Formative B	TAQ[a] Only	TPQ[b] Only	Undetermined	Total
Structure, structural debris	—	—	—	—	868	1,353	410	—	4,011	—	—	—	6,642
Surface feature	—	—	—	—	—	737	—	—	—	—	—	—	737
Trash mound	—	—	—	—	—	—	—	—	—	—	—	79	79
Wall	—	—	—	—	—	—	—	—	—	—	—	53	53
Total	1,796	146	1,437	1,012	8,098	17,389	4,062	29	5,712	638	2,500	9,118	51,937

[a] TAQ = terminus ante quem.
[b] TPQ = terminus post quem.

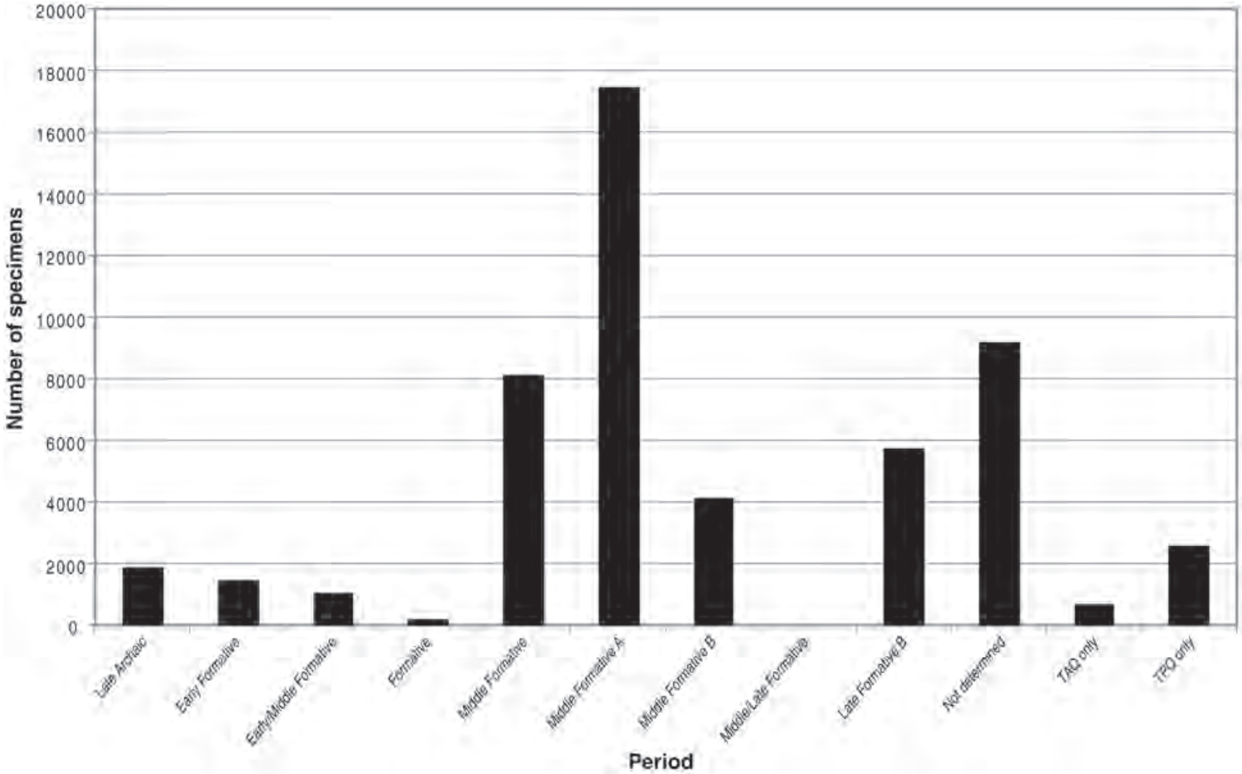


Figure 62. All flaked stone artifacts recovered from Mescal Wash, by period.

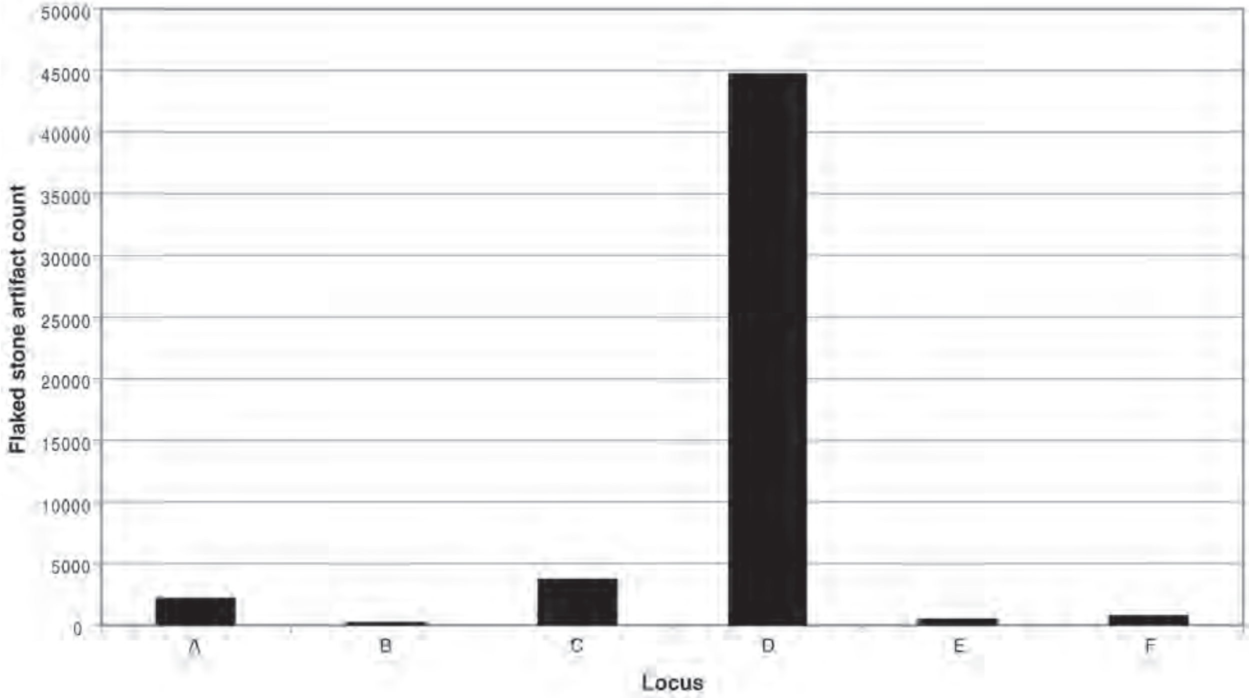


Figure 63. All flaked stone artifacts recovered from Mescal Wash, by locus.

The Analyzed Sample

This chapter is based on flaked stone data developed by Dr. Bruce Bradley in 2002. Bradley developed data on a sample of flaked stone artifacts from select contexts at Mescal Wash. The sample was selected from deposits in pits interpreted as Late Archaic in age and from deposits in Formative period structures. Because of the amount of mixing between cultural deposits at Mescal Wash, particularly structures, the analyzed sample of flaked stone for structures was derived from floor-contact or floor-fill deposits, whenever possible. Floor fill generally includes the 10 cm of sediment immediately above the floor of a structure. Other sample contexts within structures include the fill of intramural pits, including hearths and recessed hearth areas. Sample contexts were selected to maximize the potential of the sample to inform on change through time in flaked stone technology and, to the extent possible, to inform on variation in cultural affiliation. Projectile points not found within feature deposits were also analyzed. The sample included stone tools, flakes, and pieces of flaking debris from 97 features, as well as 33 tools from nonfeature locations. Totaling 9,443 artifacts, the sample consisted of 590 stone tools, 3,853 flakes, and 5,000 pieces of flaking debris. Flaking debris, including medial and distal flake fragments, were not analyzed in any detail, being simply identified as “debris.”

Spatial Distribution of the Analyzed Sample

The analyzed sample, being selected from contexts considered more likely to correspond to relatively discrete behavioral and temporal units, was concentrated mostly in Locus D (89.1 percent of the sample), with smaller percentages of artifacts coming from Loci A (2.3 percent) and C (8.5 percent) (Table 68). Flaked stone artifacts from the other loci (B, E, and F) consisted of three bifaces, five projectile points, and one core, and thus represent only a minute percentage of the analyzed sample. Because of the highly skewed nature of the sample according to loci, we focus in this chapter mostly on investigating variation in flaked stone technology according to time and feature type, focusing less on spatial variation between loci.

Methods of Identification and Analysis

Bradley’s analysis focused on identifying typological and technological attributes of tools and flakes with platforms. Debris was counted and re-bagged but not subject to any other observations. Bradley took one set of observations on flakes and another set on tools. Projectile points and some used flakes were subject to additional observations. In general, Bradley recorded those attributes he considered “the most likely to shed light on technological changes through time and between archaeological cultures, and [which] may be reproduced by other researchers” (Bradley 2002a).

Recorded Flake Attributes

A total of 3,853 complete flakes and proximal flake fragments from 62 features was analyzed (Table 69). These included both complete and incomplete specimens that retained portions of the flake platform. For platform-bearing flakes or flake fragments, Bradley made observations on type (biface, biface shaping, biface thinning, core, disk core, unifacial retouch); material type; texture; cortex (primary, secondary, none); cortex type (natural or cobble); platform type (plain, dihedral, reduced, faceted, ground); condition (complete, incomplete, fragment); and length (in mm). Flake lengths were recorded for complete and incomplete flakes. Incomplete flakes were flakes that were broken but retained enough of their original form that most observations could still be made. Although more accurate and refined methods for counting flake removals, or minimum numbers of flakes (MNF), have recently been developed, they cannot be applied because of the lack of the necessary data. Instead, we used counts of proximal flakes and longitudinal fragments as a reasonable, but less accurate estimate of MNF. More accurate MNF counts can be achieved by including consideration of medial, distal, and longitudinal fragments (Andrefsky 1998; Hiscock 2002).

Flaking Debris

A total of 5,000 pieces of flaking debris was identified in 55 features (Table 70). Debris consisted of angular fragments and nonproximal flake specimens. Rock specimens identified by Bradley as noncultural were removed. Most debris was in fill (92.1 percent, n = 4,609), but some debris (7.8 percent, n = 391) was discovered in floor contexts from 27 features. In most cases, flaking debris in floor context occurred at low frequencies, or less than 25 pieces of debris. In four features (833, 834, 1575, and 3681), 25 or more pieces of flaking debris were discovered in floor contexts.

A total of 3,336 pieces of debris was discovered in features datable to one of five specific periods: Late Archaic, Early Formative, Middle Formative A, Middle Formative B, and Late Formative B. The remaining specimens were discovered in deposits dating to broader or less well-defined periods, or were discovered in contexts that could not be dated. Evaluation of the amount of debris from the five

Table 68. Analyzed Sample of Flaked Stone Artifacts by Locus

Artifact Category	A	B	C	D	E	F	Total
Arrow point	3	—	6	83	—	—	92
Biface	—	—	—	42	1	2	45
Core	1	—	16	55	1	—	73
Core/chopper	—	—	1	—	—	—	1
Dart point	2	1	7	75	1	3	89
Drill	1	—	3	40		—	44
Flaked cobble (chopper)	1	—	—	—	—	—	1
Flaked cobble (denticulate)	—	—	1	—	—	—	1
Flake, biface	4	—	33	1,001	—	—	1,038
Flake, core	93	—	289	2,157	—	—	2,539
Flake, retouch	9	—	18	234	—	—	261
Flake, undetermined type	—	—	1	14	—	—	15
Flaking debris	83	—	401	4,516	—	—	5,000
Hammerstone	4	—	3	38	—	—	45
Hammerstone/core	—	—	3	13	—	—	16
Pièce esquillée	—	—	—	5	—	—	5
Retouched chunk	—	—	1	—	—	—	1
Retouched flake	5	—	7	84	—	—	96
Uniface	3	—	2	15	—	—	20
Utilized flake	5	—	7	47	—	—	59
Utilized flake (chopper)	—	—	—	1	—	—	1
Utilized flake (scraper)	—	—	—	1	—	—	1
Total	214	1	799	8,421	3	5	9,443
Total (%)	2.27	0.01	8.46	89.18	0.03	0.05	100.00

Table 69. Sample of Complete and Proximal Flakes from Mescal Wash

General Period	Nonfeature Contexts	Ash-Filled Pit	Entry	Erosional Depression	Hearth	Multiple Features	Pit	Posthole	Recessed Hearth Area	Structure	Total
Late Archaic	—	—	—	—	—	—	210	—	—	—	210
Early Formative	—	—	—	—	—	—	67	1	—	5	73
Early/Middle Formative	—	—	—	—	3	—	—	—	—	66	69
Formative	—	—	—	—	—	—	—	—	—	23	23
Middle Formative	—	2	—	—	5	—	6	12	6	817	848
Middle Formative A	—	3	5	—	11	—	—	2	—	1,713	1,734
Middle Formative B	—	—	18	—	5	—	—	5	17	398	443
Late Formative B	—	—	—	—	—	—	—	1	—	70	71
Not determined	60	—	—	16	—	87	73	1	—	3	240
TAQ[a] only	—	—	—	—	—	—	—	—	—	112	112
TPQ[b] only	—	—	—	—	2	—	9	—	—	19	30
Total	60	5	23	16	26	87	365	22	23	3,226	3,853

[a] TAQ = terminus ante quem.
[b] TPQ = terminus post quem.

Table 70. Sample of Flaked Stone Debris from Mescal Wash

General Period	Ash-Filled Pit	Entry	Erosional Depression	General Scatter	Hearth	Multiple Features	Pit	Posthole	Recessed Hearth Area	Structure	Total
Late Archaic	—	—	—	—	—	—	193	—	—	—	193
Early Formative	—	—	—	—	—	—	59	—	—	2	61
Early/Middle Formative	—	—	—	—	3	—	—	—	—	96	99
Middle Formative	4	—	—	—	—	—	—	—	3	1,112	1,119
Middle Formative A	2	4	—	—	7	—	—	4	—	2,522	2,539
Middle Formative B	—	18	—	—	9	—	—	1	13	448	489
Late Formative B	—	—	—	—	—	—	—	1	—	53	54
Formative	—	—	—	—	—	—	—	—	—	34	34
Not determined	—	—	4	51	—	108	69	1	—	4	237
TAQ[a] only	—	—	—	—	—	—	—	—	—	154	154
TPQ[b] only	—	—	—	—	2	—	4	—	—	15	21
Total	6	22	4	51	21	108	325	7	16	4,440	5,000

[a] TAQ = terminus ante quem.
[b] TPQ = terminus post quem.

periods indicates that most debris accumulated during the Middle Formative, particularly during Middle Formative A. Middle Formative A debris made up 76.3 percent of datable debris and Middle Formative B debris made up 14.5 percent of datable debris. If we take the percentage of flake specimens (debris + complete flakes + incomplete flakes + proximal flake fragments) that were classed as debris as an indication of the degree of fragmentation, the greatest degree of fragmentation occurred during Middle Formative A, when pieces of debris made up 59.4 percent of flake specimens (Figure 64). During Middle Formative B, fragmentation was slightly lower, as pieces of debris made up 52.5 percent of flake specimens. Fragmentation was lowest during the other periods. Possibly, variation in flake fragmentation between periods signals differences in the intensity of occupation or trash disposal, change in reduction technology, or a combination of factors.

Recorded Tool Attributes

A total of 557 analyzed tools came from 87 features. An additional 33 point-provenienced tools (mainly projectile points and bifaces) recovered from nonfeature contexts were also analyzed. Tool types identified during the analysis included arrow points (n = 92), bifaces (n = 45), cores (n = 73), dart points (n = 89), drills (n = 44), hammerstones (n = 45), hammerstone/cores (n = 16), *pièces esquillées* (n = 5), retouched flakes (n = 96), unifaces (n = 20), utilized flakes (n = 59), choppers (n = 2), a core/chopper, a denticulate, a retouched piece, and a scraper. For artifacts interpreted as tools, Bradley made observations on artifact type; subtype; material type; condition (complete, incomplete, or fragment); and portion (base, medial, distal). Additional observations were made for projectile points. These included material texture; percent missing; fracture type (bend, snap, perverse, radial, impact); stage of production (early, middle, late, finished); blank type (flake or unknown); primary flaking (none, percussion, percussion thinning, pressure, unknown); and secondary flaking (none, percussion, pressure, pressure selective).

Material Types

Raw-material types recorded in Bradley's sample included agate, chalcedony, chert, igneous, jasper, limestone, metamorphic, obsidian, quartz, quartz crystal, sandstone, and siltstone (Table 71). The raw material for some artifacts could not be determined. During his analysis, Bradley observed that most flaked-stone artifacts could be considered relatively local in origin, particularly stones from gravel deposits in nearby alluvium (Bradley 2002b). The overwhelming majority of raw material used at Mescal Wash was metamorphic (73 percent of sample) and is considered to be an immediately available resource. An example of

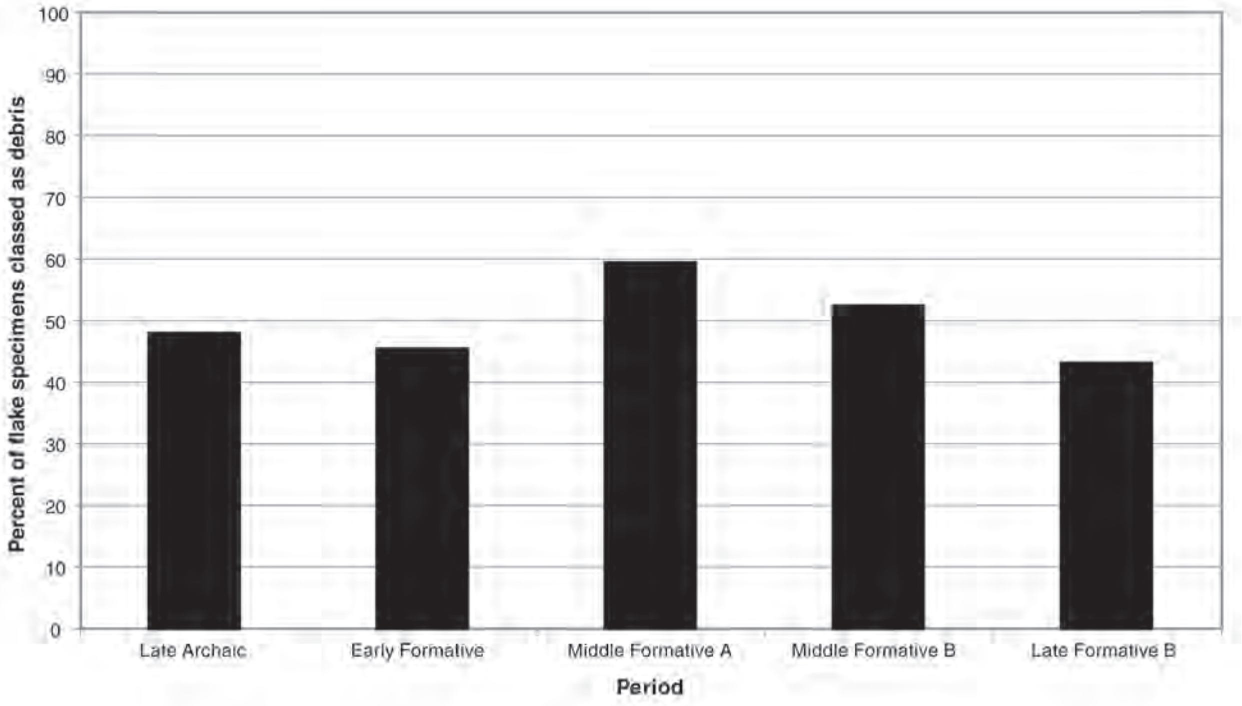


Figure 64. Percent of flake specimens classed as debris, by period.

Table 71. Analyzed Flaked Stone Artifacts by Material Type

Artifact Type	Agate	Chalcedony	Chert	Chert (Sonoita)	Chert (Whetstone)	Igneous	Jasper	Limestone	Metamorphic	Obsidian	Quartz	Quartz Crystal	Sandstone	Siltstone	Unidentified	Total
Arrow point	2	29	20	2	29	—	—	—	2	7	1	—	—	—	—	92
Biface	3	5	10	—	—	1	—	—	26	—	—	—	—	—	—	45
Core	2	—	—	2	10	1	—	1	56	1	—	—	—	—	—	73
Core/chopper	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
Dart point	1	3	14	6	2	2	5	—	48	3	1	—	—	—	4	89
Debitage	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	
Unidentified	—	2	—	—	—	—	—	—	13	—	—	—	—	—	—	15
Biface	16	64	97	33	5	5	17	—	448	—	1	—	—	2	1	689
Biface shaping	8	18	24	6	—	3	4	—	152	—	—	—	—	—	1	216
Biface thinning	1	5	13	5	—	2	2	—	105	—	—	—	—	—	—	133
Core	14	69	104	25	6	34	14	10	938	1	1	—	5	4	1	1,226
Disk core	16	77	82	12	11	35	13	6	1,052	1	—	1	5	2	—	1,313
Unifacial retouch	5	26	22	10	3	4	4	1	184	—	—	—	1	—	1	261
Drill	2	21	9	2	2	—	—	—	6	1	—	1	—	—	—	44
Flaked cobble (chopper)	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
Flaked cobble (denticulate)	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
Hammerstone	—	—	—	—	1	—	—	—	43	—	—	—	—	—	1	45
Hammerstone/core	—	—	—	—	—	—	—	—	16	—	—	—	—	—	—	16
Pièce esquillée	1	4	—	—	—	—	—	—	—	—	—	—	—	—	—	5
Retouched chunk	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	1
Retouched flake	1	2	3	5	6	1	3	1	73	1	—	—	—	—	—	96
Uniface	—	1	—	—	—	2	—	—	17	—	—	—	—	—	—	20
Utilized flake	—	—	—	1	2	—	1	—	55	—	—	—	—	—	—	59
Utilized flake (chopper)	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
Utilized flake (scraper)	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	1
Total	72	326	398	109	77	90	63	20	3,239	15	4	2	11	8	9	4,443

a nonlocal material is obsidian. Only 15 flaked stone artifacts were made on obsidian in the analyzed sample, with 9 percent of these found in Late Formative B contexts. No obsidian sources are known near the site. Furthermore, 13 of the 15 obsidian artifacts were tools, suggesting that most obsidian in the sample represents finished tools imported to the site during the Late Formative B period. The remaining material types in the sample could have had sources within a 1-or-2-day walk from Mescal Wash (e.g., 5–30 km away), including the cryptocrystalline cherts and chalcedonies.

In his analysis, Bradley identified two specific varieties of chert in the Mescal Wash sample: Sonoita chert and Whetstone chert. Sonoita chert is an opaque, mottled pinkish white chert, with no visible grains. A total of 109 flaked stone artifacts was made on Sonoita chert. Whetstone chert is a fine-grained grayish blue translucent material with a few speckles. A total of 77 flaked stone artifacts was made on Whetstone chert. Both varieties of chert are named for their discovery location. In 2002, Bradley, accompanied by Allen Denoyer, investigated areas of naturally occurring raw materials in the Cienega Valley. According to Allan Denoyer (personal communication, 2010) Sonoita chert was discovered in secondary contexts in Sonoita Creek, near the town of Patagonia, Arizona. Sonoita Creek has its headwaters along the eastern end of the Santa Rita Mountains, about 5 km west of the town of Sonoita, Arizona, and flows southwest along Highway 82, eventually emptying into the Santa Cruz River. Whetstone chert was discovered as a primary outcrop originating in the limestone of the Whetstone Mountains, which border Cienega Creek to the east. The Whetstone Mountains are located about 20 km southeast of Mescal Wash. Nodules of Whetstone chert were also identified in secondary contexts in the alluvium of Cienega Creek.

Estimating Tool and Flake Counts from Fragmentary Artifacts

People typically use complete tools in the performance of activities, not fragments of tools. Artifacts, however, are commonly discovered as fragments of once-complete items. Depending on material type, artifact form, use, and postdepositional processes, artifacts undergo different kinds of stresses and have different fracture properties. As a result, artifacts are subject to different kinds and degrees of fragmentation and these differentially affect artifact counts.

If we are interested in tool-making and tool-using behavior, it is important to obtain reasonable estimates of the number of flakes and tools. Counts of fragments and complete items can provide some information on the degree of fragmentation in particular artifact classes, but such counts do not necessarily approximate the number of tools or whole flakes to which artifacts correspond. Theoretically, the same number of tools or once-whole flakes can be recovered as many or a few artifacts. As a result, “simple counts of tool frequencies can be misleading. If we exclude fragments, our counts probably are too low and we neglect the information that resides in fragments. If we equate all fragments, no matter their size, with complete tools, we risk multiple counting that inflates the frequency of broken specimens” (Shott 2000:726).

The problem of estimating counts of systemic items from artifact counts is a problem requiring much future research, particularly for flaked stone. Some advances have been made, however, and these are discussed below. Fragmentation is important to estimating the abundance of tools and flakes as well as interpreting the effects of formation processes on archaeological assemblages. Consideration of fragmentation has been systematically incorporated into the study of faunal assemblages and ceramic assemblages (Grayson 1984; Orton 1993; Orton and Tyers 1990; Outram et al. 2005) and incorporated into the study of flaked stone artifacts to a lesser degree (Hiscock 2002; Mayer-Oakes and Portnoy 1993; Odell 1996; Shott 2000).

Estimating Tool Counts

One way to estimate the minimum number of tools (MNT) is to add the number of complete specimens to the maximum number of distal, medial, or proximal fragments (Mayer-Oakes and Portnoy 1993; Shott 2000). Although this provides an approximation of MNT, it may tend to underestimate the true number of tools. Another way to estimate tool abundance is to calculate what Shott (2000:728) refers to as tool information equivalents (TIEs). Shott (2000) adapted Orton and Tyers (1990; see also Orton 1993) method for calculating pottery information equivalents, or PIEs, in order to estimate numbers of tools. PIEs and TIEs are statistical approximations of the number of pots or stone tools, respectively. As such, PIEs and TIEs allow the inference and comparison of numbers of systemic items between assemblages.

Calculation of TIEs takes into account the percentage of a whole item represented by a fragment. In order to calculate TIEs, analysts need numbers of complete items and fragments and the percentage completeness of fragments. Shott refers to this quantity as an estimated tool equivalent (ETE). Equations for calculating TIEs using ETEs and artifact counts are found in Shott (2000).

Whole items are 100 percent complete. Fragments are less than 100 percent complete. In order to calculate TIEs, Shott (2000) assigned proximal, medial, or distal fragments a standard ETE of 33 percent. In cases where information allows unique ETEs to be assigned to individual specimens, specific ETEs can be applied on an artifact-by-artifact basis to calculate TIEs. Below, we calculate projectile point TIEs using Bradley's estimate of percent complete and assign an ETE to each projectile point specimen. For other tools lacking this measurement (percent complete), we use standard percentages, following Shott (2000).

Shott (2000) estimated MNTs and TIEs for experimental data on broken arrow and dart points (Cattelain and Perpère 1993) and archaeologically recovered tool specimens. MNTs and TIEs often provide somewhat different results. In the case of experimental dart and arrow points, MNTs underestimated the number of points and TIEs overestimated the number of points. Shott (2000) recommends that both quantities be used until it can be more conclusively determined whether one is better than the other in estimating tool abundance. Because our analysis is not intended to compare the two quantities, we focus on calculating TIEs to estimate tool quantities.

Estimating Flake Counts

Along similar lines, Hiscock (2002) identified the need to account for fragmentation in counting flakes. Like more-complex tools, flakes also can break up into many fragments as a result of manufacture, use, or postdepositional processes, and many flakes are discovered in fragmentary condition. A simple way to estimate the MNF is to count the number of fragments with platforms. Like MNT, this provides an approximation of flake abundance but one that may tend to underestimate the original number of flakes. On the other hand, if proximal fragments are longitudinally split, then counts of proximal fragments may overestimate the true number of flakes. To minimize problems in calculating MNF, Hiscock (2002) offered an equation that uses complete flakes, the maximum number of proximal, medial, or distal fragments, and the number of right and left longitudinal fragments.

In the following analysis, MNTs, MNFs, and TIEs are calculated when possible in order to estimate abundances of tools and flakes. It must be noted, however, that how the assemblage is divided impacts these estimates. For instance, one may make these calculations according to material type, period, and tool or flake type, or in different ways. Hiscock's equation for MNF cannot be applied to the Mescal Wash data because flake fragments were not recorded in the same manner as in Hiscock (2002). All the flakes, however, that Bradley made observations on were complete or retained portions of their striking platforms. In addition, Bradley recorded whether or not flakes were longitudinally split. MNF is calculated for this chapter as: complete flakes + proximal flake fragments + (split flakes / 2).

In the case of projectile points, Bradley supplied an estimate of percent missing. Although subjective, this estimate may supply a better estimate of ETE than a standard 33 percent for projectile point fragments. Instead of using an ETE of 33 percent for projectile point fragments, we calculated ETE for each individual point as: 100 - percent missing. Because of the way TIE was calculated, TIE equals zero when n equals one. To correct for this, we reassigned TIE to a value of one when n equaled one.

Technological Change through Time

In the following section, flakes and tool types are discussed individually in terms of material types, temporal and depositional context, and other attributes. For each tool class, change through time is identified and assessed.

Cores

A core can be defined as any objective piece from which flakes are removed (Andrefsky 1998). In order to distinguish between tool manufacture and core reduction, we instead used the more restricted definition supplied by Bamforth and Becker (2000:279): "objects whose flaking patterns indicate reduction designed to produce useful flakes rather than to shape the worked piece into a useful form." This definition of course assumes the objective of reduction a priori but it also allows clear rhetorical distinction between tool manufacture and core reduction.

A total of 73 cores was analyzed in this Mescal Wash sample, and 66 cores were discovered in datable features. Fifty-two of these cores were in features dating to sometime between A.D. 700 and 1150 and a few were found in earlier or later features. Similar numbers of disk and globular cores were discovered in features dating to either Middle Formative A or Middle Formative B. Single-platform cores were the most common core type (Figure 65).

Evidence from cores is difficult to evaluate because only 65 cores could be assigned to chronological periods, and bipolar, disk, globular, and single-platform cores were observed in multiple periods. No cores were associated with Early Formative deposits and only small numbers of cores were associated with deposits from other periods. A possible trend is that the manufacture of single-platform cores increased through time. No single-platform cores could be affiliated with Late Archaic period deposits. Around 44 percent of Middle Formative cores were single platform (n = 23). Both Late Formative cores (n = 2) were single platform (Table 72).

Most cores were made on metamorphic materials (n = 56). Smaller numbers of cores were made on Whetstone

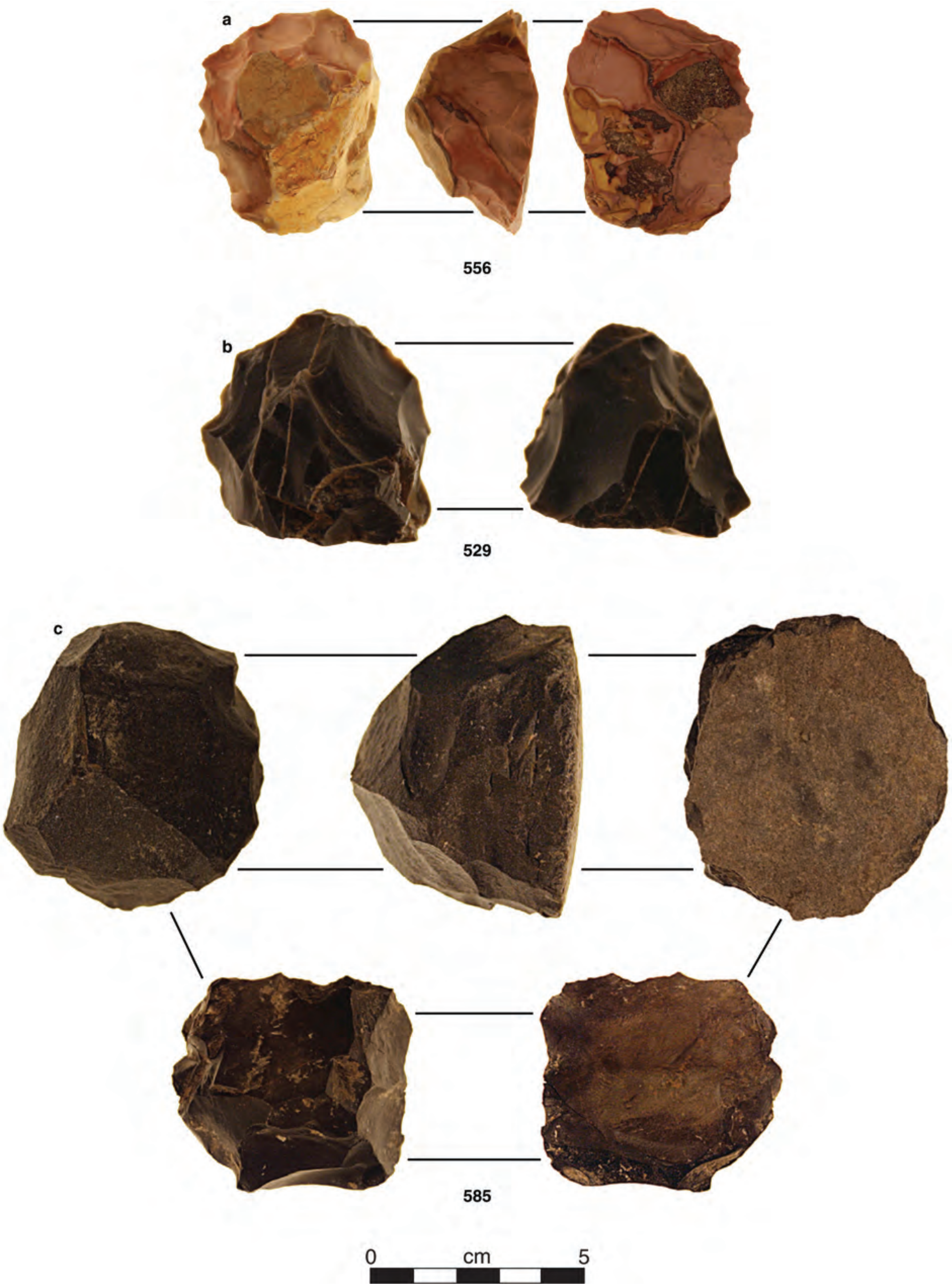


Figure 65. Cores from Mescal Wash (catalog numbers appear below images): (*a*) single-platform core, Feature 4682, Sonoita chert; (*b*) single-platform core, Feature 6154, Whetstone chert; (*c*) disk core, Feature 7880, metamorphic.

Table 72. Core Types Identified at Mescal Wash and the Core-Reduction Index (CRF/Core)

Period	Bipolar	Disk	Globular	Single Platform	Unifacial	Total	Minimum No. of Non-Disk Core Flakes	Minimum No. of Non-Disk Core Flakes Per Non-Disk Core	Minimum No. of Disk Core Flakes	Minimum No. of Disk Core Flakes Per Disk Core	Minimum No. of All Core Flakes (MNCF)	Minimum No. of All Core Flakes Per Core (MNCF/Core)
Late Archaic	—	1	1	—	—	2	30	14.0	34	34.0	64	32.0
Formative	—	—	1	1	—	2	8	—	8	—	16	8.0
Early Formative	—	—	—	—	—	—	13	—	10	—	23	—
Early/Middle Formative	—	1	2	1	—	4	29	6.3	19	19.0	48	12.0
Middle Formative	—	1	1	5	—	7	275	38.3	298	298.0	573	81.9
Middle Formative A	—	9	8	11	—	28	491	8.5	557	61.9	1,048	37.4
Middle Formative B	—	4	5	7	1	17	192	7.3	162	40.5	354	20.8
Late Formative B	1	—	—	2	—	3	30	—	26	—	56	18.7
TAQ[a] only	—	—	1	—	—	1	25	25.0	39	—	64	64.0
TPQ[b] only	—	—	—	1	—	1	12	12.0	10	—	22	22.0
Not determined	—	5	2	1	—	8	78	4.8	64	12.8	142	17.8
Total	1	21	21	29	1	73	1,183	22.8	1,227	58.4	2,410	33.0

[a] TAQ = terminus ante quem.

[b] TPQ = terminus post quem.

chert (n = 10), Sonoita chert (n = 2), agate (n = 2), limestone (n = 1), obsidian (n = 1), and other igneous materials (n = 1). All cores made on Whetstone chert were discovered in contexts dating to the Formative period, a finding that agrees well with the fact that most projectile points made on Whetstone chert were Formative period types (see below).

As long as the number of cores and core flakes corresponds to on-site core reduction, there is clear change over time in the intensity of core reduction (see Table 72). The minimum number of core flakes (MNCF) per core can be calculated for each period and used as an index of core-reduction intensity (Dibble et al. 2005). This measure indicates that the intensity of core-reduction was moderate during the Late Archaic (32 MNCF per core) and reached its highest level during Middle Formative A (37.4 MNCF per core) (see Table 72). Intriguingly, the core-reduction index for contexts assigned to Middle Formative A or B contexts was much higher than that calculated for each period individually, or 81.9 flakes per core. Possibly, this suggests some bias in where cores and flakes were deposited with respect to each other. Core-reduction intensity declined to its lowest levels during the Middle Formative B (20.8 MNCF per core) and Late Formative (18.7 MNCF per core). If people manufactured flakes in an expedient manner, you might expect fewer flakes to be removed per core. However, some cores deposited during the Middle Formative B and later could have been reused cores from earlier periods. Reuse of previously reduced cores would likely have resulted in higher discard rates for cores and fewer flakes removed per core. This would also have reduced counts of cores in earlier contexts, possibly resulting in inflated core-reduction intensity indexes for earlier periods.

Interestingly, the number of flakes increased exponentially at Mescal Wash as the number of cores increased (MNCF = $46.244e^{0.1285 \times \text{cores}}$, $r^2 = 0.9923$) (Figure 66), suggesting that exponentially more flakes were produced with increasing numbers of cores. During the Middle Formative A, when the most core flakes and cores were deposited, there was a substantial increase in the number of core flakes per core, which might correspond to a greater emphasis on core reduction over biface manufacture and tool maintenance. Alternatively, cores with remnant mass may have been reused in later periods.

Hammerstones and Core/Hammerstones

A total of 61 hammerstones and core/hammerstones was identified in the Mescal Wash sample (Table 73). Bradley recorded 45 hammerstones and 16 hammerstone/cores (n = 16) (see Table 68). Hammerstones are defined as the

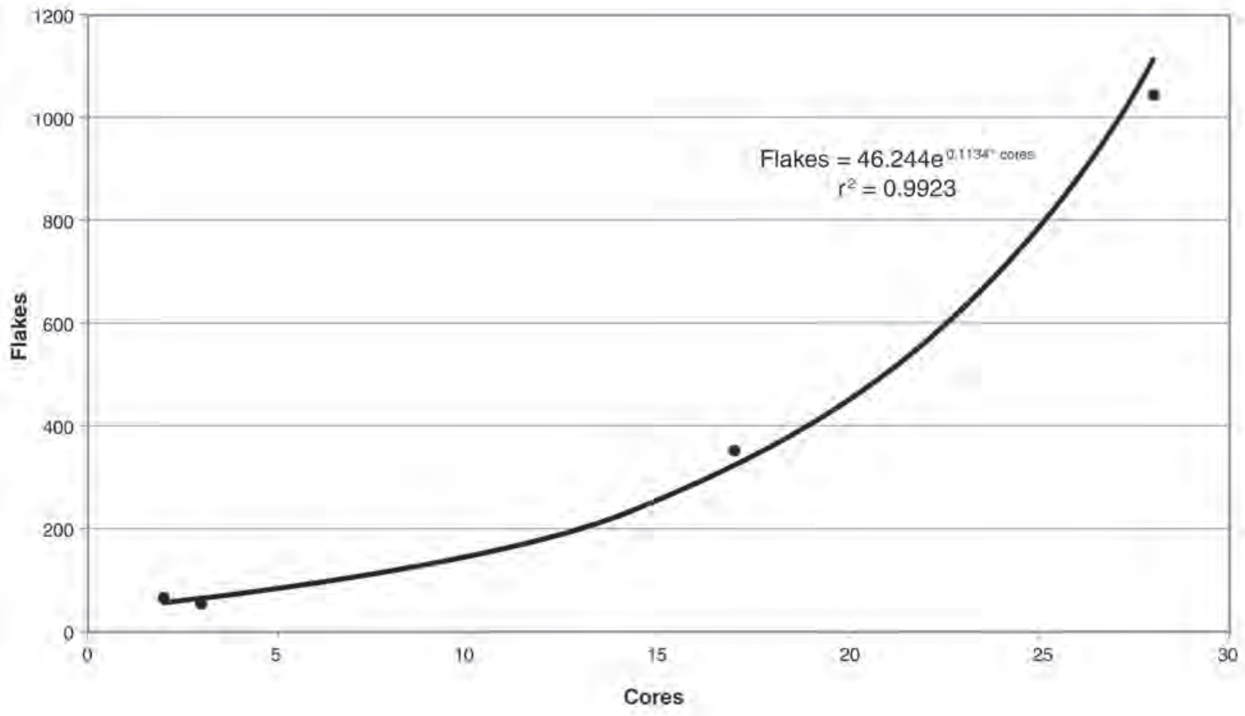


Figure 66. Core-reduction index: relationship of cores and core-reduction flakes.

Table 73. Hammerstones by Period and Extent of Battering

General Period	Full	Marginal	Partial	Total
Early/Middle Formative	—	—	1	1
Formative	1	—	—	1
Middle Formative	4	1	—	5
Middle Formative A	14	4	9	27
Middle Formative B	5	—	4	9
Late Formative B	3	—	10	13
TPQ[a] only	2	1	1	4
Not determined	1	—	—	1
Total	30	6	25	61

[a] Terminus post quem.

percussion implement used to detach flakes from an objective piece, i.e., core (Andrefsky 1998:11; Crabtree 1982:7). Adams (2002:151–152) differentiates hammerstones and peckingstones based on the amount of force applied by the user, such that peckingstones are used with less force. Adams also implies that peckingstones are used to shape objects (such as grinding tools) and hammerstones are used for flaked stone reduction. No contextual or experimental data exist to verify this distinction; therefore, this discussion refers to all battered items as hammerstones. All but two of the hammerstones were made on metamorphic materials; one was made on Whetstone chert and one on an unidentified material. The high frequency of metamorphic materials used for hammerstones suggests these percussors were predominantly derived from locally available stone and likely were expedient in nature. As noted by Greenwald and Vierra (Chapter 5 in this volume), over 27 percent of all hand stones exhibited evidence of battering, suggesting that these grinding stones were reused as percussion stones. Similarly, over 70 percent of pestles were reused to some degree, including some as hammerstones. Over one-third of the hammerstones in this sample were classified as hammer-cores (hammerstones/cores), indicating that this tool type was often reused as cores. This reuse is indicative of curation or recycling behavior, where certain items are used for a variety of tasks either concomitantly or sequentially.

Bradley classified the extent of battering on all hammerstones as either full (n = 30), marginal (n = 6), or partial (n = 25) (see Table 73). Although subjective, these categories can be interpreted as providing a relative measure of use for each hammerstone. Items classified as full correspond to hammerstones with battering over the entire surface of the artifact. Partial use indicates the hammerstone was only battered across part of its surface. Marginal use indicates that only the margin of the cobble was battered (Figure 67). The above categories indicate that approximately half (49 percent) of the hammerstones in the sample exhibited battering over the entire surface of the object, and 40 percent exhibited battering over part of the artifact. Hammerstones that showed evidence of battering only along one or more margins (10 percent) indicate two possible scenarios. Marginal hammerstones may indicate a very expedient use of the artifact prior to discard. Alternatively, marginally battered hammerstones may indicate use for a specialized task that required more control of the application of force, such as bifacial reduction or platform preparation. Unfortunately, the latter assumption cannot be substantiated with the data at hand.

All hammerstones were recovered from structures, with the exception of two, which came from extramural pits. Half of the hammerstones recovered from structures (n = 30) were discovered on the floor. This suggests that hammerstones were often kept within structures, not routinely discarded in pits or recycled, but also not curated if the structure had a planned abandonment. Ninety percent of hammerstones were recovered from Formative period contexts, particularly from Middle Formative A structures (n = 27, 44 percent), Middle Formative B structures (n = 9, 14.7 percent), and Late Formative B structures (n = 13, 21.3 percent). No hammerstones were recovered from Late Archaic period contexts. The absence of hammerstones in Late Archaic period contexts suggests that hammerstones from these contexts may have been reused by Formative period groups. Alternatively, Late Archaic groups may have used a variety of soft-hammer percussors that did not preserve in the archaeological record or hammerstones were curated and transported to other locations.

Flakes

In archaeological literature, flakes have been described as “prosaic” and “mundane” (Shott and Sillitoe 2005). Such descriptions, however, are typically made by investigators who have an explicit interest in deriving more information

Figure 67. Hammerstones from Mescal Wash (catalog numbers appear below images): (*a*) full, Feature 7880; (*b*) marginal, Feature 5781.

from this "humble" and lowly artifact category. Such descriptions are generally made in recognition of the fact that for many years archaeologists have undervalued the potential of flakes to inform on past behavior in favor of more-complex tools, such as projectile points. In some past excavations, flakes were completely ignored. In others, flakes were initially collected but then discarded.

Yet flakes have the potential to inform on technology, tool use, and site-formation processes. In terms of sheer numbers, the flake is one of the most abundant artifact types in many archaeological contexts. As a result, flaked stone artifacts represent an important link to the study of past behavior. Below, changes in technological attributes of flakes are explored across time. It is found that many attributes of flakes register fundamental change in lithic technology. Over time, expedient technology became superabundant at Mescal Wash. More-formal bifacial technologies became relatively less abundant. By the Late Formative, however, trends in flaked stone technology began to change, suggesting that fundamental changes in technological organization, discard patterns, or mobility occurred between the Middle Formative and Late Formative periods.

Cortex

Cortex refers to the natural outer surface of stone nuclei. Cortex generally appears as a different color and texture than freshly fractured rock surfaces. Cortex can result from either chemical or mechanical weathering. Chemical weathering typically results from exposure to water or heat whereas mechanical weathering typically results from the mechanical interaction (abrasion) of rocks with other materials, such as occurs in a river. In general, exposed bedrock may be expected to have chemically weathered cortex and river cobbles may be expected to have mechanically weathered cortex (Andrefsky 1998).

Bradley recorded cortex attributes on platform-bearing flakes and identified whether these flakes possessed primary, secondary, or no cortex. Flakes with primary cortex were those with dorsal surfaces that were entirely covered with cortex, whereas flakes with secondary cortex were those with some trace of cortex on their dorsal surface. Primary and secondary cortex are typically seen on flakes removed early in the reduction process or removed according to a fairly expedient reduction strategy. Flakes lacking cortex on their dorsal surfaces would have been removed from interior portions of a core and can be associated with later stages of reduction.

Bradley also typologized flakes as to whether cortex was cobble (mechanical) or natural (chemical). In a general sense, natural cortex can be interpreted as forming on rocks that have not been naturally transported great distances from their original geologic source. Although rocks with natural cortex could certainly have been transported over great distances by people, rocks with natural cortex can be interpreted as probably having been collected for use close to their geologic source, such as from an exposed bedrock formation. In contrast, rocks with cobble cortex can be interpreted as collected some distance from their original geological source, having likely been transported along waterways over many centuries as small boulders or cobbles. Recording cortex type in this fashion allows us to gain some insight into the kinds of lithic sources that were exploited at different times as well as to infer whether different kinds of sources were favored for different kinds of tools or reduction strategies.

At Mescal Wash, the percentage of flakes that were noncortical steadily decreased from Late Archaic through Middle Formative B times, but increased slightly during Late Formative B times. Decreasing percentages of noncortical flakes through time agrees with the idea that core reduction becomes more expedient over time, as fewer flakes were removed from the interior of cores. The slight increase in percentage of noncortical flakes during the Late Formative period is intriguing, in that it suggests that flaked stone technology was less expedient during that time. Possibly, Late Formative occupants of Mescal Wash stayed there for shorter periods and as a result were more likely to use finished tools and prepared cores that they had imported into the site. Interestingly, the percentage of flakes with primary cortex (PC%) increases predictably with the percentage of flakes with either primary or secondary cortex (C%) ($PC\% = 0.1485\mathrm{Ln}(C\%) + 0.4218$, $r^2 = 0.9781$), suggesting that the more cortex-bearing flakes there are, the more with primary cortex as opposed to secondary cortex. Somewhat surprising was the large percentage of noncortical flakes in all periods which could suggest that, regardless of reduction strategies or intensities or period, many nuclei had already been reduced to some degree before being brought into excavated areas of the site and ultimately deposited (Carr and Bradbury 2001; Wenzel and Shelley 2001). Of course, the fact that only whole flakes and flakes with intact proximal portions were analyzed to this level of detail could present some bias as artifacts classed as debris could have conceivably more often retained cortex than the analyzed flakes and flake fragments.

Cortex type is somewhat more difficult to interpret, in part because of low numbers of flakes with observable cortex type. To evaluate change through time in cortex type, and thus the possible sources of raw materials, we calculated the ratio of flakes with mechanically weathered cortex to flakes with chemically weathered cortex. The sample size was particularly low for Late Archaic, Early Formative, and Late Formative contexts, so the validity of temporal trends is difficult to assess. Moreover, the directionality seen in other variables when viewed according to time was not apparent, causing one to wonder whether sample vagaries were polluting any observable patterns. However, the apparent difference in cortex type between Middle Formative A and Middle Formative B is rather striking (Figure 68 and Table 74). Middle Formative A flakes were dominated by flakes with chemically weathered cortex, whereas Middle Formative B flakes were dominated by flakes with mechanically weathered cortex. If the above trend is correct, Late Formative B flakes, like Middle Formative A flakes, were dominated by chemically weathered cortex. This suggests the possibility that Middle Formative A raw materials, and possibly Late Formative B raw materials, were more often obtained from bedrock outcrop sources, and Middle Formative B raw materials were more often obtained from cobble quarries. Interestingly, most of the Middle Formative A flakes with observable cortex type were made on metamorphic materials, with a ratio similar to that obtained for all material types for the period, meaning that most flakes made on metamorphic materials came from rock outcrops, rather than cobbles. Chert, chalcedony, and agate materials deposited in Middle Formative A features also tended to more often have chemically weathered cortex. By contrast, most Middle Formative B flakes with mechanically weathered cortex were also made on metamorphic materials, suggesting that metamorphic materials may have more often been obtained from cobble quarries, rather than rock outcrops, during the Middle Formative B period. The validity of these differences is hard to assess, but perhaps Middle Formative A knappers preferred to use metamorphic materials of sizes or shapes that differed from those preferred by Middle Formative B knappers or different kinds of sources were more or less accessible during the Middle Formative A and Middle Formative B periods.

Discovery Context

Flakes were discovered in a wide variety of contexts at Mescal Wash (Table 75). Most flakes were discovered in the fill of pits or structures. Not surprisingly, analyzed flakes associated with the Late Archaic and Early Formative periods were typically discovered in pits, whereas flakes associated with later periods were typically discovered in structures. During the Formative period, relative frequencies of flakes potentially associated with interior domestic spaces (i.e., hearths, postholes, structure entries, and structure floors) increased. The vast majority of analyzed flakes associated with Middle Formative and Late Formative contexts came from deposits we can associate with interior domestic space: hearths, postholes, structure floors, structure floor fill. This pattern is merely a reflection of the sample selection technique, however, which focused on analyzing flaked stone artifacts from deposits that appeared to be relatively unmixed and that had the best chance of being securely dated. As a result, the vast majority of analyzed flakes came from select controlled contexts. In other words, the fact that most analyzed flakes were found in contexts

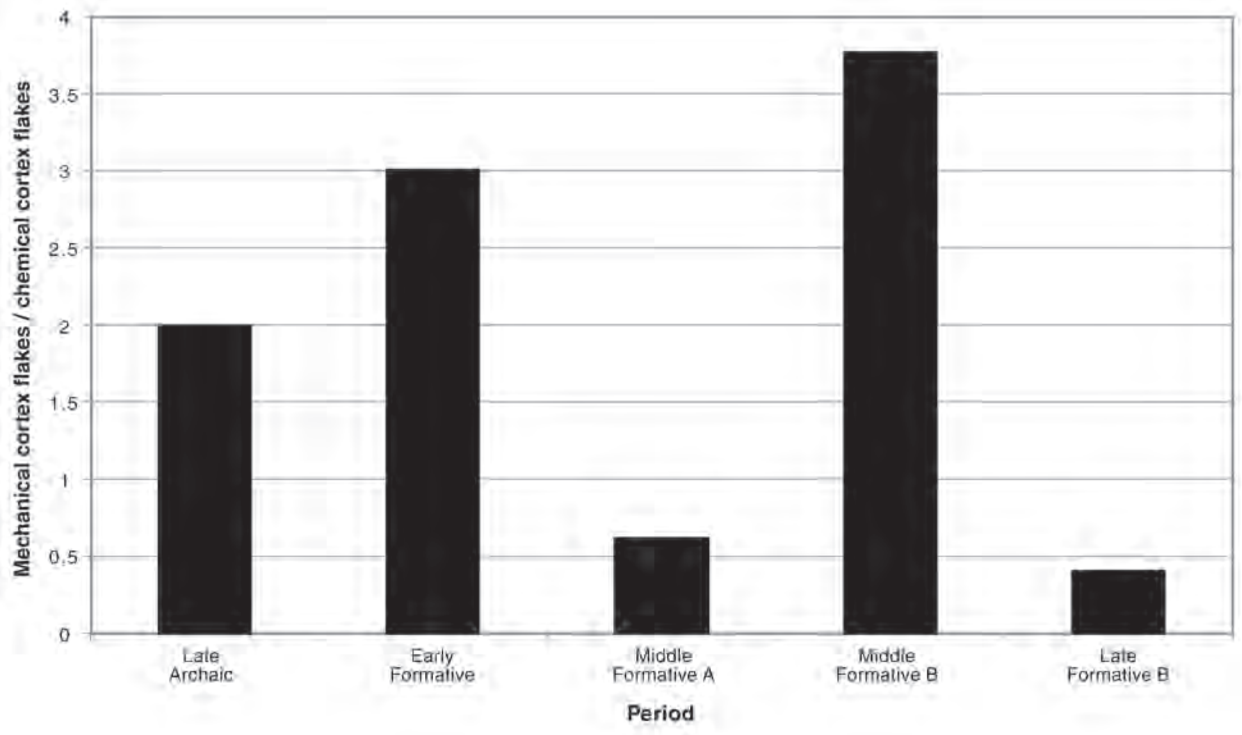


Figure 68. Ratio of flake specimens with mechanical or chemical cortex, by period.

Table 74. Cortex Types for Proximal Flakes at Mescal Wash

General Period	Mechanical Cortex Flakes	Chemical Cortex Flakes	No Cortex Type Observable	Not Determined	Total	Mechanical/ Chemical	% Sample With Cortex Type Obsered
Late Archaic	8	4	187	11	210	2.00	5.7
Early Formative	3	1	62	7	73	3.00	5.5
Early/Middle Formative	7	8	52	2	69	0.88	21.7
Formative	5	2	14	2	23	2.50	30.4
Middle Formative	21	146	673	8	848	0.14	19.7
Middle Formative A	118	191	1,385	40	1,734	0.62	17.8
Middle Formative B	79	21	326	17	443	3.76	22.6
Late Formative B	4	10	54	3	71	0.40	19.7
TAQ[a] only	13	10	87	2	112	1.30	20.5
TPQ[b] only	5	—	25	—	30	—	16.7
Not determined	15	25	191	9	240	0.60	16.7
Total	278	418	3,056	101	3,853	0.67	18.1

[a] TAQ = terminus ante quem.
[b] TPQ = terminus post quem.

Table 75. Discovery Context of Proximal Flakes from Mescal Wash

General Period	Nonfeature	Floor Fill	Fill	Floor	Structural Debris	Total
Late Archaic	—		210	—	—	210
Early Formative	—	5	67	1	—	73
Early/Middle Formative	—	57	3	9	—	69
Formative	—	22	—	1	—	23
Middle Formative	—	781	33	28	6	848
Middle Formative A	—	1,495	14	225	—	1,734
Middle Formative B	—	377	35	31	—	443
Late Formative B	—	14	—	57	—	71
Not determined	60	83	73	24	—	240
TAQ[a] only	—	111	—	1	—	112
TPQ[b] only	—	19	7	4	—	30
Total	60	2,964	442	381	6	3,853

[a] TAQ = terminus ante quem.
[b] TPQ = terminus post quem.

we can associate with interior domestic space is the result of a methodological approach, rather than the consequence of specific prehistoric behaviors.

In fact, the relative amount of flaked stone artifacts discovered in interior domestic spaces, as determined from the initial laboratory sort, increased dramatically in contexts from the Early Formative through the Late Formative B periods (Figure 69). In deposits dating to the Early Formative, most of the flaked stone artifacts were discovered in extramural contexts, as was the case for the preceding Late Archaic period, when all of the flaked stone artifacts were discovered in extramural contexts. By the Middle Formative, most of the flaked stone artifacts began to be found within domestic features, with greater and greater percentages of flaked stone artifacts found in interior domestic spaces, as opposed to postabandonment fill deposits.

During the Middle Formative A period, around half of the flaked stone artifacts were found in interior domestic space and almost 30 percent were found in the upper fill of structures (see Table 67); the remaining artifacts were discovered in extramural contexts. By the Late Formative B period, over 80 percent of flaked stone artifacts were found in interior domestic spaces and most of the remainder were found in the upper fill of structures. The implication of this pattern could be that through time the storage and maintenance of flaked stone tools were increasingly reserved for private, intramural domestic space. Flaked stone artifacts may have increasingly been kept within structures, on structure floors, or as parts of tools hung from structure roofs. Perhaps the gradual decrease in flaked stone artifacts in structure fill from the Middle Formative A through Late Formative B periods reflects a decreasing tendency to store or discard artifacts immediately outside houses (which subsequently would have washed into features after abandonment) or alternatively reflects a decreasing tendency to use abandoned features for tool production or refuse disposal. The different locations where flaked stone artifacts were found according to period could reflect changing social organization, site function, duration of occupation, etc. Perhaps, through time, there was a gradual change from communally focused activities in extramural settings to more privately focused activities that were restricted to interior domestic spaces. Concepts of ownership could potentially have played a role in this pattern as well, with earlier groups sharing food and materials more openly and communally and later groups restricting the circulation of food and materials to specific individuals or households.

Bifacial vs. Core-Reduction Technology at Mescal Wash

In addition to other variables, Bradley identified proximal flake specimens as bifacial (b), bifacial shaping (bs),

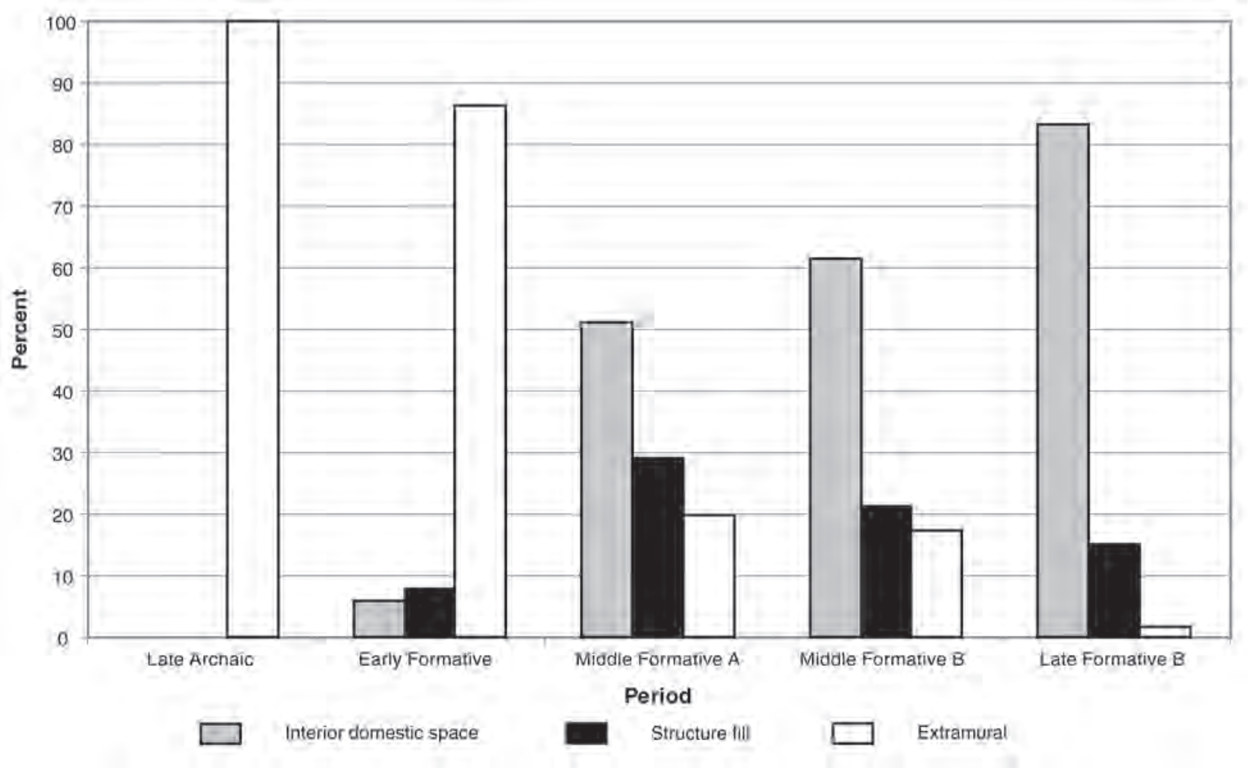


Figure 69. Percent of all flaked stone artifacts, by period and recovery context.

bifacial thinning (bt), core (c), or disk core (d) flakes. Adding b, bs, and bt flake counts for particular contexts or site components provides an estimate of the total number of biface flakes. Adding c and d provides an estimate of the total number of core flakes. These counts were converted into relative frequencies and tracked through time to estimate the degree to which flaked stone reduction focused on either bifacial or core technology (Figure 70 and Table 76).

At Mescal Wash, relative frequencies of debitage from bifacial tool manufacture or maintenance declined over time. At the same time, relative frequencies of core-reduction debitage increased. If increasing frequencies of core reduction register increased occupation duration, the implication is that at Mescal Wash the duration of occupation increased through time. Early occupants of Mescal Wash used the site for short periods. Later occupants of Mescal Wash used the site for longer periods. As is shown below, however, the situation may have been more complex. Other indexes suggest that the duration of occupation increased into the Middle Formative and started to decline by perhaps the Middle Formative B period.

As at other contemporaneous sites, the material consequences of bifacial technology became relatively less common over time at Mescal Wash. During the Late Archaic and Early Formative periods, over 50 percent of flakes were bifacial, and bifacial flakes were more common than core-reduction flakes or unifacial retouch flakes. For both periods, around 30 percent of bifacial flakes were bifacial-shaping flakes and a little over 10 percent of bifacial flakes were bifacial-thinning flakes. During the Middle Formative A period, bifacial flake production declined to 29 percent and core reduction increased to 64 percent. Bifacial flake production continued to decline to 8 percent during the Middle Formative B period and remained low during the Late Formative B period (10 percent).

Analysis of flake type, according to period, suggests that bifacial reduction did not disappear suddenly or completely and was not entirely replaced by expedient core technologies. Instead, bifacial reduction was reorganized or relocated and eventually overwhelmed by nonbifacial core reduction. If bifacial reduction was a pleasant conversation conducted at normal volume, expedient flake production was a shouting match of increasing intensity. The most lithic reduction evidently occurred during the Middle Formative period. Five times more bifacial flakes were removed during the Middle Formative than were removed during the Late Archaic and Early Formative periods, and 112 times more bifacial flakes were removed during the Middle Formative than during the Late Formative. At a finer scale (Late Archaic, Early Formative, Middle Formative A, Middle Formative B, Late Formative B), the result is similar with the exception that change occurs over the Middle Formative. The major change observed between Middle

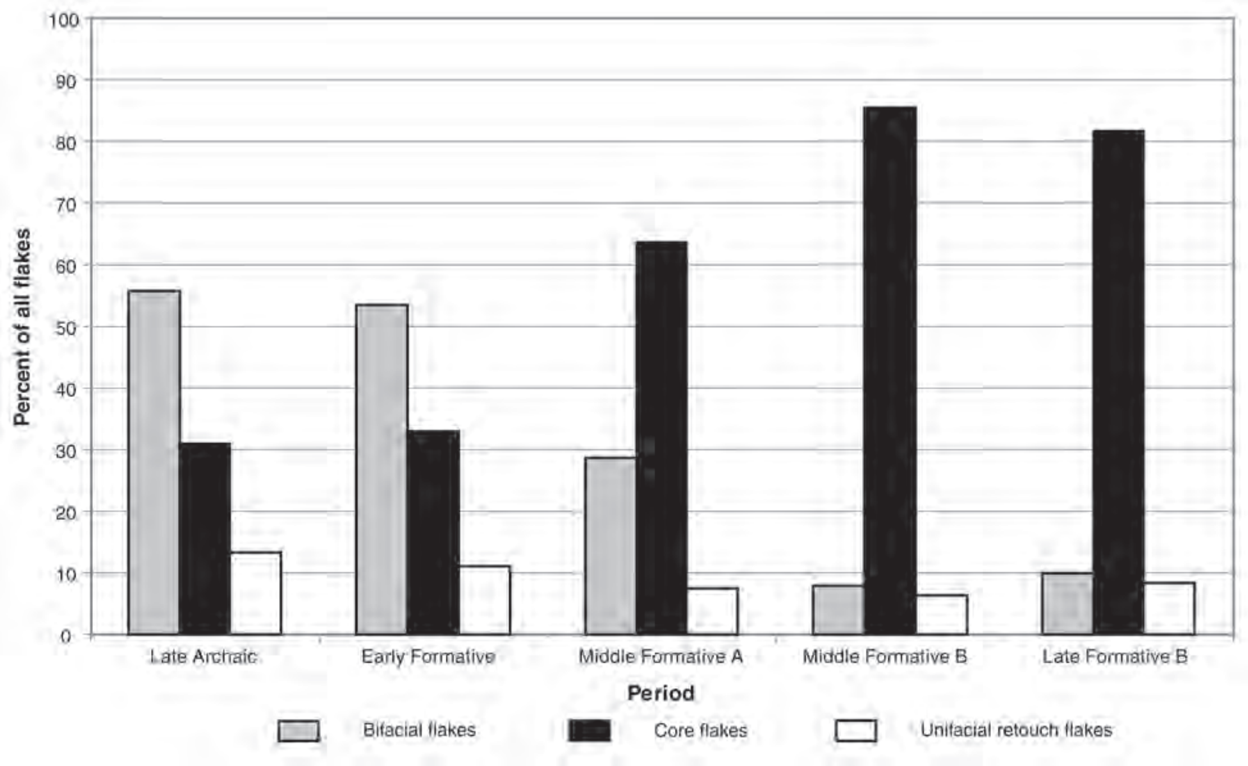


Figure 70. Percentage of all bifacial, core, and unifacial retouch flakes, by period.

Table 76. Bifacial vs. Core-Reduction Flakes from Mescal Wash

General Period	Not Determined	Biface Flake	Biface- Shaping Flake	Biface- Thinning Flake	Core Flake	Disk Core Flake	Unifacial Retouch	Total	Total Biface Flakes (%)	Total Core Flakes (%)	Unifacial Retouch (%)
Late Archaic		65	36	16	30	35	28	210	55.7	31.0	13.3
Early Formative	2	23	11	5	13	11	8	73	53.4	32.9	11.0
Early/Middle Formative		10	4	2	30	21	2	69	23.2	73.9	2.9
Formative		2	1		8	8	4	23	13.0	69.6	17.4
Middle Formative	9	158	40	24	283	313	21	848	26.2	70.3	2.5
Middle Formative A	5	342	98	55	510	594	130	1,734	28.5	63.7	7.5
Middle Formative B	1	23	4	8	201	178	28	443	7.9	85.6	6.3
Late Formative B		2	2	3	31	27	6	71	9.9	81.7	8.5
TAQ[a] only		26	7	7	27	41	4	112	35.7	60.7	3.6
TPQ[b] only		2	1	2	12	12	1	30	16.7	80.0	3.3
Not determined		36	12	11	81	73	27	240	24.6	64.2	11.3
Total	17	689	216	133	1,226	1,313	259	3,853	26.9	65.9	6.7

[a] TAQ = terminus ante quem.
[b] TPQ = terminus post quem.

and Late Formative contexts appears to have occurred during the Middle Formative. However, it may be the case that Middle Formative B trash was deposited in Middle Formative A features, making this change appear earlier than had occurred.

Core Reduction and Disk Core Reduction

Flakes identified by Bradley (2002b) as core flakes came in many shapes but tended to be either slightly elongated or have nearly equal length and width dimensions. In contrast, disk core flakes had distinctively triangular cross sections, thick platforms, and were typically wider than they were long. Disk core-reduction technology was common at Mescal Wash. The percentage of core flakes that were disk core flakes was remarkably even across time at Mescal Wash. During Early Formative, Middle Formative B, and Late Formative B periods, disk core flakes made up around 46 percent of all core flakes (see Table 76). During the Late Archaic and Middle Formative A periods, disk core flakes made up around 54 percent of all core flakes. Possibly, disk core reduction was somewhat more important than other forms of nonbifacial core reduction during the Late Archaic and between A.D. 700 and 950. At other times, disk core reduction may have been somewhat less important than other forms of nonbifacial core reduction, but again, sample vagaries could have played a role in creating this subtle pattern.

Platform Preparation and Technological Change

Flake platform attributes, such as faceting or grinding, are often used to infer technological strategies for stone tool manufacture. Platforms that are deliberately shaped and ground typically allow more control over the size and shape of flakes and the objective piece. In general, formal tools and standardized cores require more controlled flake removal and concomitant investment in platform preparation. Although faceted platforms can result from a variety of bifacial and nonbifacial reduction technologies, faceted platforms occur far more often as a result of bifacial reduction (Magne and Pokotylo 1981; Tomka 1989).

For some time, the percentage of faceted proximal flakes has been used as a proxy measure for the degree of emphasis on bifacial reduction (Parry and Kelly 1987). More recently, Carr and Bradbury (2001, Figure 8.1) empirically demonstrated that platform faceting is directly related to bifacial reduction. The percentage of flakes resulting from bifacial reduction increases predictably as the percentage of faceted platforms increases. The relationship between the two variables is almost linear with the exception that the relationship becomes more dispersed as the percentage of faceted platforms decreases. In their study, Carr and Bradbury found that most bifacial flake platforms have one or more facets (80 percent), and most nonbifacial flake platforms do not have one or more facets. In addition, uniface production and amorphous core reduction both result in around 20 percent faceted platforms whereas bifacial reduction results in around 80 percent faceted platforms. In Carr and Bradbury's experiments, a combination of bifacial and amorphous core reduction resulted in around 33 percent faceted platforms.

At Mescal Wash, flake platforms without facets were common in all periods (Table 77). Large numbers of flakes without faceted platforms indicate that core reduction likely occurred at Mescal Wash throughout the sequence. Judging from the percentage of faceted platforms, Late Archaic and Early Formative period deposits resulted from a mixture of bifacial and nonbifacial core reduction, but strongly emphasized bifacial reduction. Bifacial reduction was far less common in later periods, when most reduction appeared to have been more expedient.

The greatest emphasis on bifacial reduction occurred during the Late Archaic and Early Formative periods. Flaked stone artifacts in deposits from both periods were quite similar, containing around 46 percent faceted platforms. Middle Formative deposits had less evidence for bifacial reduction and Late Formative deposits even less still. Middle Formative A deposits contained 20 percent faceted platforms and Middle Formative B contained 7 percent faceted platforms. Late Formative B deposits contained only 4 percent faceted platforms.

Evidence for ground or reduced platforms mirrored the trend in platform faceting. Flake platforms with evidence of grinding decreased in relative abundance from around 19 percent of platforms during Late Archaic and Early Formative periods to 1.4 percent of platforms in the Middle Formative B period. Similarly, reduced platforms decreased from around 31 percent of platforms during the Late Archaic and Early Formative periods to 9 percent of platforms during the Middle Formative B. Percentages of ground platforms and reduced platforms increased slightly in the Late Formative B, suggesting a possible departure from the long-term trend in increasing expediency in flaked stone reduction.

Percentages of plain platforms and dihedral platforms generally increased through time. During the Late Archaic and Early Formative, around 45 percent of platforms were plain and 6 percent of platforms were dihedral. Dihedral platforms were on 12 percent of Middle Formative A flakes and 10 percent of Middle Formative B flakes. The percentage of plain platforms increased into the Middle Formative B period, when 77 percent of platforms were plain. By the Late Formative, plain platforms declined somewhat in relative abundance (72 percent of flake platforms were plain), but dihedral platforms continued to

Table 77. Platform Types of Complete Flakes from Mescal Wash

General Period	Platform Types										Total
	Plain		Dihedral		Reduced		Faceted		Ground		
	n	%	n	%	n	%	n	%	n	%	
Late Archaic	97	46.2	13	6.2	64	30.4	97	46.2	41	19.5	210
Early Formative	31	42.5	5	6.8	28	38.4	34	46.6	14	19.2	73
Early/Middle Formative	45	65.2	8	11.6	8	11.6	13	18.8	4	5.8	69
Formative	16	69.6	1	4.3	3	13.0	5	21.7	1	4.3	23
Middle Formative	550	64.9	101	11.9	102	12.0	147	17.3	82	9.7	848
Middle Formative A	1,086	62.6	211	12.2	231	13.3	345	19.9	173	9.9	1,734
Middle Formative B	343	77.4	45	10.2	40	9.0	30	6.8	6	1.4	443
Late Formative B	51	71.8	13	18.3	7	9.9	3	4.2	2	2.8	71
Not determined	156	65.0	24	10.0	50	20.8	50	20.8	21	8.8	240
TAQ[a] only	77	68.8	10	8.9	22	19.6	20	17.9	15	13.4	112
TPQ[b] only	17	56.7	5	16.7	1	3.3	5	16.7	1	3.3	30

[a] TAQ = terminus ante quem.

[b] TPQ = terminus post quem.

Note: The counts for each platform attribute correspond to the number of observed platforms with that attribute and an individual platform could have multiple attributes, e.g., both ground and faceted. The total number of observed platforms is the total number of platforms exhibiting one or more of the listed attributes. Percentages are by row.

increase. The highest relative frequency of dihedral platforms occurred during the Late Formative B, when 18 percent of flake platforms were dihedral.

Clearly, investment in platform preparation decreased over time at Mescal Wash. Over time, relatively fewer flake platforms were ground, faceted, or reduced. Conversely, plain and dihedral platforms became more common over time. Moreover, change was not sudden or episodic, but instead occurred continuously and gradually across the sequence. Variables that could have influenced change in technology, such as residential mobility, may have also changed gradually, rather than suddenly, over time.

A particularly interesting finding is that relative frequencies of platform types and flake types at Mescal Wash were nearly identical between deposits in features dating to either Late Archaic or Early Formative times. As the Late Archaic and Early Formative samples were both small and from a limited number of features, sample size issues could have played a role in creating this pattern. Samples associated with Early Formative period occupations could also have conceivably been filled with reworked Late Archaic materials. If this is the case, then Early Formative samples could reflect Late Archaic lithic technology instead of Early Formative technology. Otherwise, it appears that Early Formative reduction technology at Mescal Wash was similar to Late Archaic reduction technology.

Despite the incorporation of domesticates and agricultural technologies into Formative period (ca. A.D. 200–1450) and earlier lifeways, it appears that there was continuous and gradual change in flaked stone technology. In other words, the view from Mescal Wash suggests that the adoption of agricultural practices into prehistoric lifeways did not necessitate an immediate change in flaked stone technology (Whittlesey and Ciolek-Torrello 1996). The organization of stone tool production and use appears to have been similar between Late Archaic and Early Formative times, and the gradual change to more expedient core reduction began in later periods. Finally, Late Formative technology appears to have a somewhat reduced emphasis on expedient core reduction.

Flake Fragmentation

One way to assess fragmentation is to compare the number of fragments to the number of systemic items. The ratio of flake specimens (NFS) to MNF, for instance, can be used as an index of fragmentation. The larger the ratio, the greater the degree of fragmentation. Given limited experimental evidence and evaluation, it is of course difficult to ascertain the source(s) of fragmentation. Variation in fragmentation can result from variation in material type, reduction strategies,

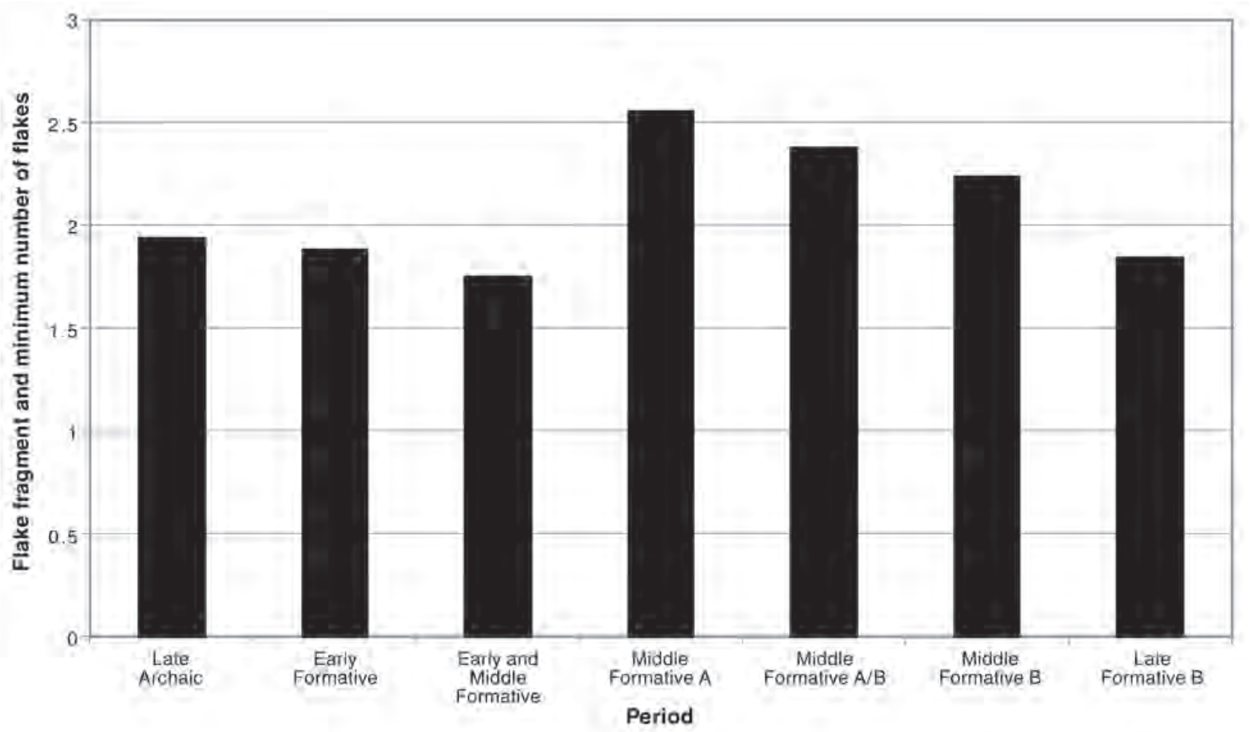


Figure 71. The ratio of flake fragments to the minimum number of flakes at Mescal Wash.

or as a result of postdepositional transformations, such as fire or trampling.

At Mescal Wash, there was apparent change over time in fragmentation (Figure 71 and Table 78). Fragmentation was moderate during the Late Archaic and declined somewhat during the Early Formative. The greatest degree of flake fragmentation occurred during the Middle Formative A period and declined thereafter.

Occupation duration may have something to do with this pattern. That is, the longer the occupation duration, the greater the number of activities capable of fragmenting artifacts. Indeed, Surovell's mobility index (M), an index of occupation duration per capita (see below), predicts fragmentation well for Late Archaic, Middle Formative A, Middle Formative A/B, and Late Formative B deposits ($NFS/MNF = 0.0233 \times M + 1.7542$, $r^2 = 0.9907$). According to this relationship, fragmentation increases proportionally with increased occupation duration. Early Formative and Middle Formative B deposits had lower than expected degrees of fragmentation than would be implied by the above relationship. Possibly, activities conducted at the site during the Early Formative and Middle Formative B periods were less likely to contribute to flake fragmentation. Alternatively, trash may have been deposited differently during the Early Formative and Middle Formative B periods in comparison to other periods.

Flake Size

Across time, flakes at Mescal Wash differed in terms of technology. Investment in platform preparation decreased over time and biface flakes decreased in relative frequency over time. The implication is that implementation of bifacial technology decreased or remained steady and implementation of simpler core-and-flake technology increased. Does flake size respond to this change? If so, how?

Bradley measured the length of complete and incomplete flakes. Bradley defined incomplete flakes as flakes that were mostly complete. The length of indeterminate flake fragments (i.e., debris) was not measured. For all flake types, the average length of incomplete flakes was approximately 90 percent of the average length of complete flakes (complete flake length = [0.8915 × incomplete flake length], $r^2 = 0.9894$). In order to examine flake size distributions across time, we multiplied the length of incomplete flakes by 1.1 in order to adjust for the smaller size of incomplete flakes. In general, flake size increased through time until the Middle Formative B and decreased somewhat during the Late Formative B (Figure 72). Bifacial-thinning flakes were generally largest during the Late Archaic and Early Formative and smallest during the Middle Formative A and B periods. Bifacial-shaping flakes were smallest during the Late Formative B period, but bifacial-thinning flakes were also largest during this period (Table 79). There was a significant difference (90 percent level) in the length of biface flakes between Late Archaic and Middle Formative A ($t = 1.81$, $sd = 6.35$, $df = 385$, $p = .071$). Overall, Middle Formative A biface flakes were typically slightly shorter than Late Archaic period flakes. Unpaired Student's *t*-test suggest no significant difference in the size of biface flakes between Late Archaic and Early Formative periods ($t = .143$, $sd = 6.97$, $df = 110$, $p = .89$) or between Late Archaic and Middle Formative B times ($t = -0.635$, $sd = 6.97$, $df = 112$, $p = .53$).

Because the bifacial tools (i.e., projectile points) at Mescal Wash decreased in overall size over time, it is expected that bifacial flakes should have also decreased in size. Necessarily, the maximum attainable size of flakes removed from small tools must be less than the maximum attainable size of flakes removed from large tools. San Pedro projectile points are larger in every dimension than most Formative period point styles, for instance. Flake size distributions, however, are a product of the size of objective pieces and technology. Even when bifacial cores are considerably larger than blade cores, blade cores produce more usable flakes of a larger size class than bifacial cores. In comparison to usable flakes removed from blade cores, usable flakes from bifacial cores tend to be smaller and broader (Rasic and Andrefsky 2001). The difference results from differences in reduction technology as opposed to other factors such as raw material or core size. Another possibility is that many post–Late Archaic bifacial flakes were actually manufactured during the Late Archaic and redeposited into later contexts.

Core flakes generally appear to have increased in length over time from the Early Formative through Middle Formative B periods and then decreased slightly in length during the Late Formative B period. Despite this general trend, it appears that the most significant increase in length occurred during the Middle Formative B period and remained a significant increase in the Late Formative B period. We used unpaired, two-sample *t*-tests to test for significant differences between the mean lengths of complete core flakes from different periods. There was no significant difference between the mean lengths of complete core flakes between Late Archaic and Early Formative times ($t = 0.885$, $df = 60$, $p = .380$), Late Archaic and Middle Formative A times ($t = 1.226$, $df = 663$, $p = .221$), or between Early Formative and Middle Formative A times ($t = 1.617$, $df = 630$, $p = .106$). Middle Formative B core flakes, however, were significantly longer than Late Archaic core flakes ($t = 3.987$, $df = 308$, $p < .0001$), Early Formative core flakes ($t = 2.886$, $df = 270$, $p = .002$), and Middle Formative A core flakes ($t = 7.022$, $df = 878$, $p < .0001$), but were not significantly longer than Late Formative B core flakes ($t = 1.292$, $df = 296$, $p = .099$). Like Middle Formative B core flakes, Late Formative B core flakes were significantly longer than Late Archaic core flakes ($t = 1.816$, $df = 86$, $p = .036$), Early Formative core flakes ($t = 1.884$, $df = 48$, $p = .033$), and Middle Formative A core flakes ($t = 1.635$, $df = 656$, $p = .051$).

Table 78. Flake Types Identified at Mescal Wash

General Period	n	Flake Types							Minimum Number of Flakes (MNF)	Debris	Number of Flake Specimens (NFS)	NFS:MNF
		Unidentified	Bifacial	Bifacial Shaping	Bifacial Thinning	Core	Disk Core	Unifacial Retouch				
Late Archaic	210	—	65	36	16	30	34	28	208	193	403	1.94
Early Formative	73	2	23	11	5	13	10	8	72	61	134	1.87
Early/Middle Formative	4	—	2	—	—	—	2	—	4	3	7	1.75
Middle Formative A	1,759	5	352	101	58	492	559	134	1,700	2,571	4,330	2.55
Middle Formative A/B	864	9	157	40	24	281	307	21	839	1,127	1,991	2.37
Middle Formative B	443	1	23	4	8	192	162	28	418	489	932	2.23
Late Formative B	71	—	2	2	3	30	26	6	68	54	125	1.84

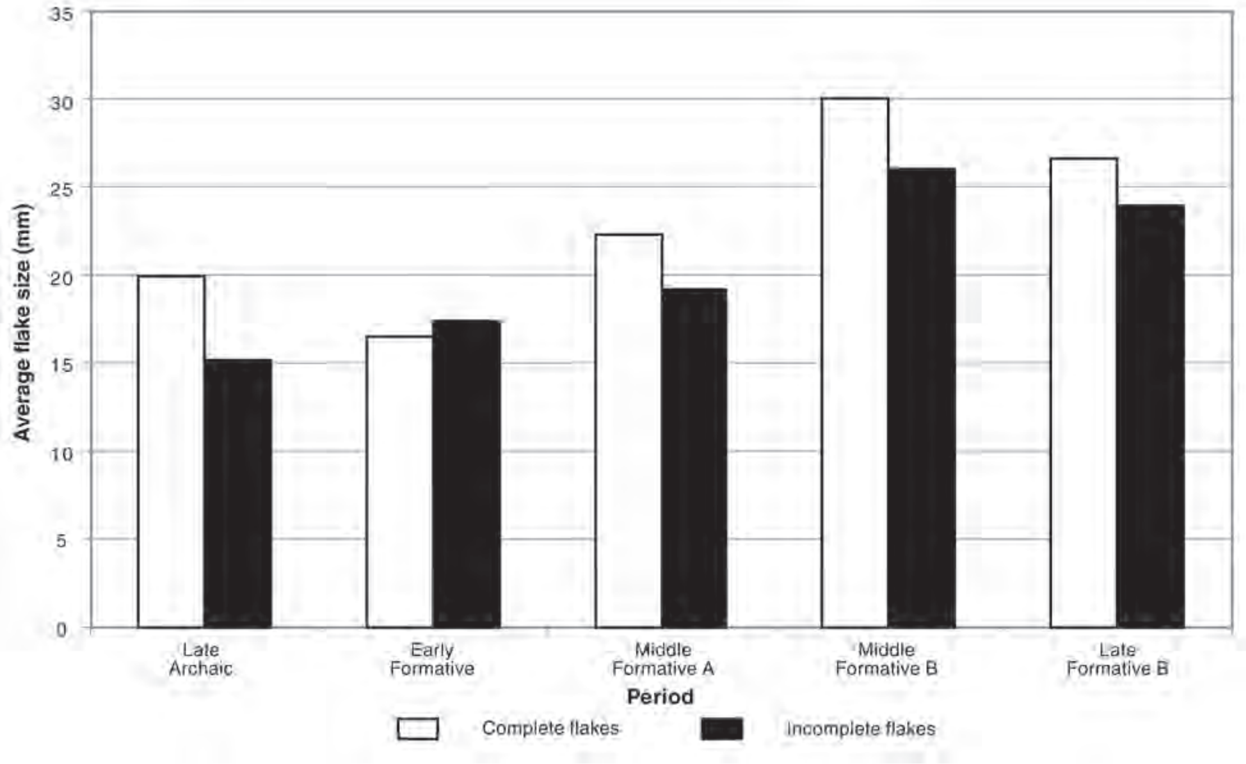


Figure 72. Average size of complete and incomplete flakes, by period.

Table 79. Average Size (in mm) of Platform-Bearing Flakes from Mescal Wash

General Period	No. of Flakes	Total Average of Length	Bifacial	Bifacial Shaping	Bifacial Thinning	Core	Disk	Unifacial Retouch
Late Archaic	177	18.29	13.37	17.11	27.44	27.07	17.63	12.04
Early Formative	56	16.84	14.00	17.18	23.40	18.58	17.90	11.63
Early/Middle Formative	66	22.53	12.88	11.25	21.00	25.55	25.29	12.50
Formative	21	23.00	9.00	23.00	—	29.29	24.63	12.25
Middle Formative	657	20.80	16.10	16.79	23.86	26.25	18.63	11.65
Middle Formative A	1,388	21.03	14.69	14.40	22.80	28.08	20.45	11.41
Middle Formative B	420	28.85	17.53	15.00	22.00	33.93	27.08	14.74
Late Formative B	66	25.74	12.00	12.00	29.00	34.31	20.74	13.17
TAQ[a]	91	17.79	16.00	15.43	20.50	21.52	17.33	9.00
TPQ[b]	28	24.11	21.00	16.00	25.50	27.92	21.73	13.00
Total	2,970							

[a] TAQ = terminus ante quem.
[b] TPQ = terminus post quem.

In general, these tests suggest that although core flakes may have gradually increased in length from the Late Archaic through the Middle Formative period, they had become significantly longer than earlier core flakes by the Middle Formative B period and remained long during the Late Formative B period. What caused this change? One possible explanation is that flake tools became increasingly important after A.D. 950. Another possibility is that cores were less intensively reduced. In Middle Formative B and Late Formative times, smaller numbers of large flakes may have been struck from cores.

Special Flake Attributes

Bradley recorded a number of special attributes of flakes in the comment section of his database. These included whether flakes retained evidence of step fracture and hinge fracture terminations, lipped platforms, or cortical platforms. Bradley also noted flakes that appeared to be pressure flakes and flakes that appeared to be corner flakes. As with other variables, we can track the number of flakes that possessed these attributes through time. As a percentage of MNF, the frequency of hinge fracture terminations, corner flakes, cortical platforms, and step fracture terminations increased through time. With the exception of step fractures, these attributes reached their highest relative frequencies by the Middle Formative and remained common through the Late Formative. Step fracture terminations were not observed on flakes discovered in Late Formative contexts.

In contrast, pressure flakes and flakes with lipped platforms, attributes that may be associated with the production of bifaces, were only common during the Late Archaic and Early Formative. Pressure flakes were rare during the Middle Formative A period and absent in later periods. Possibly, the small size and narrow width of Middle Formative and later projectile points resulted in small pressure flakes that evaded archaeological discovery. Otherwise, this indicates that little shaping of bifaces using antler tines or other types of indentors occurred during the Middle Formative and Late Formative periods. Similarly, lipped platforms decreased in relative frequency through the Middle Formative B, but increased somewhat in relative frequency during the Late Formative. The apparent increase during the Late Formative may simply be a function of sample size, as only one flake with a lipped platform was discovered in a Late Formative context. In any case, lipped platforms are frequently (but not always) the result of soft-hammer percussion. Possibly, soft-hammer percussion using wooden or antler batons also became less common at Mescal Wash through time.

Used Flakes

A total of 79 used flakes was identified in the analyzed sample (typed as utilized flakes by Bradley). Bradley recorded one set of variables for 59 used flakes (Table 80), including whether the use-edge was abraded, bifacial, or unifacial. The remaining 20 used flakes were recorded in more detail according to a different set of variables (Table 81). Most used flakes of the 59 recorded by Bradley (n = 55, 93 percent) were made on metamorphic materials and were likely made on locally available nuclei (Figure 73). Small numbers of used flakes were also made on Whetstone chert (n = 2), Sonoita chert (n = 1), chalcedony (n = 1), and jasper (n = 1). Out of the total sample of used flakes (n = 79), flakes were typically complete (n = 72, 91 percent), suggesting they were not often broken during or after use.

Discard of used flakes increased through time at Mescal Wash. This trend is indicated by an increase over time in relative frequencies of used flakes (100 × [used flakes / MNF]). Used flakes were rare during Late Archaic and Early Formative times. Only 1 used flake (0.5 percent) was discovered in a Late Archaic context and no used flakes were discovered in Early Formative contexts. During Middle Formative A, B, and Late Formative B periods, used flakes became more common and increased in relative frequency through time (used flakes / MNF = 0.0101 × end date -7.5761, $r^2 = 0.9999$). During Middle and Late Formative times, used flakes increased in relative frequency by 1 percent every 100 years. Prior to this time, used flake percentages increased more slowly, perhaps on the order of 1 percent every 500 years.

If used flakes from the Early Formative period appeared at nearly the same rate as Late Archaic used flakes, we would not expect to discover any Early Formative used flakes until a sample size near 200 flakes was reached. Only 73 flakes were associated with the Early Formative period. If instead we assume that the percentage of used flakes increased linearly between Late Archaic and Middle Formative A periods (used flakes/flakes = 0.002 × end

Table 80. Used Flakes by Use-Wear Type

General Period	Abraded	Backed	Bifacial	Unifacial	Total
Late Archaic	—	—	1	—	1
Middle Formative	3	—	1	6	10
Middle Formative A	2	—	9	19	30
Middle Formative B	5	—	2	5	12
Late Formative B	—	1	1	3	5
TAQ[a]	—	—	—	1	1
Total	10	1	14	34	59

[a]Terminus ante quem.

Table 81. Observations on Utilized Edges on 20 Used Flakes (in mm)

Period	Edge Form	Abraded	Bifacial	Bifacial and Abraded	Bifacial, Alternate	Unifacial	Total No. of Specimens	Total Average of Length
Middle Formative	wavy	0.00	0.00	0.00	50.00	0.00	1	50.00
Middle Formative	straight, toothed	0.00	0.00	0.00	0.00	37.00	1	37.00
Middle Formative A	wavy	0.00	0.00	0.00	0.00	65.00	1	65.00
Middle Formative B	concave	0.00	47.00	0.00	0.00	64.00	2	55.50
Middle Formative B	convex	65.00	72.00	50.00	0.00	0.00	3	62.33
Middle Formative B	convex, toothed	0.00	0.00	46.00	0.00	26.00	2	36.00
Middle Formative B	straight	37.00	49.00	58.00	0.00	67.00	5	52.75
Middle Formative B	wavy	0.00	0.00	0.00	61.00	0.00	5	61.00

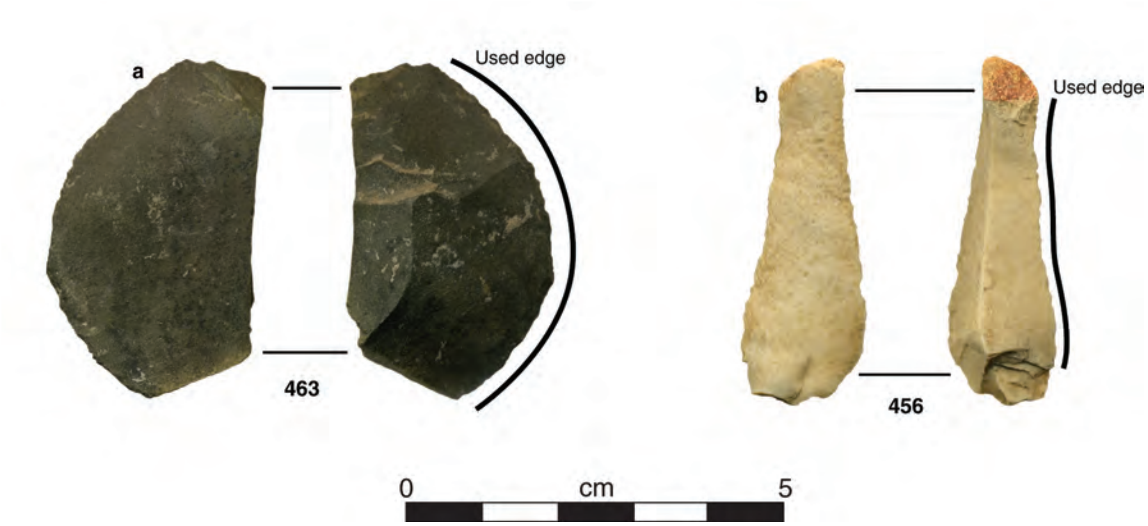


Figure 73. Used flakes from Mescal Wash (catalog numbers appear below images): (*a*) Feature 3617; (*b*) Feature 834. Lines indicate working edges.

date + 0.0726), we might estimate that Early Formative period flakes occurred at a rate of 1.37 percent. At this rate, we would expect to discover exactly 1 Early Formative used flake with a sample size of 73. We did not discover an Early Formative used flake, but the failure to do so is not difficult to understand.

Twenty used flakes were recorded in greater detail (see Table 81). Variables recorded on these flakes included condition; platform; cortex (primary, secondary, none); material type; texture; length, width, and thickness; edge form; damage type (abrasion, polish, bifacial, unifacial flaking dorsal); damage intensity (low, moderate, heavy); use (cutting, scraping, grinding); and length of used edge. All of the used flakes recorded in greater detail could be dated according to period, and all of these dated to some time during the Middle Formative period. One used flake was assigned to Middle Formative A and 17 were assigned to Middle Formative B. Sample sizes were small, but there were some apparent differences between used flakes from these two periods. The Middle Formative A used flake was longer than it was wide. Several Middle Formative B used flakes were wider than they were long (6 out of 17).

Used flakes tended to have either secondary cortex or no cortex and typically had plain or dihedral platforms. Most used flakes were made on medium-grained metamorphic materials. Middle Formative B used flakes had concave (n = 2), convex (n = 3), convex toothed (n = 2), straight (n = 5), and wavy edges (n = 5); the Middle Formative A used flake had a wavy edge. Differences in edge form between the two periods could possibly implicate different functions, but the sample size was too small to assess the possibility. Damage types included bifacial flaking, abrasion, and unifacial dorsal flaking but there were no obvious differences in damage types between periods. Damage intensity was most often low (68 percent) or moderate (26 percent). The fact that most used flakes exhibited low or moderate damage intensity suggests that they were minimally curated and discarded with remnant use life. The evidence is circumstantial and more experiment is necessary, but the limited curation of used flakes at Mescal Wash could mean that used flakes were used to work materials such as meat or bone as opposed to wood or plant materials. In this sense, Mescal Wash used flakes could register the number of activities rather than the amount of material worked (e.g., Shott 2000).

Middle Formative A used flakes were typically larger in every dimension than Middle Formative B used flakes. Middle Formative A used flakes were elongated and relatively thick. Middle Formative B used flakes were typically as long as they were wide and relatively thin. This is interesting because, overall, Middle Formative A core flakes were typically shorter than Middle Formative B core flakes. The median length of Middle Formative A used flakes is approximately 3.25 times longer than the median length of Middle Formative A core flakes. The median length of Middle Formative B used flakes is 1.5 times longer than the median length of Middle Formative B core flakes. This suggests, in both periods, used flakes were larger than most flakes, but that abnormally large flakes were selected for use during Middle Formative A times.

Because of their larger size, Middle Formative A used flakes had longer used edges. When one large outlier is removed, Middle Formative A used flakes had used edges averaging 42.3 mm in length. Middle Formative B used flakes had used edges averaging 37.0 mm in length. When the length of used edges is considered in terms of the length of usable edge (calculated here as 100 × used length / [length + width + length]), Middle Formative flakes had more usable edge used but the difference between the two periods was minor. On average, around 25–28 percent of a usable edge was used.

At Mescal Wash, used flakes were employed for cutting, scraping, and grinding tasks. Used flakes may have been used differently in the two periods, but the sample size was small. During Middle Formative A times, flakes were used for a variety of tasks, most of which involved scraping. Middle Formative B flakes were more often used for cutting tasks. Four out of seven Middle Formative A used flakes were used for scraping. Three out of seven were used for cutting and two out of seven were used for grinding. Evidence of grinding was not observed on Middle Formative B flakes and evidence of scraping was observed less often. Evidence for cutting was more common on Middle Formative B used flakes. During the Middle Formative B period, two out of six used flakes were used for scraping and four out of six were used for cutting. Perhaps the unusually large size of Middle Formative A used flakes had to do with their use as handheld scrapers.

Most flakes were found in the fill of structures, but a substantial percentage (33.3 percent, n = 26) were discovered on floors or in hearths. Possibly, these latter flakes indicate their articulation with domestic activities performed in houses. Six of the 20 used flakes recorded in more detail were discovered in floor or hearth contexts. All of these had either bifacial- or unifacial-flaking dorsal edge damage, straight or wavy edges, and were used for low-intensity cutting or scraping activities.

The Kuhn (1994) model of flake tool design predicts that, in general, the longest flake tool should be no longer than twice the length of the smallest flake tool. Surovell (2003) tested the Kuhn model with data on 30 Folsom end scrapers from five sites in the Rocky Mountain region. Surovell's (2003) data did not support the Kuhn model in that the largest end scraper was 3.3 times the size of the smallest end scraper. Unfortunately, we cannot test the model using retouched flakes or unifaces at Mescal Wash as their lengths were not measured. We can, however, test the model on the 20 used flakes whose lengths were measured. The Mescal Wash data are consistent with Surovell's (2003) conclusions. Remarkably, the largest used flake was 3.4 times the size of the smallest used flake. Because most flakes were made expediently on local materials, it may be the case that mobility constraints were not at issue, allowing the size of used flakes to vary more freely.

Shott and Sillitoe (2005:654) observed that "archaeologists often equate use life and curation, on the logic that things that last long times are highly curated and things that are used and wear out or break quickly are little curated ("expedient" in common parlance)." Use life and curation, however, are independent variables that sometimes covary. Shott and Sillitoe (2005:654) "define curation as the relationship between realized and maximum utility." Tools that have high maximum utility and low realized utility are little curated, or expedient. Tools that have high realized utility are highly curated. According to Shott and Sillitoe's definition, a flake could be expedient or highly curated, depending on the degree to which its maximum utility has been attained.

Archaeologists seldom have the opportunity to witness stone tool use firsthand. For many stone tool users, flakes were probably the most abundant stone tool type. Flakes could have been used for a wide variety of activities. Though used flakes are "prosaic" and "mundane," Shott and Sillitoe (2005:653) argue that flakes can "directly record kinds and amounts of tool-using activity" because, in contrast to more complex stone tools, they are used briefly and discarded immediately. Many flakes at Mescal Wash were probably incorporated into secondary trash deposits and do not directly record precisely where they were used. They were likely used at the site, rather than at other sites, and they were likely discarded not long after use and may be more likely to be in coeval deposits.

Ethnographic observations suggest that flakes are used only briefly as tools. For the Wola tribe of New Guinea, flakes were typically used for around 10 minutes and all flakes were used for less than an hour. Hafted flakes could have been used for longer periods, but an insufficient number of hafted flake uses were observed to substantiate this possibility. An interesting result of Shott and Sillitoe's (2005) study is that use-life distributions varied according to activity. Flakes used on wood or plants were used longer than flakes used on meat or bone. At least among the Wola, this is because flakes used on meat or bone tend to complete cutting tasks before edges become unusable. Flakes used on wood or plant material, in contrast, tend to be discarded once they are all used up. Depending on use, numbers of used flakes correspond to fundamentally different entities—materials or activities. "In the Wola data, the number of flakes used on wood measures the *amount* of wood- and plant-working performed, while the number of flakes used on meat measures the *number* of episodes of use" (Shott and Sillitoe 2005:661). In prehistoric contexts, used flakes with remnant use life certainly could have been retrieved and reused later, but new flakes may have been just as likely to be used so long as raw material was available.

At Mescal Wash, only 81 of 3,853 examined flakes (2.10 percent) were identified as used from macroscopic evidence. Only 96 flakes were retouched (2.49 percent). Overall, the small number of used or retouched flakes implies that only around 1 out of every 21.8 flake removals (4.59 percent) was actually used as a tool. These numbers suggest that flakes were seldom selected for use. If the goal of flake removal was the production of expedient tools, one would expect that a large proportion of flakes would be used. Microscopic examination for use wear could yield more examples, but use-wear analysis is time-consuming and is not often considered a cost-effective approach for the study of large samples.

Retouched Flakes

A total of 97 retouched flakes was recorded (Table 82). Retouched flakes were discovered in a wide variety of contexts including a burial, a structure entry, an erosional depression, two pits, a recessed hearth, and multiple structures. Nearly half of the retouched flakes were in Middle Formative A deposits, which suggests the modification and resharpening of flakes was most prevalent during the Middle Formative period. On average, 3 out of 4 retouched flakes were made on metamorphic materials. The use of metamorphic materials in the production of retouched flakes appears most common during the Middle Formative B period. Small numbers of retouched flakes were made on other materials, including Whetstone chert, Sonoita chert, chert, jasper, chalcedony, limestone, agate, igneous materials, and obsidian. Some retouched flakes, particularly those made on Whetstone chert, Sonoita chert, and obsidian may have been brought into the site as finished tools, and these show particularly fine edge-modification (Figure 74). Most (around 87 percent) were discovered in either structures or multiple features that likely represent multiple intruding structures. Like used flakes and unifaces, a substantial percentage of retouched flakes (27.8 percent, n = 27) were discovered in either floor or hearth contexts. Most retouched flakes were unifacially retouched (72.2 percent, n = 70), but some were multifacially retouched (14.4 percent, n = 14), and a few were bifacially retouched (3.1 percent, n = 3). Around 10 percent were classified as unifaces.

Unifaces

A total of 20 unifaces was recorded (Table 83). All unifaces except 1 were complete. Like most flakes, retouched flakes, and used flakes, 17 unifaces were made on metamorphic materials. Two were made on igneous materials and 1 was made on chalcedony. The discovery context of unifaces was similar to the discovery context of used flakes. All but one of the unifaces were discovered in deposits associated with the Middle Formative period. Eight unifaces were associated with Middle Formative A deposits, 6 with Middle Formative B deposits. Most of the unifaces (n = 15) were discovered on or near the floor of a structure. Additionally, 3 were deposited in hearths within structures, and 1 was discovered in a structure entry This suggests that a substantial portion (perhaps one-third or more) were associated with use of the structures. A variety of activities involving unifaces or used flakes could have been performed within structures, including food preparation and the manufacture and maintenance of tools and clothing.

Table 82. Retouched Flakes by Reduction Type

General Period	Bifacial	Multifacial	Unifacial	Total
Undated	—	2	8	10
Late Archaic	—	—	2	2
Early/Middle Formative	—	1	2	3
Formative	—	—	2	2
Middle Formative	—	—	9	9
Middle Formative A	3	7	37	47
Middle Formative B	—	2	11	13
Late Formative B	—	2	4	6
TAQ[a]	—	—	4	4
TPQ[b]	—	—	1	1
Total	3	14	80	97

[a] TAQ = terminus ante quem.

[b] TPQ = terminus post quem.

Figure 74. Retouched flakes from Mescal Wash (catalog numbers appear below images): (*a*) obsidian, Feature 4729; (*b*) chert, Feature 4729; (*c*) Feature 6154, metamorphic. Lines indicate working edges.

Table 83. Unifaces by Period and Recovery Context

General Period	Entry	Hearth	Posthole	Recessed Hearth Area	Structure Floor/Floor Fill	Total
Middle Formative	—	1	—	—	4	5
Middle Formative A	—	—	—	—	8	8
Middle Formative B	1	1	—	1	3	6
Not determined	—	—	1	—	—	1
Total	1	2	1	1	15	20

Drills

A total of 44 drill specimens was discovered at Mescal Wash. Most drill specimens were bifacial (n = 32), but 12 specimens were made on flakes (Table 84). Three of the bifacial drills had flared bases (Figure 75). Drills were made on chalcedony, chert, metamorphic materials, agate, Whetstone chert, Sonoita chert, and obsidian, and one drill was made from a quartz crystal. Chalcedony was by far the most common material for drill manufacture. When calculated according to material type, the minimum number of drills (MND) was estimated to be 32. The drill TIE of 29 was somewhat smaller. By either estimate of tool abundance, around half of the drills were made on chalcedony and around one-fifth were made on chert. Despite the local availability of metamorphic materials, a fairly small percentage of drills (13.6 percent) were made on metamorphic materials.

The remarkable thing about drills at Mescal Wash is that they were associated primarily with the Middle Formative A period (see Table 84). Of the 31 drill specimens discovered in dated features, 19 were found in Middle Formative A features, 5 in features dated to the Middle Formative A or B periods, and 3 in features dated to the Middle Formative B period. These correspond to 14 Middle Formative A drill TIEs, 2 Middle Formative B drill TIEs, and 3 Middle Formative A or B drill TIEs. Drill specimens were not discovered in Late Archaic period contexts, 1 was discovered in an Early Formative context, and 3 (TIE = 2) were discovered in Late Formative B contexts. Two drills were also discovered in contexts postdating A.D. 500 and probably date to the Formative period. The number of drill specimens per feature declined predictably from Middle Formative A to Late Formative B times (drills/features = -0.0015 × end date + 3.1501, $r^2 = 0.9904$).

Most drill specimens made on chalcedony were discovered in Middle Formative A contexts (n = 12), but drills made on chalcedony were also found in features dating to other periods. In addition to Middle Formative A features, drill specimens made on chalcedony were discovered in features dating to the Middle Formative B period (n = 1), the Middle Formative A or B periods (n = 3), and Late Formative B period (n = 2). Both bifacial drills and drills made on flakes were discovered in Middle Formative A contexts. Sixty percent of drill specimens made on flakes were found in Middle Formative A features and 38 percent of bifacial drill specimens were found in Middle Formative A features. This distribution is not significant ($\chi = 0.625$; $df = 1$; $p \leq 1$) suggesting that how drills were made did not vary according to time.

Drills were likely used to work other materials. Specifically, drills were likely used to perforate or create voids in materials such as hide, shell, or ceramics. Drills could have been used to make a wide variety of items such as clothing, ornaments, or other gear. It is curious why drills appear to have been particularly important during the Middle Formative A and why a large proportion of them were made on chalcedony. If drills were used for such activities as making clothing, gear, or ornaments or to mend broken pots, it may be that the large number of Middle Formative period drills resulted from longer occupation duration. People stayed longer, so they may have had a greater need to restore or mend broken items as well as had more downtime for handiwork. An emphasis on chalcedony could indicate that this material was considered to be durable for the kinds of activities to which drills were put.

Projectile Points

A total of 181 projectile point specimens was analyzed and initially categorized by Bradley as either arrow points or dart points based on overall size (see Table 71). Bradley assigned more specific typologies for most projectile points, according to their style. Analysis of projectile point types indicated that many different types of projectile points from multiple periods were discovered at Mescal Wash. Projectile points discovered at Mescal Wash included styles associated with Late Archaic and Formative periods. Given the site's deep history and its geographic position between major valley systems at the juncture of multiple culture areas, the diversity of projectile point types is not surprising.

Projectile Point Styles

What may be surprising, however, is that despite the fact that at least 23 different projectile point types were recognized at Mescal Wash, 3 types dominated the collection (Table 85). Further, types such as Cienega that might be expected to be abundant because of the location and occupational history of Mescal Wash, were rare. The most abundant and ubiquitous point styles at Mescal Wash were San Pedro (between ca. 1200–800 B.C. and A.D. 300), Rincon (ca. A.D. 950–1150), and Hohokam Serrated (ca. A.D. 700–1150). Of the 181 projectile point specimens, 49 were classified as San Pedro (Figure 76), 29 were classified as Rincon (Figure 77), and 24 were classified as Hohokam Serrated (Figure 78). Thus, despite the fact that numerous

Table 84. Flaked Stone Drills by Design

General Period	Bifacial	Bifacial, Flared Base	Flake	Total
Undated	8	2	3	13
Early Formative	—	1	—	1
Middle Formative	4	—	1	5
Middle Formative A	12	—	7	19
Middle Formative B	3	—	—	3
Late Formative B	2	—	1	3
Total	29	3	12	44

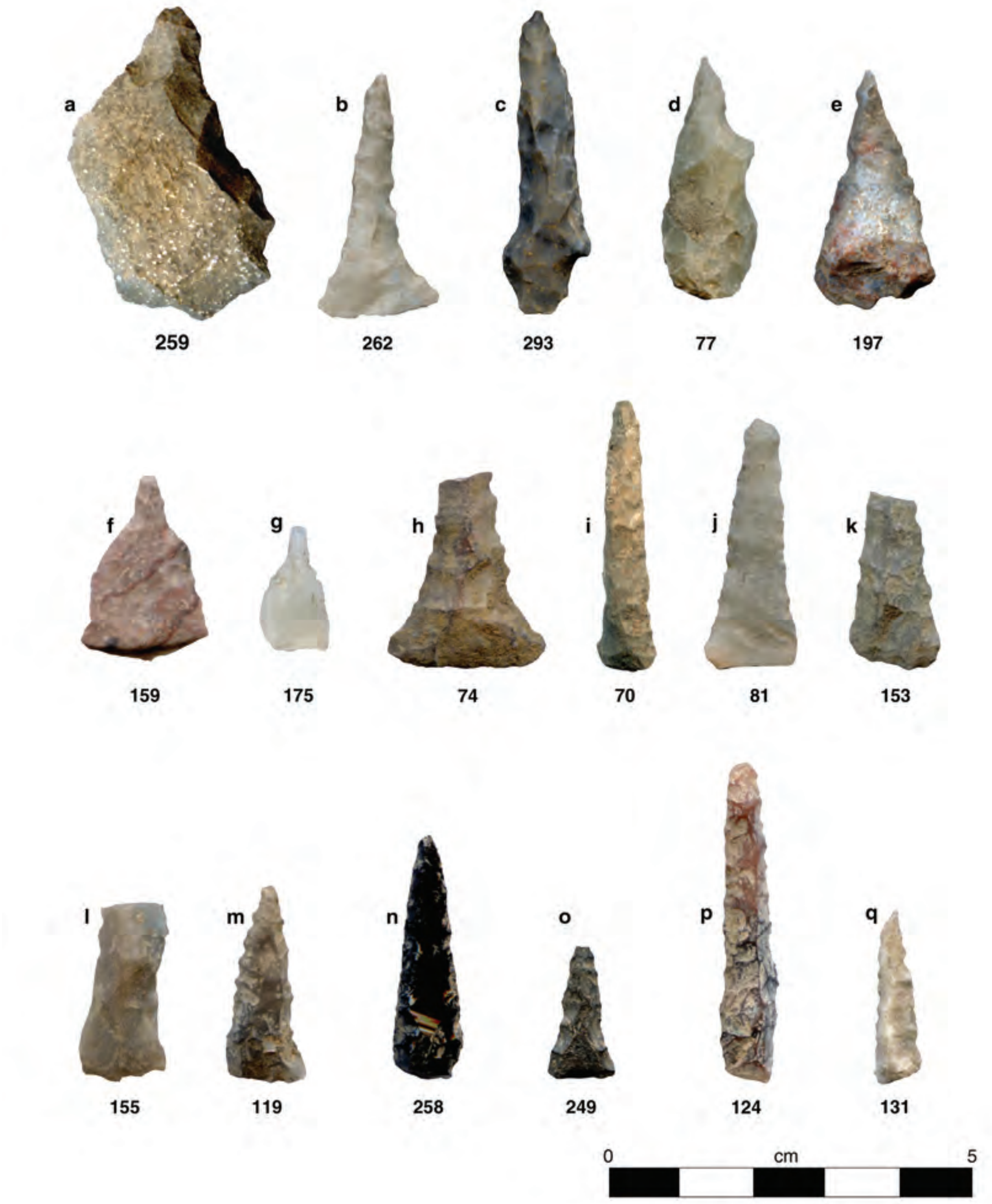


Figure 75. Drills from Mescal Wash (catalog numbers appear below images): (*a*-*c*) nonfeature contexts; (*d*) Feature 7942; (*e*) Feature 3617; (*f*) Feature 438; (*g*) Feature 3681; (*h*-*i*) Feature 7978; (*j*) Feature 4729; (*k*) Feature 7697; (*l*) Feature 3544; (*m*-*n*) Feature 379; (*o*) Feature 4912; (*p*) Feature 3879; (*q*) Feature 3679.

Table 85. Projectile Point Tool Information Equivalents (TIEs) by Material Type

Projectile Point Style	Agate		Chalcedony		Chert		Igneous		Jasper		Metamorphic		Obsidian		Quartz		Quartzite		Sonoita Chert		Whetstone Chert		Total	
	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE	n	TIE
Basketmaker III	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Cienega	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	2	2
Classic	—	—	—	—	—	—	—	—	—	—	—	—	2	1	—	—	—	—	—	—	—	—	2	1
Classic Concave Base	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	2
Classic Leaf-shaped	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Classic Side-notched	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	2
Classic Triangular	1	1	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	2	2
Corner-notched	—	—	—	—	2	1	—	—	—	—	—	—	—	—	—	—	—	—	2	1	2	1	6	3
Cortaro	—	—	—	—	—	—	—	—	—	—	2	1	—	—	—	—	—	—	2	1	—	—	4	2
Eared	—	—	—	—	2	1	—	—	—	—	2	1	—	—	—	—	—	—	1	1	—	—	5	3
Empire	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	2	1	1	1	4	3
Gypsum	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	2	2
Hohokam Serrated	2	1	5	4	4	3	—	—	1	1	1	1	1	1	—	—	—	—	3	2	7	6	24	19
Pinto	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	1	1
Pueblo III	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	1
Rillito	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	1	3	3
Rincon	2	1	4	3	2	1	—	—	—	—	1	1	—	—	—	—	—	—	2	1	18	15	29	22
Salado Side-notched	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	5	4	6	5
San Pedro	—	—	—	—	2	1	1	1	1	1	37	20	—	—	—	—	2	1	6	4	—	—	49	28
Sinagua Side-notched	—	—	—	—	—	—	—	—	—	—	—	—	3	2	—	—	—	—	—	—	—	—	3	2
Stem-expanding	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—			1	1
Stemmed-contracting	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1	1	1	1	3	3
Tanque Verde	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	1
Unknown	—	—	1	1	1	1	—	—	5	2	6	2	1	1	—	—	—	—	7	3	6	3	27	13
Total	6	4	13	11	17	12	2	2	7	4	50	27	9	7	1	1	2	1	28	17	46	37	181	123

Figure 76. Complete or partial San Pedro points from Mescal Wash (catalog numbers appear below images): (*a*) Feature 3976; (*b*) Feature 3008; (*c*) Feature 3677; (*d*) Feature 5505; (*e*) Feature 3983; (*f*) Feature 437; (*g*) Feature 6139; (*h*) Feature 6098; (*i*) nonfeature; (*j*) Feature 379; (*k*) Feature 784; (*l*) Feature 3582; (*m*) Feature 4768; (*n*) Feature 5809; (*o-p*) Feature 187; (*q*) Feature 3681; (*r*) Feature 4312; (*s*) nonfeature context; (*t*) Feature 3681; (*u*) nonfeature context; (*v*) Feature 3681; (*w*) Feature 10645; (*x*) Feature 4326; (*y*) Feature 3748; (*z*) Feature 4684; (*aa*) Feature 5505.

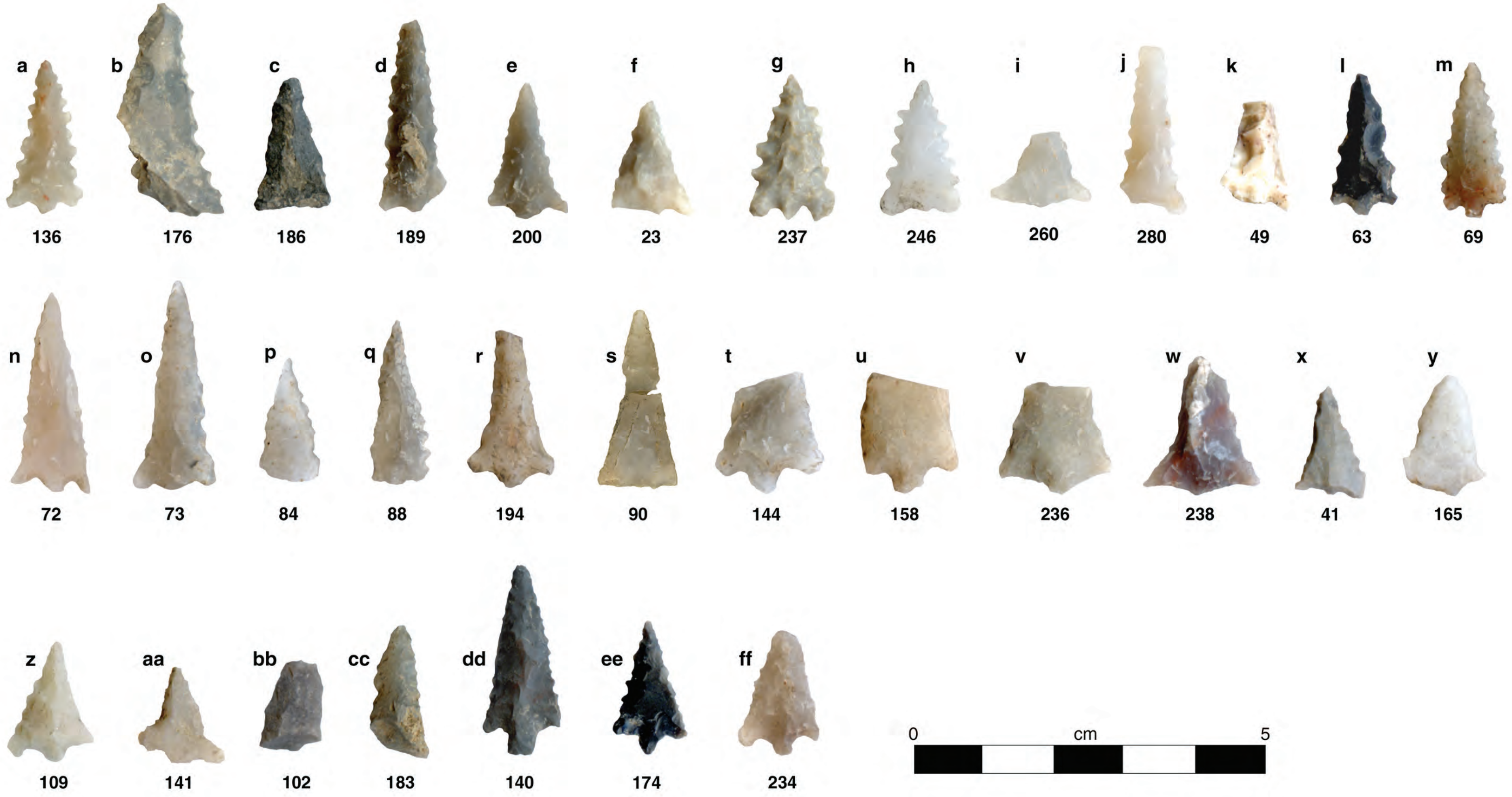


Figure 77. Rincon and Rillito projectile points from Mescal Wash (catalog numbers appear below images). Rincon points: (*a*) Feature 8655; (*b*) Feature 3870; (*c-d*) Feature 3545; (*e*) Feature 784; (*f*) Feature 825; (*g*) Feature 6148; (*h*) Feature 5612; (*i*) Feature 6146; (*j*) nonfeature context; (*k*) Feature 4684; (*l*) Feature 833; (*m*) Feature 8655; (*n*) Feature 7697; (*o*) Feature 7943; (*p-q*) Feature 3879; (*r*) Feature 3870; (*s*) eature 438; (*t*) Feature 3668; (*u*) Feature 438; (*v*) Feature 7697; (*w*) Feature 438; (*x*) Feature 3679; (*y*) Feature 4684; (*z*) Feature 10507; (*aa*) Feature 3670; (*bb*) Feature 438; (cc) Feature 7697. Rillito points: (*dd*) Feature 3670; (*ee*) Feature 3817; (*ff*) Feature 7697.

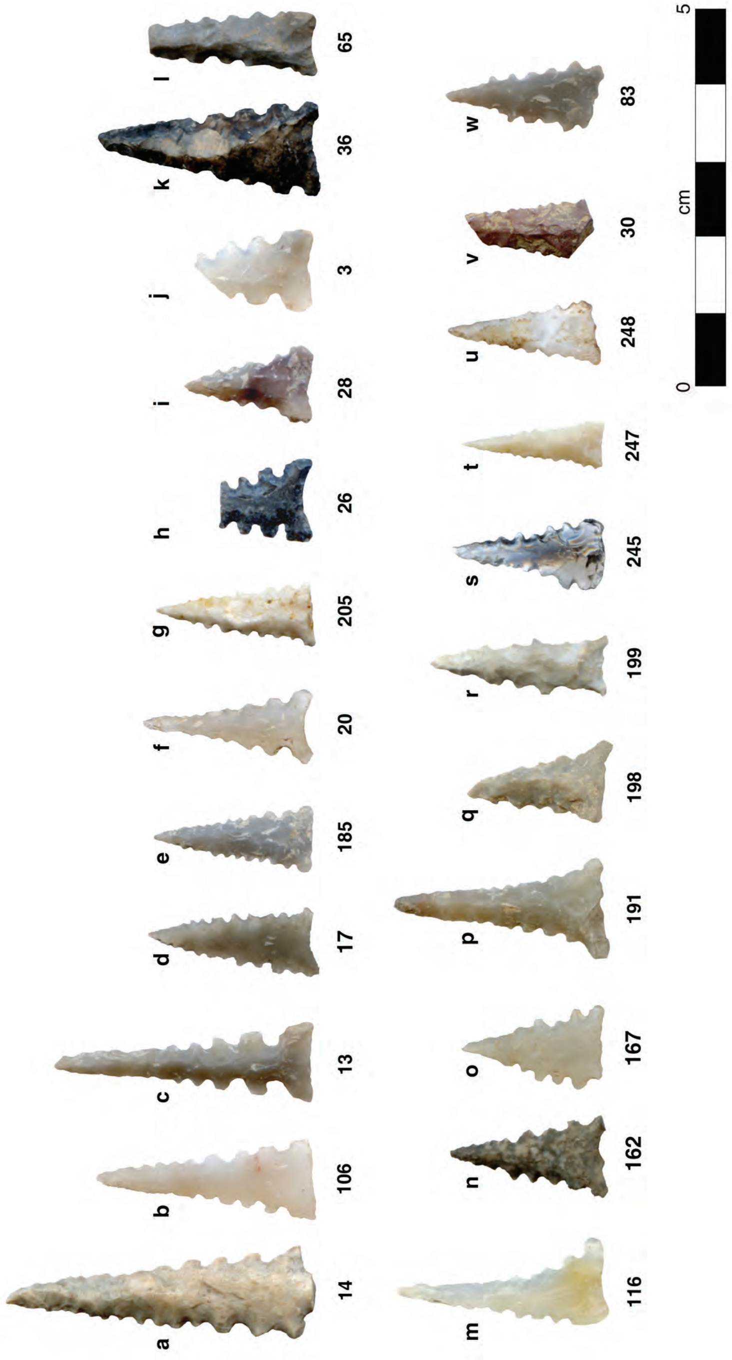


Figure 78. Hohokam Serrated projectile points from Mescal Wash (catalog numbers appear below images): (*a*) Feature 789; (*b–c*) Feature 10739; (*d*) Feature 825; (*e*) Feature 3617; (*f*) F3501; (*g*) Feature 4635; (*h*) Feature 3696; (*i*) Feature 3582; (*j*) Feature 2192; (*k*) Feature 2157; (*l*) Feature 3545; (*m*) Feature 2192; (*n*) Feature 438; (*o*) Feature 4684; (*p*) Feature 3557; (*q–r*) Feature 3617; (*s*) Feature 379; (*t*) Feature 5378; (*u*) Feature 4768; (*v*) Feature 3501; (*w*) Feature 3870.

projectile point styles were recognized at Mescal Wash, 102 specimens (56 percent) were one of the three styles. The remainder of point styles appeared in small numbers. These included a Basketmaker III (ca. A.D. 500–750), 2 Cienega (ca. 800 B.C.–A.D. 200), 9 Classic (ca. A.D. 1350–1450), 4 Cortaro (ca. 2000–300 B.C.), 4 Empire (ca. 1200–800 B.C.), 2 Gypsum (ca. 2000–800 B.C.), 1 Pinto (between ca. 6000–5000 and 3000 B.C.), 1 Pueblo III (A.D. 1150–1350), 3 of a type Bradley identified as Rillito (A.D. 700–950), 6 Salado Side-notched (A.D. 1150–1500), 3 Sinagua Side-notched (ca. A.D. 1150–1300), and 1 Tanque Verde (ca. A.D. 1150–1300). When the style of a projectile point specimen could not be clearly discerned, Bradley classified projectile point specimens according to their most salient morphological attributes, such as corner-notched (n = 5), eared (n = 6), stem-expanding (n = 1), or stem-contracting (n = 3). These attributes, although diagnostic of a particular point style, could occasionally be used to lump points with similar morphological attributes for analysis. Additionally, 27 projectile points, including 17 dart points and 10 arrow points, were of unknown types, some of which are illustrated in Figure 79.

Projectile points at Mescal Wash were made on nearly every material type recognized in the collection. Most projectile points, however, were made on two general material types, either metamorphic or cryptocrystalline (agate, chalcedony, chert, jasper, and obsidian) materials. The material types used for projectile points was also sensitive to time period. For instance, 54 percent of dart points were made on metamorphic materials, and 38 percent were made on cryptocrystalline material. On the other hand, 97 percent of arrow points were made on cryptocrystalline material, and only 2 percent were made on metamorphic materials. This suggests that Late Archaic period occupants of Mescal Wash used both types of material but placed an emphasis on the use of metamorphic materials in projectile point manufacture. Formative period occupants instead used cryptocrystalline materials far more than any other material. Reasons for this difference may relate to differences in technological organization or land-use strategies, such as Late Archaic groups producing most of their projectile points on-site. Formative period groups, on the other hand, likely imported their points as finished tools, perhaps for the functional advantages of different material types or because of changes in provisioning strategies.

Late Archaic Point Styles

A total of 61 projectile points at Mescal Wash (34 percent) can be attributed to the Late Archaic period (Figure 80, and see Figure 76). Despite proximity to Cienega Creek, where many Cienega points have been found during previous investigations (e.g., Huckell 1995), Late Archaic projectile points at Mescal Wash were dominated by San Pedro–style points. Dating between ca. 1200–800 B.C. and A.D. 300 (Justice 2002; Mabry 2005b; Sayles 1983:130), San Pedro projectile points were both ubiquitous and abundant at Mescal Wash. The small number of Cienega-style points and chronometric dates obtained from Late Archaic features at Mescal Wash suggest that occupation of the site during the Cienega phase (ca. 800 B.C.–A.D. 50) (Mabry 2005b) of the Late Archaic period may have been minimal or fleeting. Forty-nine San Pedro–style projectile point specimens were discovered in 28 features. Eight San Pedro–style projectile point specimens were discovered in nonfeature contexts. During his analysis, Bruce Bradley suspected that many bifaces and biface flakes at Mescal Wash were related to the manufacture of San Pedro projectile points, and many of the bifaces in the sample were typed as dart point blanks (see below). In contrast, only 2 projectile point specimens were classified as Cienega and only 4 were identified as Cortaro (Roth and Huckell 1992). Two Gypsum points (Harrington 1933) were also

Figure 79. Miscellaneous arrow point fragments from Mescal Wash (catalog numbers appear below images): (*a*) Feature 4729; (*b*) nonfeature context; (*c*) Feature 3679; (*d*) Feature 1575; (*e*) Feature 4684; (*f*) Feature 4326; (*g*) Feature 7697.

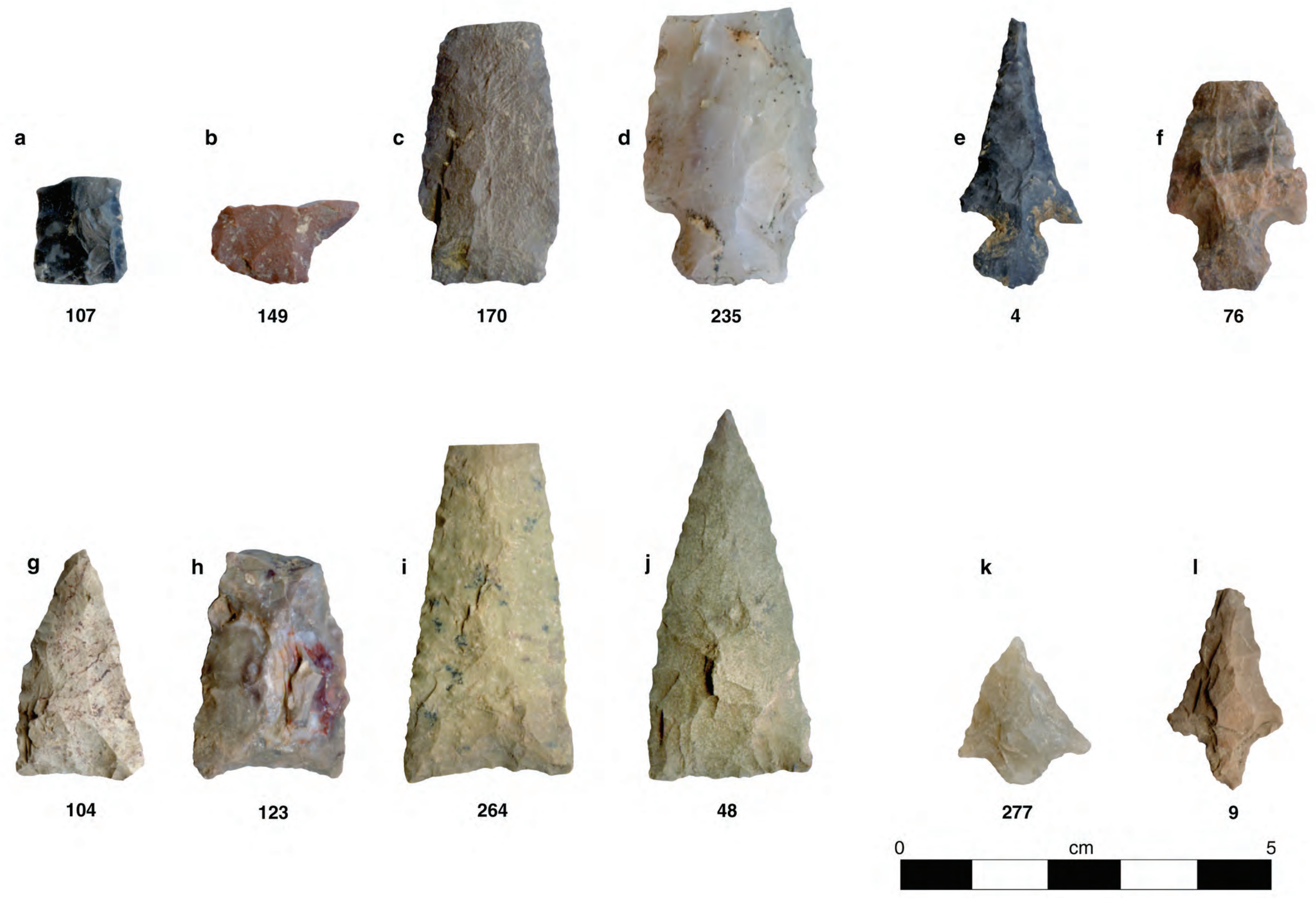


Figure 80. Late Archaic-style projectile points from Mescal Wash (catalog numbers appear below images). Empire points: (*a*) Feature 4684; (*b*) Feature 3582; (*c*) Feature 4684; (*d*) Feature 6171. Cienega points: (*e*) Feature 2192; (*f*) Feature 4684. Cortaro points: (*g*) Feature 3501; (*h*) Feature 3870; (*i*) nonfeature context; (*j*) Feature 784. Gypsum points: (*k*) nonfeature context; (*l*) Feature 5612.

recovered, 1 from a Middle Formative A context, and 1 from a nonfeature context. Empire projectile points have also recently been associated with the Late Archaic period (Stevens and Sliva 2002), and 4 of this style were found at Mescal Wash, although all in later contexts.

Formative Period Point Styles

A total of 74 projectile points (41 percent) could be assigned to the Formative period at Mescal Wash. Formative period styles included Rincon; Hohokam Serrated; Classic (including Classic Leaf-shaped, Classic Side-notched, Classic Triangular, and Classic Concave Base); Pueblo III; Rillito; Salado Side-notched; Sinagua Side-notched; and Tanque Verde. Additionally, a possible Basketmaker III point style, which corresponds to the Early Formative period, was recovered, but it was from a Late Formative B context.

The most abundant and ubiquitous of the Formative period point types was a type Bradley referred to as Rincon. Rincon points are small, unserrated to slightly serrated points with slightly incurvate-to-excurvate blades, slightly barbed or eared blade corners, and short contracting stems (see Figure 77a–cc). Twenty-nine Rincon-style projectile point specimens were discovered in deposits from 19 features. One Rincon-style projectile point specimen was found in a nonfeature context.

Points classed as Hohokam Serrated were also ubiquitous and abundant (see Figure 78). A total of 24 Hohokam Serrated projectile point specimens was discovered in 19 features. Many Hohokam Serrated points date to the Sacaton phase of the Hohokam, between ca. A.D. 950 and 1150, but some may date to the Santa Cruz phase, between A.D. 850 and 1000. Snaketown Triangular Concave Base and Snaketown Triangular Straight Base are Hohokam Serrated types dating to the Sacaton phase. Hodges Contracting-stem points are Hohokam Serrated points that may date to the earlier Santa Cruz phase (Hoffman 1997; Justice 2002:274–289). Some features with Hohokam Serrated points also contained Rincon points, suggesting that the two types may be roughly contemporaneous at Mescal Wash and that they may have been used by the same group or by coresiding groups that deposited trash in the same areas.

Both Rincon and Hohokam Serrated points are associated with the Middle Formative period. Hohokam Serrated–style points cross over the Middle Formative A and B boundary, and Rincon-style points are associated with the Middle Formative B period. Rillito points are associated with the Middle Formative A period and show similar characteristics to Rincon-style points (see Figure 77dd–ff), suggesting a possible stylistic continuity from the Middle Formative A to Middle Formative B periods. Late Formative–style points included several styles associated with the Late Formative A period, a time period poorly represented at Mescal Wash. Pueblo III, Salado Side-notched, Sinagua Side-notched, and Tanque Verde points were all associated with the Late Formative A period, or ca. A.D. 1150–1300. If Mescal Wash was unoccupied during that period, then these points may have been brought to the site during the Late Formative B period, or the site was lightly used during the Late Formative A period. The remainder of the Formative period point styles date to the Late Formative B (ca. A.D. 1300–1450) and included Classic, Classic Leaf-shaped, Classic Side-notched, Classic Triangular, and Classic Concave Base styles (Figure 81).

Other Point Styles

Eighteen projectile points were not associated with the Late Archaic or Formative period, or were not associated with a particular style. A Pinto-style projectile point was identified by Bradley, which was recovered from the first level of a test pit (TP 972) in Locus E (Figure 82a). Pinto-style points are associated with the Middle Archaic period and represent a wide-ranging and stylistically variable type (Justice 2002:138).

Projectile points classified only by their morphological attributes included six corner-notched, five eared, one stem-expanding, and three stem-contracting dart points (see Figure 82). The five eared projectile points (see Figure 82j–n) may represent San Jose, Pinto, or Ventana Side-notched types, indicative of the Middle Archaic period, but significant overlap between these point styles (Justice 2002:137–138) makes identification difficult. The three stem-contracting points were similarly difficult to identify as a specific type. One of the specimens (see Figure 82i) may represent a Jay or Lake Mojave– style point. Jay or Lake Mojave points were originally identified around the margins of the Pleistocene Lake Mojave (Campbell et al. 1937), and they are believed to date between ca. 9000–6000 B.C., thus crossing over the Paleoindian–Early Archaic time periods (Holmer 1986:95; Justice 2002:97–107). Another stem-contracting point (see Figure 82g) may represent a Maljamar-style projectile point. Maljamar points are associated with the Late Archaic period, but they are generally restricted geographically to southern New Mexico (Justice 2002:182–186), although a few of this style were recovered from Ventana Cave (Haury 1950:267, Figure 53). The corner-notched and stem-expanding projectile points are also indicative of Archaic-style points, but they were not assigned to a particular style.

Estimating Numbers of Once-Complete Projectile Points

TIEs were calculated for projectile points according to style and material type (see Table 85). TIE estimates suggest that the 181 analyzed projectile point specimens correspond to approximately 123 once-complete tools. TIEs suggest that the 49 San Pedro point specimens correspond to approximately 28 San Pedro points. Most San Pedro points were made on metamorphic materials. The remainder were made on Sonoita chert, chert, jasper, igneous material, and quartzite.

The 29 Rincon point specimens correspond to approximately 22 tools. Most of these, were made on Whetstone chert. The remainder were made on chalcedony, chert, Sonoita chert, and agate. The 24 Hohokam Serrated specimens correspond to approximately 19 tools. In comparison to Rincon and San Pedro points, Hohokam Serrated points were made on more diverse materials. Hohokam Serrated points were made on Whetstone chert, chalcedony, Sonoita chert, chert, agate, metamorphic material, and obsidian. Hohokam Serrated points were made on many of the same materials as Rincon points, with the largest number being made on Whetstone chert for both point styles, but Whetstone chert appears to have been more heavily emphasized in the manufacture of Rincon points in comparison to Hohokam Serrated points. It is interesting that several of both projectile point styles were made on chalcedony, given that most drills at Mescal Wash were made on chalcedony and date to the same time period.

When divided by n, TIEs can provide an estimation of the degree to which projectile points have been fragmented. TIEs indicate that, of the three of the most common projectile point styles, San Pedro points were the most fragmented, and Hohokam Serrated and Rincon types were both fragmented to lower and similar degrees.

When all types are considered, n is a fair predictor of TIE (Figure 83). Thus, for this particular context at least, ratios of different projectile point types may be reasonably accurate whether calculated using TIEs or counts of projectile point specimens, but it should be noted that differences in the degree of fragmentation influence projectile point counts among point styles and, in this context, specimen count may considerably overestimate systemic tool count. When all types are considered, projectile point specimen counts could overestimate systemic tool counts by as much as 50–75 percent.

Discovery Context of Points, According to Style

One way to check for potential mixing of deposits is to track how many projectile points associated with particular periods were found in deposits associated with different periods (Figure 84). In other words, what percentage of Late Archaic points were found in Late Archaic period deposits? What percentage of Late Archaic–style points are found in later deposits? In the following analysis, we calculated

Figure 81. Miscellaneous Formative period arrow points from Mescal Wash (catalog numbers appear below images). Possible Basketmaker III point: (*a*) Feature 4684. Salado Side-notched points: (*b*) Feature 3748; (*c*) Feature 1575; (*d-g*) Feature 4684. Sinagua Side-notched points: (*h*) nonfeature context; (*i*) Feature 1575; (*j*) Feature 4684. Tanque Verde point: (*k*) Feature 4683. Classic point: (*l*) Feature 4684. Classic Side-notched points: (*m*) Feature 784; (*n*) Feature 379. Classic Triangular points: (*o*) Feature 4684; (*p*) Feature 1573. Classic leaf-shaped point: (*q*) Feature 3617. Classic Concave Base points: (*r*) nonfeature context; (*s*) Feature 4684.

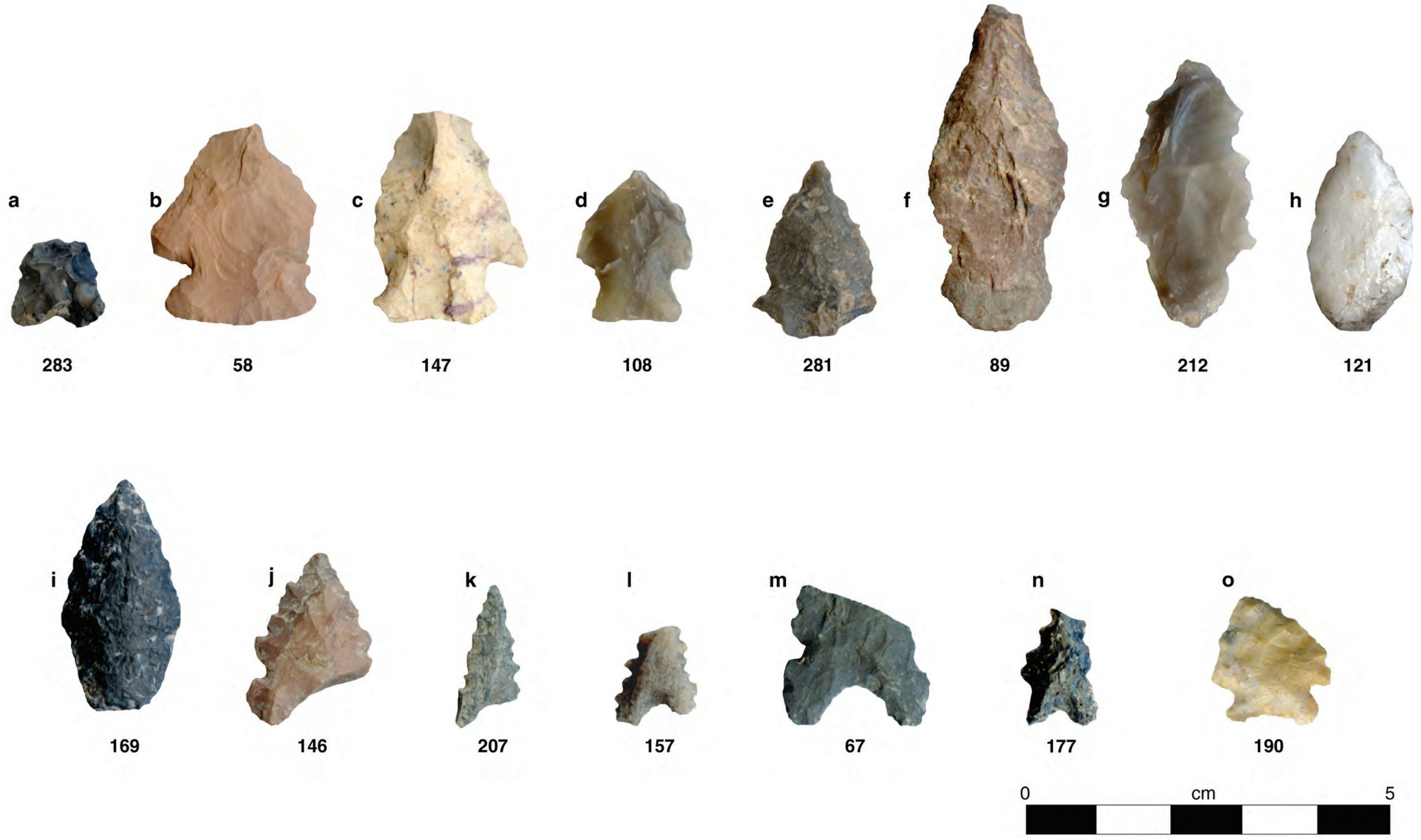


Figure 82. Miscellaneous dart points from Mescal Wash (catalog numbers appear below images). Pinto point: (*a*) nonfeature context. Corner-notched points: (*b*) Feature 1815; (*c*) Feature 3748; (*d*) Feature 4683; (*e*) nonfeature context. Stem-expanding point: (*f*) Feature 379. Stem-Contracting points: (*g*) Feature 3870; (*h*) Feature 5612; (*i*) Feature 3879. Eared points: (*j*) Feature 4684; (*k*) Feature 3679; (*l*) Feature 438; (*m*) Feature 11342; (*n*) Feature 3545. Unknown (possible eared) point: (*o*) Feature 3582.

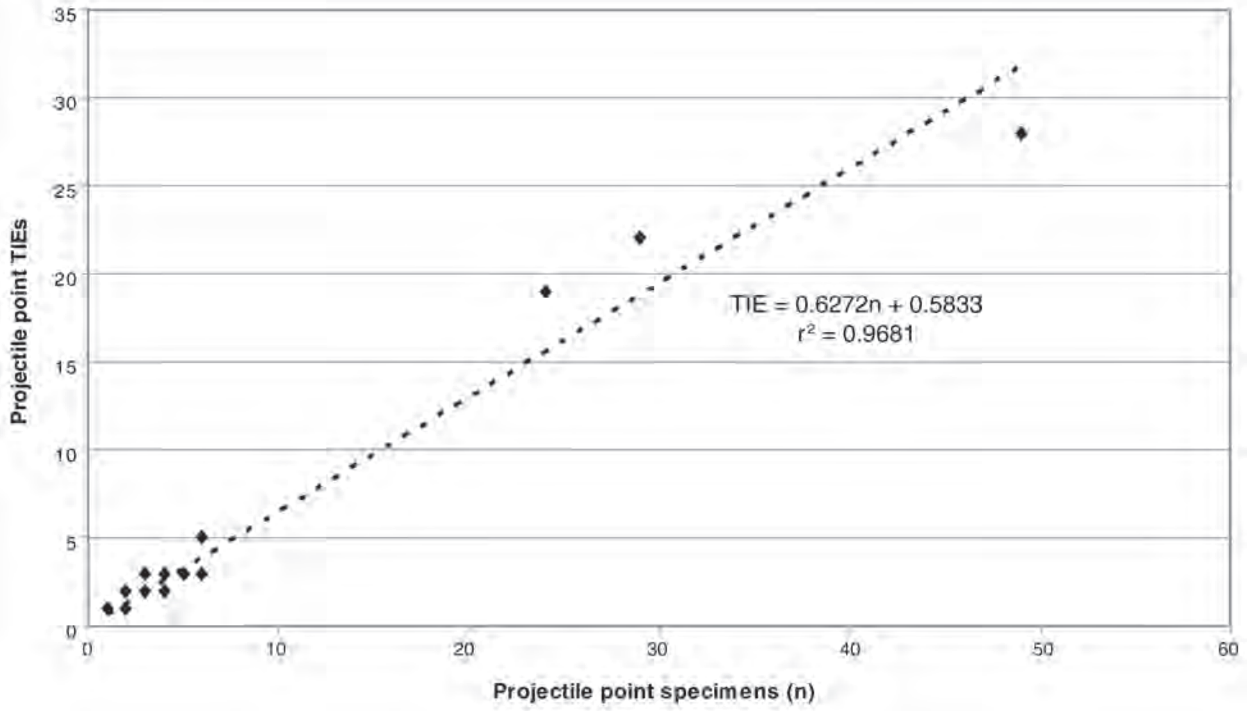


Figure 83. Projectile point tool information equivalents (TIEs).

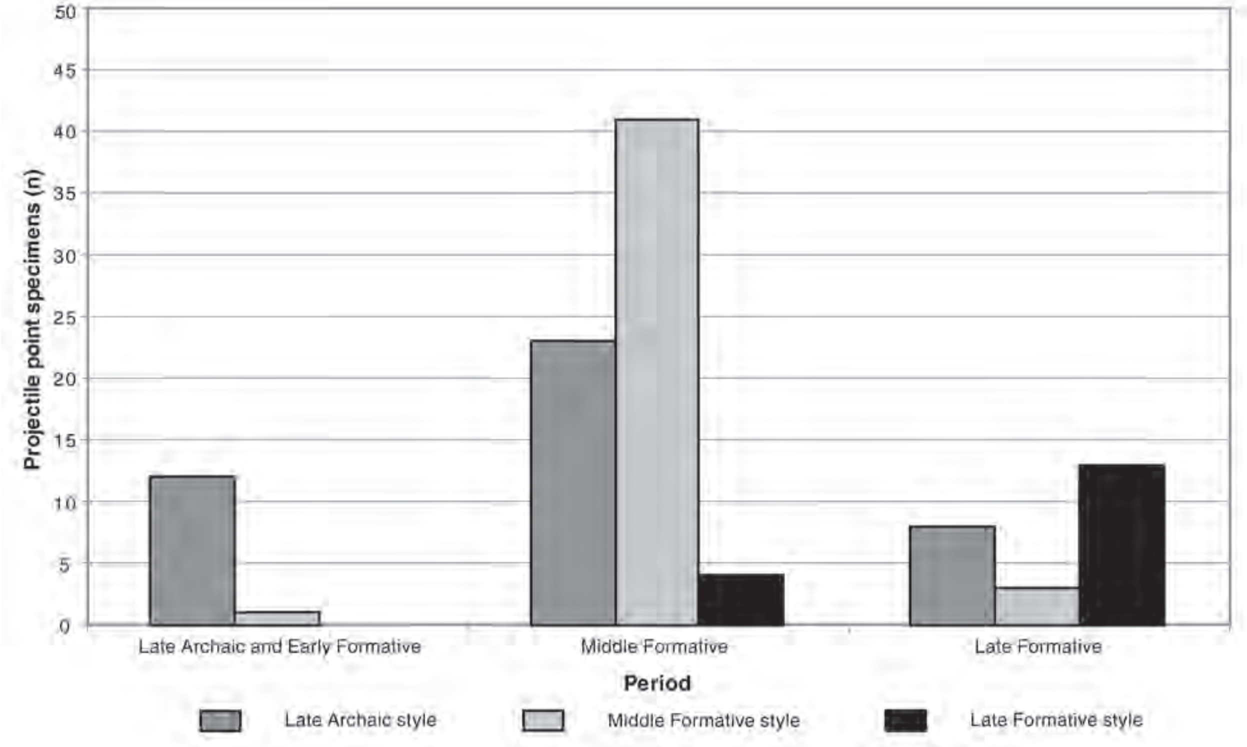


Figure 84. The recovery location of Late Archaic, Middle Formative, and Late Formative projectile point styles.

specimen counts of projectile point styles affiliated with the Late Archaic or Early Formative, the Middle Formative, and the Late Formative periods. We then tracked how many of each group were found in deposits dated to the Late Archaic and Early Formative, Middle Formative, and Late Formative B periods. In this section, we lump projectile point styles and contexts into one of three periods because some projectile point styles may date to both the Middle Formative A and B periods and some styles associated with the Late Archaic may have persisted into the Early Formative period. Points in deposits lacking dates or with ambiguous dates were excluded from analysis.

We can derive a series of expectations about the contexts in which we expect to find specific projectile point types. If mixing or reuse did not occur, we expect that Late Archaic–style and Early Formative–style projectile points should be found in the fill of Late Archaic and Early Formative features, Middle Formative projectile points should be found in the fill of Middle Formative features, and Late Formative projectile points should be found in the fill of Late Formative features. If earlier styles are found in later deposits, it implies the collection and reuse of earlier projectile points by later occupants or the disturbance of earlier deposits by later activities. The discovery of later styles in presumably earlier deposits implies that later projectile points were incorporated into earlier deposits through postabandonment disturbance or that some features remained open to deposition in later periods.

Most projectile point specimens associated with the Middle Formative period (91 percent, n = 41) were found in the fill of features dating to the Middle Formative. No Middle Formative projectile point types were found in earlier features and only 6 percent (n = 3) were found in later features. This indicates that Middle Formative artifacts were rarely introduced into earlier deposits and a few were introduced into later deposits. Perhaps, either Middle Formative points were collected by later occupants or some mixing occurred.

Most Late Formative projectile points (76 percent, n = 13) were discovered in the fill of features dating to the Late Formative period. Four were discovered in features dating to the Middle Formative. This indicates that most Late Formative points were incorporated into Late Formative deposits, but that some were introduced to earlier deposits. Possibly, some Middle Formative features were open to deposition during the Late Formative or were disturbed during or after the Late Formative occupation. Late Formative occupants either could have deposited some of their trash in Middle Formative features, or postabandonment processes could have resulted in some mixing of deposits. Two of the four Late Formative points found in Middle Formative feature deposits, however, were fairly tentative classifications. In addition, one of these was from a structure (Feature 1575) abandoned fairly late in the sequence, between A.D. 1010 and 1140. Given a late date for abandonment, this feature could conceivably have been open to deposition during the Late Formative period. One Salado Side-notched point was found in the fill of a structure (Feature 3748) dated between A.D. 785 and 950. Feature 3748 was dated using artifactual materials, stratigraphic associations, and the dates of stratigraphically related features and was not directly dated chronometrically.

A variety of formation processes, including disturbance during feature construction or after abandonment, could account for these few chronological anomalies. In any case, the discovery contexts of projectile points suggest that deposits inferred to date to one of the three general time periods defined above mostly date to the periods during which features were constructed and abandoned, but that some mixing had occurred.

Discovery Context of Late Archaic Points

Nearly three-quarters of Late Archaic–style points were found in the fill of features dating to the Middle Formative or Late Formative period (see Figure 84). Finer analysis reveals that nearly 40 percent of Late Archaic–style points were found in Middle Formative A deposits. The tendency for Late Archaic style projectile points to be found in Formative period structures is often recognized in the Hohokam region. During the Formative period, Late Archaic–style projectile points may have been collected as curios, used in ceremonial contexts, recycled into usable tools, or introduced to later deposits through disturbance processes. Reclamation of archaeological materials, however, may have been selective and restricted to certain artifact categories with intrinsic technological or symbolic values, such as projectile points. The discovery of early projectile points in later contexts implies some mixing, but if mixing was the result of artifacts reentering systemic context and not disturbance, then mixing may be biased towards reusable or symbolically potent tools, such as projectile points. Debitage could also be mixed, but possibly to a lesser degree.

At some Hohokam sites, anomalously early projectile points have been found in subfeatures, such as postholes, possibly indicating their involvement in the dedication of a house. Late Archaic–style dart points could also have been reclaimed from archaeological contexts and recycled into usable tools, such as drills or arrow points. Just as pragmatically, large dart points could have been used as chinking in the support of architectural posts or accidentally released from subsurface contexts during house construction. However, only 1 Late Archaic–style point was found in a posthole, 1 was found in a recessed hearth, and 1 was found in a floor groove. Thirty-eight were discovered in structures and 22 were found in pits.

Does the presence of Late Archaic–style points in Middle Formative contexts indicate mixing of deposits or preferential selection of Late Archaic–style projectile points for other uses? Because of their potential utility, Late Archaic–style projectile points may have retained some value and could have been reincorporated into systemic context by Middle Formative inhabitants of Mescal Wash. As such, they may have been more likely than other Late Archaic materials to be reincorporated into later contexts. No Middle Formative or later point styles were recovered from features dating to the Late Archaic or Early Formative periods, suggesting that flaked stone artifacts from these earlier contexts could be purely pre-Middle Formative in age. Flaked stone artifacts from Late Archaic and Early Formative contexts were more likely to have been incorporated into Middle Formative contexts, but much of this reincorporation may have been restricted to reusable tools or large nuclei, such as projectile points or still-usable cores.

Projectile Point Size

The absolute size of projectile points can be used to assess projectile point function and life history. Dart points, for instance, may be distinguished from arrow points based on size, as well as other dimensions (Bradley 2002a; Shott 1993; Thomas 1978). Along with other variables, size can be an indicator of weapons systems technology, time, and even ethnicity. At Grasshopper Pueblo, for instance, evidence from projectile points suggested that both bow-and-arrow and dart-and-atlatl weapon systems were used at the same time by different coresiding groups. Projectile point evidence supported the notion that populations affiliated with different weapon and hunting systems coresided there (Reid and Whittlesey 1999; Whittaker 1984).

Depending on the systems with which they articulate, projectile points are also limited in terms of their maximum size. Dart points may tend to be heavier and larger overall than bow-and-arrow points because of the requirements of different delivery systems. One variable that is likely important to the functional performance of projectiles is weight. If projectiles points used to tip arrows are too heavy, for instance, they will compromise the ability of an arrow to reach its target. Moreover, control of a projectile is probably best achieved when the weights of projectiles are relatively standardized. Weight was recorded for projectile point specimens, but using a fairly coarse measure. Because of the sensitivity of the measurement device, all Hohokam-Serrated and Rincon points were recorded as weighing 1 gram. Weights of complete San Pedro points were more variable, weighing between 5 and 10 grams.

In addition to length, width, and thickness, Bradley also estimated the portion of a point that was missing. Using the estimated percent missing, we can develop a crude estimate of the original length of projectile points prior to breakage. This gives us a sense of how long some projectile points may have been prior to being broken and also allows us to assess how size may have factored into discard patterns. Understandably, Hohokam-Serrated and Rincon arrow points were considerably shorter than San Pedro dart points. On average, Hohokam Serrated and Rincon arrow points were of similar sizes, with Rincon points being slightly more variable in size as well as slightly thicker and wider at the base (Table 86). Unpaired *t*-tests reveal that the difference in length between Hohokam Serrated and Rincon points was not significant ($t = 0.515$, $df = 50$, $p = .608$), but differences in width ($t = -3.102$, $df = 50$, $p = .003$) and thickness ($t = -2.178$, $df = 50$, $p = .034$) were significant. San Pedro dart points were over 3 times longer on average, and ca. twice as wide and somewhat less than twice as thick.

In order to overcome problems in the measurement of weight, an alternative measure of overall size was developed combining length, width, and thickness into a single, one-dimensional metric. Because of how it is calculated, we refer to this experimental measure of overall size as cube size. Cube size was calculated by taking the cube root of the product of maximum length, width, and thickness for each projectile point. Taking the cube root collapses some variation and probably makes size distributions appear more regular than examination of individual dimensions would suggest. This measure shows that the Rincon points were larger overall than Hohokam Serrated points, at least at the 10 percent confidence level ($t = -1.785$, $df = 50$, $p = .080$), and that, obviously, these Middle Formative points were in an entirely distinct size class compared to the much larger San Pedro points (Figure 85). Although the combined distribution of Hohokam Serrated and Rincon points appears visually to be more modal and normally distributed than the distribution of San Pedro point cube size, the cube size of Hohokam Serrated and Rincon points has a higher coefficient of variation (18.6 percent and 15.6 percent, respectively) than San Pedro points (11.9 percent). In terms of overall size, San Pedro points at Mescal Wash were more standardized than Hohokam Serrated and Rincon points.

Table 86. Dimensions of Select Projectile Point Styles from Mescal Wash

Dimension	Hohokam Serrated	Rincon	San Pedro
Estimated length (mm)	23.8 ± 2.9	22.9 ± 2.4	69.8 ± 8.2
Width (mm)	10 ± 0.7	11.7 ± .8	20.6 ± 1.1
Thickness (mm)	3.3 ± 0.4	3.8 ± 0.3	6.3 ± .4
Cube size (mm^3)	9.1 ± 0.7	9.9 ± 0.6	20.3 ± 0.7

Bifaces

The Mescal Wash sample contained 45 bifaces (Table 87). Most bifaces (n = 20) were basal sections, with 2 midsections and 4 tips; the rest could not be identified in terms of these designations. Nine of the bifaces were considered complete, 6 were considered incomplete, and 30 were fragmented. Of the total, 28 were classified by Bradley as projectile point blanks, 1 was classified as a knife, and the remainder (n = 16) could not be specified. Four of the projectile point blanks were classified as arrow point blanks, and 22 were classified as dart point blanks (Figure 86). As mentioned above, Bradley suspected that many of these dart point blanks were related to the production of San Pedro points at Mescal Wash. As with the provenience of Late Archaic projectile points, dart point blanks were

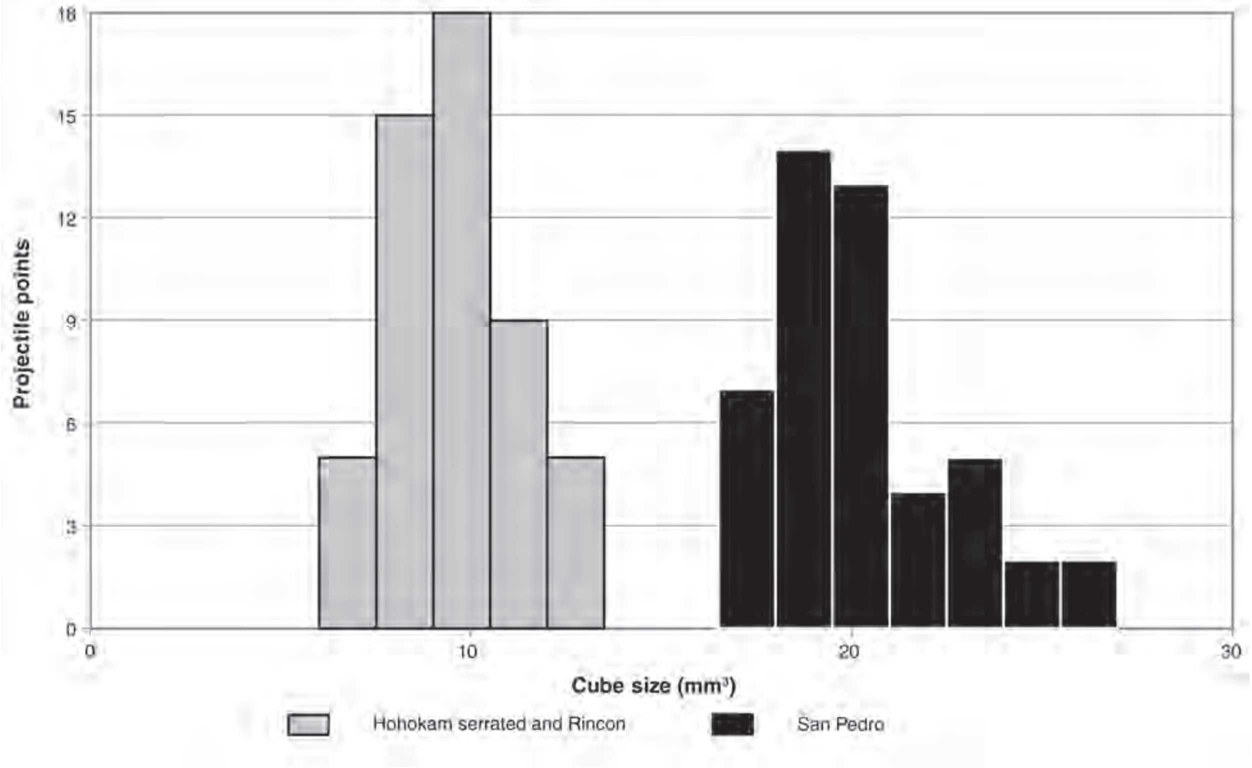


Figure 85. The dimensions (cube size) of San Pedro and Hohokam Serrated projectile points.

Table 87. Bifaces by Blank Type at Mescal Wash

General Period	Arrow Point Blank	Dart Point Blank	Projectile Point Blank	Knife	Untyped	Total
Late Archaic	—	—	—	—	1	1
Early Formative	—	1	—	—	2	3
Early/Middle Formative	—	—	—	—	1	1
Middle Formative	—	4	—	—	4	8
Middle Formative A	2	3	—	—	4	9
Late Formative B	1	2	—	1	2	6
Not determined	1	10	2	—	1	14
TAQ[a] only	—	—	—	—	1	1
TPQ[b] only	—	2	—	—	—	2
Total	4	22	2	1	16	45

[a] TAQ = terminus ante quem.

[b] TPQ = terminus post quem.

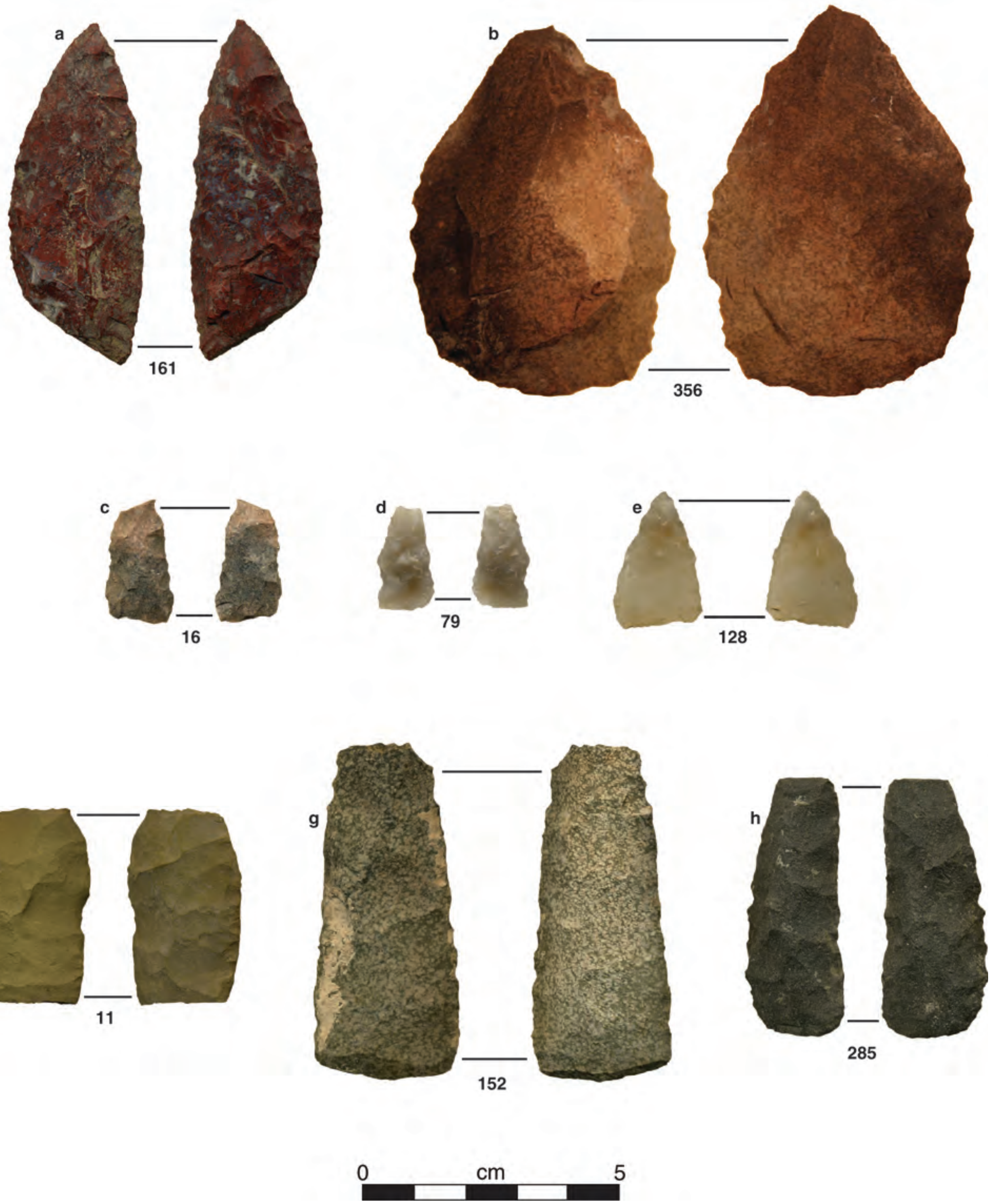


Figure 86. Bifaces from Mescal Wash (catalog numbers appear below images): (*a*) bifacial knife, Feature 4684; (*b*) biface blank, Feature 3943; (*c*) arrow point blank, Feature 825; (*d*) arrow point blank, Feature 3879; (*e*) arrow point blank, Feature 4684; (*f*) dart point blank, Feature 7697; (*g*) dart point blank, Feature 3878; (*h*) dart point blank, nonfeature context.

not associated with Late Archaic period deposits, rather they were recovered in Early, Middle, and Late Formative period deposits. Ten of the dart point blanks were associated with Formative period deposits, including 1 in an Early Formative context, 4 from Middle Formative, 3 from Middle Formative A contexts, and 2 in Late Formative B contexts. Ten dart point blanks were not associated with a dated context. Although the sample of dart point blanks was small, the above contextual information indicates that there was not a direct correlation between the style of biface blanks and dated contexts at Mescal Wash. This situation was likely the result of postdepositional mixing, or Formative period groups intentionally reusing earlier dart point blanks. Arrow point blanks were associated with Middle Formative A contexts (n = 2), and Late Formative B contexts (n = 1). The bifacial knife was associated with a Late Formative B context. One unspecified biface was associated with the Late Archaic period. Fourteen bifaces were not associated with a dated context. Most bifaces were made on metamorphic materials (n = 26), and 10 made on chert, 5 on chalcedony, 3 on agate, and 1 on igneous.

Other Tool Types

In the sample analyzed by Bradley, several types of flaked stone tools were classified based on their general attributes rather than classified by their apparent function. This typological approach actually aids in our understanding of these few tool types at Mescal Wash. For example, instead of classifying the three chopping tools specifically as choppers, Bradley identified them as a core/chopper, a flaked cobble chopper, and a utilized flake chopper (Table 88). Because of this typological approach, we were able to investigate the category of chopping tool in more detail. Rather than having three generic choppers, we could define each based on its specific form and method of manufacture. This method of classification was also used for a single scraper (utilized flake scraper) and a denticulate (flaked cobble denticulate). Additionally, five tools were classified as *pièces esquillées*.

Choppers

Only three choppers were in the sample (see Table 88). The three choppers were classified as a core/chopper, a flaked cobble chopper, and a utilized flake chopper. The core/chopper can be associated with the general lithic reduction on the site, however, this particular item was also likely used to process some other plant or animal material. The flaked cobble chopper, on the other hand, can be associated with more expedient flake reduction, and may have been purposefully designed for a specific resource-processing task. The utilized flake chopper was made on a large flake and had a bifacially flaked edge with evidence of battering (Figure 87). The core/chopper and the flaked cobble chopper were both from Middle Formative B contexts, and the utilized flake chopper was from a Late Formative B context. All choppers were made on metamorphic materials.

Scraper

Similar to the utilized flake chopper, Bradley also identified one utilized flake scraper (see Table 88). This represents the only scraper in the sample. The utilized flake

Table 88. Miscellaneous Flaked Stone Tool Types from Mescal Wash, by Recovery Context

Flaked Stone Tool Type by Period	Entry	Floor Groove	Recessed Hearth Area	Structure	Total
Middle Formative					
Pièce esquillée	—	—	—	1	1
Middle Formative A					
Pièce esquillée	—	1	—	3	4
Middle Formative B					
Core/chopper	1	—	—	—	1
Flaked cobble (chopper)	—	—	1	—	1
Flaked cobble (denticulate)	—	—	—	1	1
Late Formative B					
Utilized flake (chopper)	—	—	—	1	1
Utilized flake (scraper)	—	—	—	1	1
Total	1	1	1	7	10

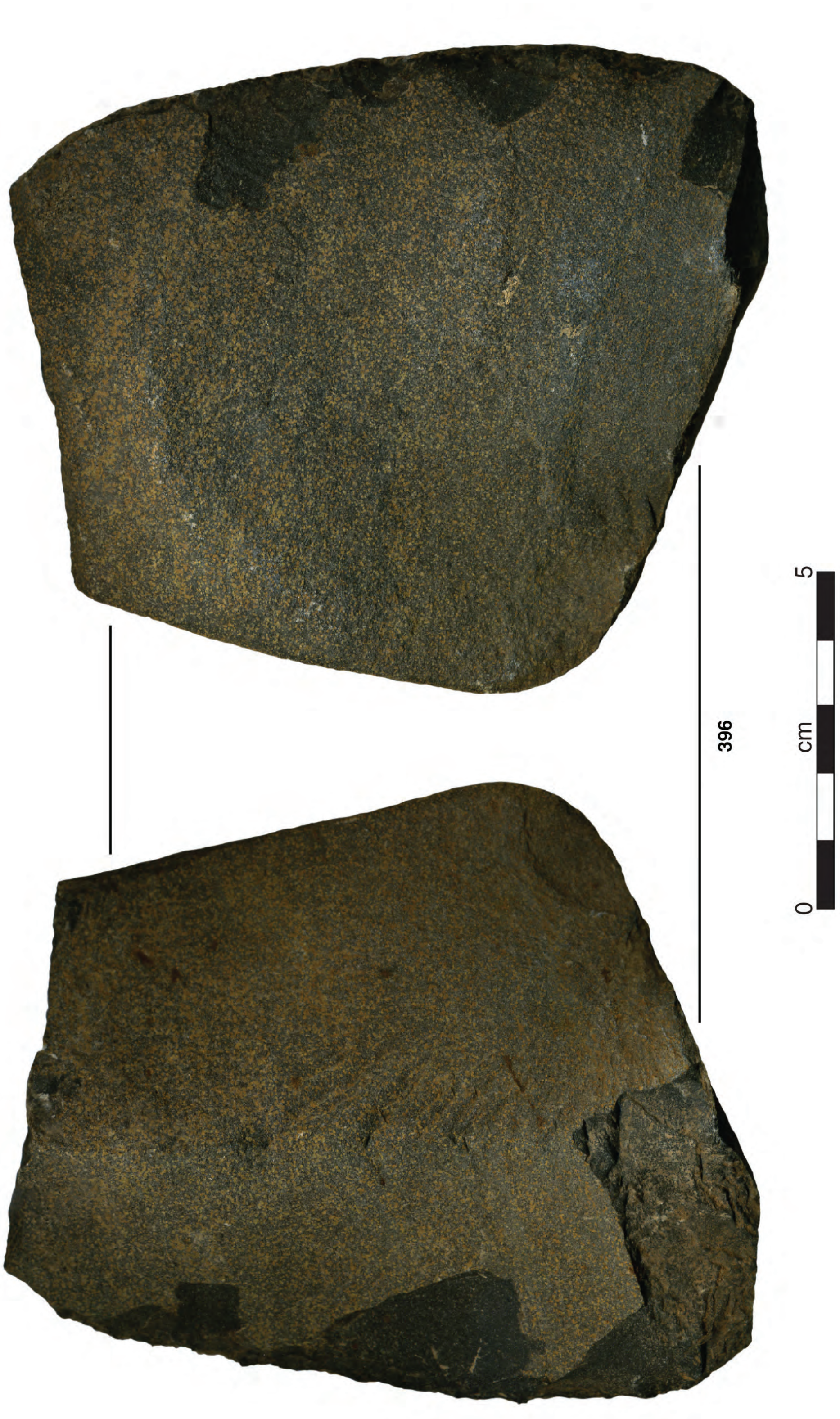


Figure 87. Utilized flake chopper from Mescal Wash, Feature 3681 (catalog number appears below image).

scraper was further classified as unifacially flaked, made on metamorphic material, and was discovered in a Late Formative B context. This tool type is indicative of expedient resource processing, and was likely used on plant or animal material.

Denticulate

Similar to the flaked cobble chopper, Bradley identified one flaked cobble denticulate (see Table 88). This tool is defined by a unifacially flaked cobble with a denticulated or serrated edge (Figure 88). The denticulate was in a Middle Formative B structure, and it was made on metamorphic material. Flaked stone tools with a denticulated or serrated edge are attributed to activities requiring a sawing motion, such as processing plant material (Kooyman 2000:103).

Pièces Esquillées

Five *pièces esquillées* were in the analyzed sample (see Table 88). *Pièces esquillées* are believed to function as wedges, used to split wood or bone. Wedges can be made from a triangular flake or core fragment and usually exhibit battering on one or both ends, which often resemble bipolar flakes (Huckell 1998:97; Kooyman 2000:104; LeBlanc 1992). The five wedges were all from Middle Formative or Middle Formative A contexts and were made on chalcedony (n = 4) and agate (n = 1). An unusually large number of wedges was recovered by Huckell (1995:56) from the Donaldson site, located in Matty Wash about 15 km south of Mescal Wash. Despite the fact that the Mescal Wash wedges were from a later period (i.e., Middle Formative A) than those from the Donaldson site (i.e., Late Archaic), the wedges from the Donaldson site show several similarities to those from Mescal Wash. For example, the wedges from the Donaldson site averaged 15–30 mm in length, resembled small biface fragments, and were almost all made on cryptocrystalline materials.

Raw-Material Preference

Raw-material use is often framed in terms of availability, preference, and performance characteristics. Lithic analysts refer to differential use of raw materials in the context of raw-material preference, as if one material was considered better than another for a specific task or a specific tool type. Paleoindians, for instance, appear to have depended on the use of high-quality materials from distant sources. Although empirical measures of raw-material quality have yet to be developed (but see Callahan 1979 and Whittaker 1994), a variety of coarse measures, such as estimations of homogeneity and grain size (Brantingham 2003) have been used to organize raw materials according to quality.

Controlled flake removal is contingent upon raw-material quality. Theoretically, by allowing better control over artifact manufacture, higher-quality materials are more easily conserved than lower-quality materials and may be more reliable in situations where local raw materials are unavailable. High-quality raw materials, however, are not available at all times and places. Depending on the region, lower-quality materials may be more abundant. In cases where the availability of higher-quality raw materials is spatially or temporally heterogeneous and lower-quality materials are more readily available, higher-quality materials will cost more energy and time than lower-quality materials cost to obtain.

Recently, Brantingham (2003) built a neutral model of raw-material procurement. Based on a limited number of conservative assumptions, Brantingham showed that archaeologically observed patterns of lithic raw-material use can be generated from simple random walk procedures. Thus, it is quite possible that the distribution of raw materials at individual sites could reflect a random selection of available raw materials. For instance, a higher percentage of San Pedro projectile points made on metamorphic materials could correspond to greater emphasis on on-site projectile point manufacture, rather than a technological preference for the material. The results of Brantingham's modeling efforts should be kept in mind when considering the distribution of raw-material types in analyzed collections.

Parry and Kelly (1987; see also Kelly 1988) argued that fine-grained, higher-quality materials are preferred for the production of formal tools and standardized cores. More heterogeneous, lower-quality materials were often used in the production of expedient flakes. Essentially, they argue that raw-material use is a function of raw-material availability. Thus, there is a general prediction in the Parry and Kelly (1987) model that raw-material quality should decrease as emphasis on expedient technology increases.

A variety of different raw materials was used at Mescal Wash. In order of decreasing abundance, these were metamorphic materials, chert, chalcedony, igneous materials, Sonoita chert, agate, jasper, Whetstone chert, limestone, sandstone, siltstone, unidentified materials, obsidian, quartz, and quartz crystal. Artifacts made on metamorphic materials were by far the most abundant, constituting around 75 percent of all artifacts. Flakes, tools, and cores made on metamorphic materials were common in all time periods. Flakes made on metamorphic materials were 8.25 times more abundant than the next most abundant material type, chert. Yet, metamorphic materials were not the most common materials for every tool type. Less than half of all bifaces were made on metamorphic materials (14 of 31) and less than a third of projectile point specimens were made on metamorphic materials (51 of 183). Calculating TIEs

Figure 88. Flaked cobble denticulate from Mescal Wash, Feature 6129 (catalog number appears below image).

for projectile points according to a matrix of material type and point types yields a smaller but similar proportion of projectile points made on metamorphic materials (27 of 123) or around 22 percent. Metamorphic materials, however, may have been the most locally abundant materials, and they may have been used most often in on-site manufacture, resulting in a lower ratio of tools to flaking debris. By contrast, raw materials that were brought into the site as finished tools, such as those made on obsidian, would obviously tend to be represented mostly as tools in the collection and would constitute a smaller percentage of all flaked stone artifacts in the collection. In other words, the disparity between the smaller percentage of tools made on metamorphic materials and the larger percentage of flaking debris and cores made on metamorphic materials may not be a result of raw-material preference, but represent stage of manufacture and local availability.

Temporal Variation in the Use of Whetstone and Sonoita Cherts

In the course of his analysis, Bradley identified two distinct varieties of chert: Sonoita chert and Whetstone chert. Surprisingly, these two materials appeared only occasionally as flakes, cores, or informal tools, and appeared much more frequently as projectile points. The implication is that these materials were obtained from nonlocal sources and were brought into the site as finished tools. Unless available sources of Sonoita chert were used up (which is unlikely because the material is available to this day) and Whetstone chert sources went largely undiscovered until the Middle Formative, it appears that differential use of these materials may signal differential use of landscapes. This trend of lithic-resource procurement and socioeconomic organization has been recognized elsewhere (Hayden et al. 1996). Late Archaic groups using Mescal Wash may have used areas to the southwest more frequently and later Formative populations may have used areas to the east and southeast more frequently. Another possibility is that the raw-material nodules of Whetstone chert were smaller on average than those of Sonoita chert and were thus unsuitable for the manufacture of large projectile points, or dart points.

Sonoita chert was used in projectile point manufacture most often during the Late Archaic period. Fewer points of Sonoita chert were made during the Middle Formative period and none were made on Sonoita chert during the Late Formative period. In contrast, use of Whetstone chert in projectile point manufacture was associated with later periods at Mescal Wash (Figure 89). Around 7 percent of Late Archaic points were made on Sonoita chert and only around 2 percent of Middle Formative points were made on Sonoita chert. Use of Whetstone chert increased from around 2 percent of points during the Late Archaic to 31.5 percent of points during the Formative. Interestingly, flakes only partially mirror this trend. Between 16 and 21 percent of flakes were made on Sonoita chert during the Late Archaic and Early Formative periods, respectively, and Sonoita chert flakes were rare to absent during the Middle and Late Formative periods. Flakes made on Whetstone chert were never common, despite the prevalence of Middle and Late Formative points made on Whetstone chert. Cores, retouched flakes, and used flakes were made on Whetstone chert, but were found only in small numbers. Possibly, projectile points made on Whetstone chert were rarely made or resharpened at Mescal Wash. Given the small size of projectiles made on Whetstone chert, it may be the case that small resharpening flakes evaded discovery. Projectiles made on Sonoita chert were likely made off-site as well but resharpened on-site.

The implication is that bifaces made on Sonoita chert were typically produced off-site, probably closer to source areas of Sonoita chert. Sonoita chert bifaces may have been further reduced at Mescal Wash. Almost all (55 out of 59) used flakes were made on metamorphic materials, suggesting that bifaces made on Sonoita or Whetstone chert were not often used as cores. Instead, they were likely in the form of projectile points. Most flakes made on Sonoita chert (48 percent) were bifacial flakes. Cores of Sonoita chert may have been transported to the site, however, as a substantial percentage of Sonoita chert flakes were core flakes (41 percent) or unifacial retouch flakes (11 percent). Another possibility is that both projectile points and flakes made on Sonoita chert were brought into the site as finished tools. In comparison, most flakes made on Whetstone chert were core flakes (68 percent) and fewer were bifacial (20 percent). A similar percentage of flakes made on Whetstone chert were unifacial retouch flakes (12 percent). Given the small size of projectile points made on Whetstone chert, it is possible that bifacial flakes made on Whetstone chert were typically small and passed through hardware cloth when screened.

Flake platforms made on Sonoita chert were more carefully prepared than flake platforms made on Whetstone chert. For Sonoita chert flakes, 42 percent had faceted platforms, 36 percent had reduced platforms, and 12 percent had ground platforms. In contrast, 24 percent of flakes made on Whetstone chert had faceted platforms, 12 percent had reduced platforms, and none had ground platforms. Aside from occasional resharpening of points made on Whetstone chert, most Whetstone chert flakes were the result of casual flake removals from cores or the resharpening of unifaces.

In summary, neither Whetstone chert nor Sonoita chert projectiles were made on-site. Projectile points of both materials were likely transported to the site in finished form, where they were sometimes used, resharpened, or discarded. New projectile points were made on local materials.

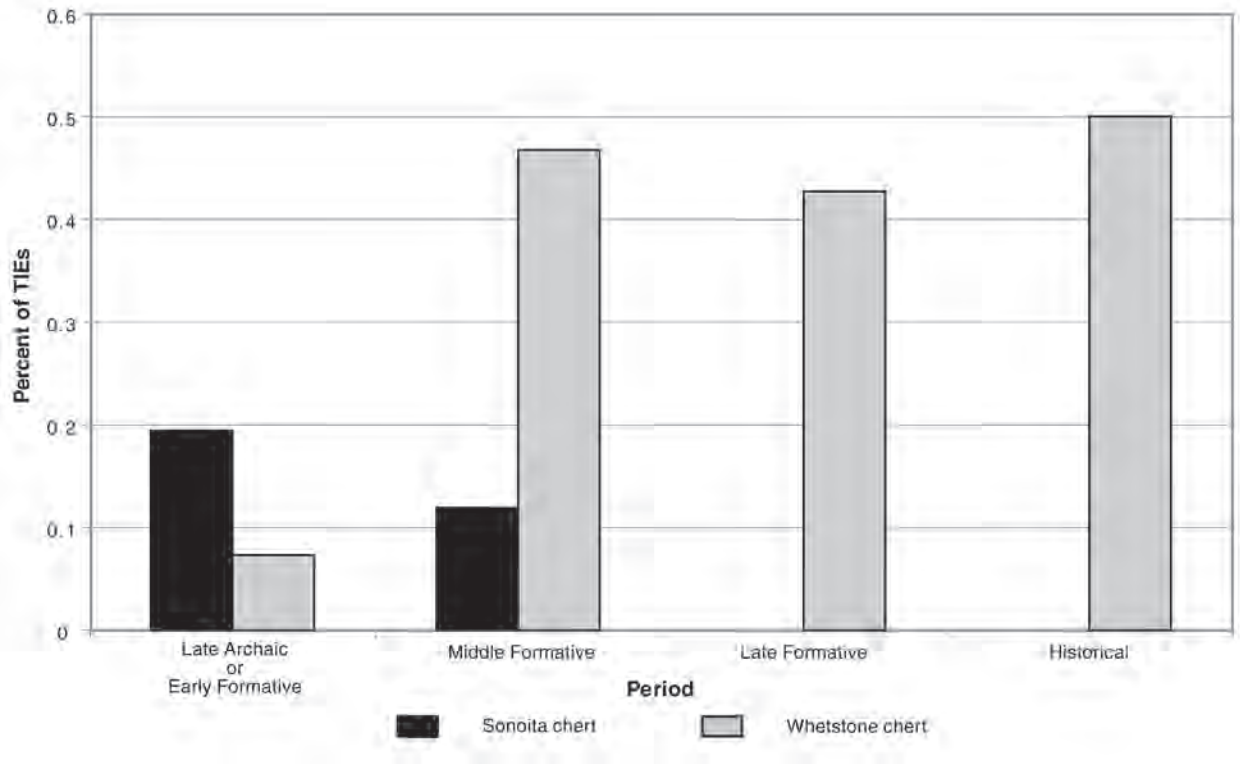


Figure 89. The percentage of projectile point TIEs made on Sonoita or Whetstone chert, by period.

Core vs. Biface Technologies Revisited

One of the bigger challenges in understanding the relationship between the abundance of archaeological materials and behavior is in calculating occupation duration and using that information to calculate the discard rate of different artifact classes. Because we rarely can measure precisely how long an individual or group stayed at a site or performed a certain activity, archaeologists often have to make fairly crude estimates of occupation duration based on ethnographic analogy or guesswork. Surovell (2003, 2009), however, has made some methodological advances in estimating relative occupation duration by calculating ratios of specific kinds of flaked stone artifacts argued to correlate with change in occupation duration, under the assumption that as people stay longer at sites they (1) manufacture and use more informal tools, and (2) they use more local, as opposed to nonlocal, raw materials. Of course, there are a variety of ways these basic assumptions can be violated, but Surovell's method at least allows us to evaluate in a relative sense what flaked stone artifacts can tell us about how long people may have stayed at a site. Below, we apply Surovell's measures of occupation duration to Mescal Wash and use them to estimate how long people may have stayed at Mescal Wash during different periods and to estimate the discard rate of key tools associated with bifacial technology, such as projectile points.

Surovell's Mobility Index (M)

One proxy measure for occupation duration is Surovell's (2003) mobility index (M). Surovell's M is composed of two ratios, local:nonlocal raw materials and debitage:nonlocal tools. Surovell calculates his mobility index by summing the two ratios and dividing by 2. Surovell (2003:144, italics original) argues that his M can be used as a relative "measure of mean *per capita* occupation span." The larger the index, the longer the occupation span. Surovell specifies that the measure is *per capita* because both population size and occupation span contribute to artifact accumulation. Surovell (2003) cogently argues that his M is related to the duration of occupation per capita. Exactly how it is related, however, is unknown. Conceivably, M could be proportional to duration of occupation per capita, but the relationship between duration of occupation per capita and M could be more complex. For instance, duration of occupation per person could equal a proportionality constant multiplied by the logarithm of M.

Surovell's measure works quite well for Folsom sites and is a keystone in his argument that the Barger Gulch Folsom locality in Middle Park, Colorado, represented a relatively long-term occupation by Paleoindian standards, perhaps on the scale of months rather than days or weeks. Applying the index to sites associated with foraging and farming subsistence strategies in southeastern Arizona is potentially problematic in that there may be a number of processes, such as cleaning activities and technological change, that violate some of Surovell's assumptions. Surovell was dealing only with Folsom sites which presumably resulted from similar behaviors over relatively brief spans of time and by occupations consisting of similarly sized groups.

Nevertheless, it is instructive to apply Surovell's M to the Mescal Wash case in order to see how it conforms to our expectations of change in occupation duration over time. Below, we calculate Surovell's M for different periods at Mescal Wash. We calculated the index as follows. One of the biggest assumptions we made was that metamorphic materials were local and all other lithic materials were nonlocal. Of course, a variety of nonmetamorphic materials probably were local, but it seems to be a reasonable assumption in this particular case as almost all retouched flakes, used flakes, unifaces, and most cores were made on metamorphic materials. We summed all tools and flakes of local or nonlocal material types in order to create the local:nonlocal ratio. In order to create the debitage:nonlocal tools ratio, we summed all flakes and debris, regardless of material type and divided that number by the number of nonlocal (i.e., nonmetamorphic) tools.

Calculating the M in this way produces understandable results for most periods but an extraordinarily high M for the Late Archaic. Most other aspects of the Late Archaic assemblage also indicate higher residential mobility than in other periods, but recalling that many Late Archaic–style projectile points were found in later contexts, we recalculated the M by removing all Late Archaic–style points in later contexts, and adding them to the Late Archaic totals as appropriate. This method produces more internally understandable results, but results that do not conform to the expectations of another index Surovell concluded was related to occupation duration, his core-reduction index (see below). According to the M, occupation duration per capita climbed steadily into the Middle Formative A period, but it began to decline thereafter. The M declined precipitously in the Late Formative, suggesting oddly that Late Formative occupations were actually of shorter duration than Late Archaic occupations (Figure 90 and Table 89).

The application of Surovell's M to Mescal Wash sheds light on how Mescal Wash may have been used over time. Surovell's M suggests that early users of Mescal Wash stayed there for relatively short periods of time. As expected, early users of Mescal Wash appear to have been more residentially mobile than later users. Occupation duration per capita increased through Middle Formative A times, suggesting that Middle Formative A people stayed for the longest periods of time. After Middle Formative A, Surovell's M declined. At this time, occupation duration may have decreased. According to Surovell's M, Late Formative period users stayed there for the shortest period of time.

The short occupation duration per capita implied by Surovell's M for Middle Formative B and Late Formative B use of Mescal Wash may not relate directly to residential mobility or occupation duration, however. Instead, it could have to do with changes in the organization of lithic technology. Perhaps, after Middle Formative A, flaked stone tools were increasingly manufactured by specialists and imported into the site through exchange. As a result of craft specialization and exchange, more nonlocal tools could have been discarded at the site not so much because people occupied the site for shorter periods but because many of the stone tools they used and discarded were manufactured by specialists who resided elsewhere.

Heuristically, we can convert M into number of days per person by assuming that M is proportional to duration. Although this is merely a thought experiment, we can use this assumption to devise possible scenarios for the occupation of Mescal Wash. For instance, if Late Archaic and Early Formative period peoples stayed at Mescal Wash for around 1 month, Middle Formative period peoples stayed at Mescal Wash for around 3 months, and Late Formative people stayed there for around a week. Regardless of absolute occupation durations, Surovell's M suggests that Middle Formative users were the least residentially mobile users of the site and Late Formative users of the site were the most residentially mobile users of the site. According to Surovell's M, Late Formative occupants of Mescal Wash stayed at Mescal Wash for shorter periods than even Late Archaic or Early Formative users of the site (see Table 89).

Short Late Formative occupation duration per capita is at odds with the apparently high technological investment in Late Formative architecture. A possible explanation for this disparity, however, is that large numbers of people occupied these structures for short periods of time or that they were repeatedly visited by the same people for short periods. A high technological investment in architecture could have been intended to limit the risk of losing tools, equipment, or foodstuffs stored in temporarily unoccupied structures at Mescal Wash or to ensure that structures remained intact despite frequent absence from Mescal Wash.

Other than the small sample size for Lat Formative contexts, another possible explanation for this unexpectedly low value for Surovell's M for the Late Formative period has less to do with occupation duration and more to do with Late Formative technological organization. Possibly, Late Formative users of the site did very little flaked-stone reduction themselves and imported flaked-stone tools into the site through exchange. The prevalence of nonlocal obsidian artifacts during the Late Formative may provide

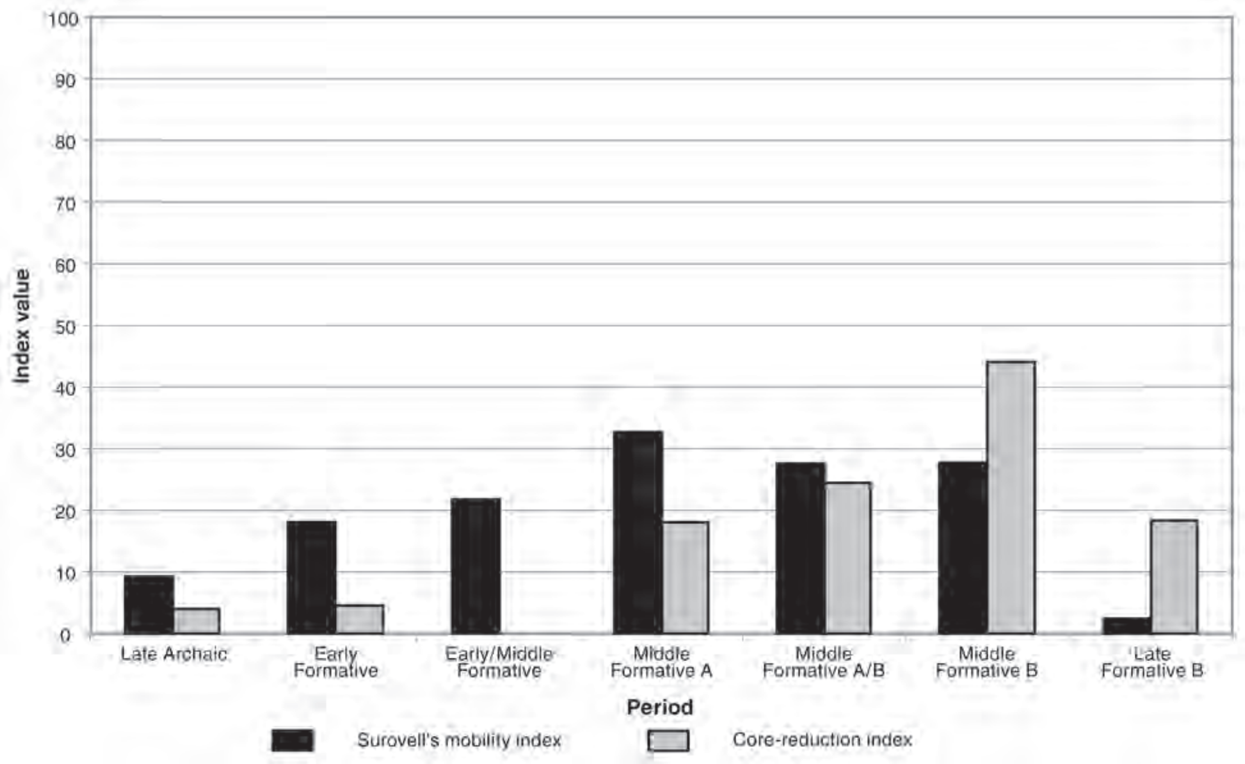


Figure 90. Surovell's mobility index (M) and the ratio of bifacial-thinning flakes to core-reduction flakes, by period.

Table 89. Surovell's Mobility Index (M) and Core-Reduction Index

General Period	LM[a]	NM[b]	LM/NM[ab]	D[c]	LT[d]	NT[e]	D/NT[ce]	M[f]	CRF[g]	BTF[h]	CRF/BTF[i]
Late Archaic	186	82	2.27	403	33	25	16.12	9.19	63	16	3.94
Early Formative	57	21	2.71	134	24	4	33.50	18.11	22.5	5	4.50
Early /Middle Formative	50	29	1.72	168	34	4	42.00	21.86	2	—	—
Middle Formative A	1,426	517	2.76	4,330	155	69	62.75	32.76	1,050.5	58	18.11
Middle Formative A/B	712	243	2.93	1,991	91	38	52.39	27.66	587.5	24	24.48
Middle Formative B	406	107	3.79	932	84	18	51.78	27.79	353.5	8	44.19
Late Formative B	74	58	1.28	125	56	36	3.47	2.37	55	3	18.33

[a] LM = Flaked stone artifact made on local material.
[b] NM = Flaked stone artifact made on nonlocal material.
[c] D = Debitage (including debris, i.e., all flakes plus all debris).
[d] LT = Flaked stone tool made on local material.
[e] NT = Flaked stone tool made on nonlocal material.
[f] M = Surovell's M ([LM/NM + D/NT]/2).
[g] CRF = Core-reduction flakes (including disk core flakes).
[h] BTF = Bifacial-thinning flakes.
[i] CRF = Core-reduction index.

some support for this hypothesis. On the other hand, the presence of both bifacial flakes and core flakes in Late Formative contexts, unless they were redeposited from earlier contexts, suggests that flaked stone reduction did occur at Mescal Wash during the Late Formative. Still another possible explanation for the exceptionally low Late Formative M is that flaked stone reduction was performed off-site or in restricted areas that were not excavated.

If, however, Surovell's M is related more to changes in occupation duration per capita rather than changes in technological organization, change in the index could signal change in landscape use and settlement pattern over time. As Heilen's (Volume 3 of this series) model of persistence place settlement shows, numbers of inhabited places in southeastern Arizona increased throughout the Middle Formative and declined precipitously during the Late Formative. Possibly, land tenure was established during the Middle Formative with people residing at individual sites for relatively long periods of time. During Middle Formative A, perhaps households or groups of households stayed at farming locales throughout the growing season. During the Middle Formative B, people may have retained land tenure at still-usable farming locales, but only stayed there at critical parts of the growing season. Or, perhaps some people stayed there throughout the growing season and larger work parties came at critical times of the growing season to help plant or harvest crops. If so, it could be that a pattern of larger, more centralized villages were established by Middle Formative B times along with numerous farmsteads that were held by some segments of the population. During this time, the large number of inhabited places may correspond to a pattern of numerous farmsteads dotting the landscape, aided by village labor that facilitated the planting and harvesting of larger crops and resulted in the redistribution of agricultural goods between households or communities. By the Late Formative, people appear to have aggregated at fewer places and behaved quite differently overall. During the Late Formative, ball courts were largely abandoned, platform mounds and aboveground adobe compounds were built, and settlement patterns shifted into new areas. By Late Formative B, populations appear to have withdrawn from many areas of the middle and upper Santa Cruz River basins and to instead have populated the lower San Pedro. Perhaps the Late Formative B presence at Mescal Wash was a small satellite of a larger village from which people imported supplies, such as flaked stone tools.

Surovell's Core-Reduction Index

Using a sophisticated modification of the discard equation (Schiffer 1976, 1987), Surovell (2003) developed a null model to predict the ratio of core reduction to biface reduction at sites of variable occupation duration. Surovell's model was developed in order to predict whether the ratio of core flakes to bifacial-thinning flakes (c/bt) should change with change in occupation duration. Surovell shows that the ratio c/bt does change with occupation duration for the sites he studied, but he argues that it may really be change in raw-material availability (whether the effect of mobility, stockpiling, technology, or other factors) that controls variation in the ratio.

In Surovell's formal model, the variable time cancels out. As such, Surovell's null model predicts that the ratio of core reduction to biface reduction should remain constant despite change in occupation duration. Not surprisingly, when Surovell tested the model against indexes of occupation duration developed for his study (such as his M), the null model was falsified. Surovell's core-reduction index was directly related to the log of his M, suggesting that the ratio of core reduction to bifacial reduction increased with per capita occupation duration. Surovell (2003:275–276) suggested three possible reasons for this outcome: "(1) The discard rate of core-reduction flakes increases with time, (2) The discard rate of bifacial-thinning flakes decreases with time, or (3) A combination of the two."

As Surovell (2003) observes, it is difficult to choose the correct alternative without a large number of data points. That is, without a large number of sites with core-reduction to biface-reduction ratios and occupation durations of varying length, it is hard to discern subtle differences in theoretical relationships between the ratio and occupation duration. By applying the marginal value theorem to this problem, however, Surovell was able to show that hypothesis 1 is most likely. With increased occupation duration, the discard rate of expedient core flakes increases while the discard rate of bifacial-thinning flakes remains constant. He suggests that it is not occupation duration per se, however, but raw-material availability that governs change in the ratio of core reduction to biface reduction, which is an important clue to interpreting the ratio at Mescal Wash. Surovell argues that as occupation duration increases, tools have shorter use lives, discard rates increase, people become more selective in choosing flake blanks to use, and core reduction will increase. As occupation duration increases, biface production may remain relatively constant, but core reduction appears to increase. The rates at which the consequences of core reduction enter the archaeological record also increase.

Surovell's formal modeling efforts corroborate predictions made by both Parry and Kelly (1987) and Kuhn (1994). Namely, flakes are more efficient tools in conditions of high raw-material availability and that flakes will be discarded earlier in their use lives at places that are provisioned with raw materials or occupied for longer periods. Surovell's model indicates that apparent decreases in the relative frequency of bifacial reduction could be produced by more or less constant biface reduction coupled with increased core reduction, higher selectivity, and less curation of usable flakes. The performance of biface reduction, then, is a constant and the performance of core reduction is increasing. Biface production is not phasing out, core reduction is phasing in. This does not necessarily mean that more activities involving flakes were performed with increased occupation duration, but instead that curation rates of usable flakes decreased with occupation duration.

In contrast to Surovell's M, Surovell's core-reduction index (see Figure 90) continued to increase into the Middle Formative B period, rather than decline during this time. At Mescal Wash, the core-reduction index increased slightly during the Early Formative, but was otherwise similar to the Late Archaic value. The Middle Formative A core reduction increased fourfold over the Early Formative value and continued to increase into the Middle Formative B period, as indicated by an increase of 2.5 times that of the Middle Formative A. The core-reduction index decreased during the Late Formative B to approximately the same value as Middle Formative A occupations.

Reconciling the Differences

In the Mescal Wash data, c/bt continues to increase into the Middle Formative B although Surovell's M has begun to decline by this time. All of the sites Surovell studied appear to have had only a single occupation, however, suggesting that stockpiling of resources would only benefit the original occupants of the site. This factor may account for the correlation Surovell found between his M and core-reduction index. When raw materials are stockpiled, usable raw materials are collected during logistical forays and brought to sites as surplus material for later use. Surovell refers to this behavior as resulting in "ultra-local" concentrations of raw materials. Possibly, occupation duration did begin to decline during Middle Formative B times, but c/bt did not yet decline because stockpiled raw materials remained available for use. That is, even though people may have spent less time at the site, on average, raw-material availability remained high because of a preexisting surplus at a previously provisioned place.

Another explanation for the discrepancy has to do with differences in population size. Because M is conceptualized as a *per capita* measure of mobility, the discrepancy between M and the core-reduction index could possibly signal differences in site population. If we conceptualize M as proportional to occupation duration / person and c/bt as proportional to duration, we can combine and rearrange the two equations such that population equals (c × k2/ bt × k1)/ M. K1 and K2 are unknown proportionality constants, but if we assume they are equal, then the discrepancy between temporal change in c/bt and temporal change in M can be explained by a continuously increasing population size. This would suggest that during the Late Archaic, relatively small numbers of occupants used the site for a relatively short duration. During the Early Formative, smaller numbers of occupants used the site for somewhat longer durations. During the Middle Formative A, larger numbers of people used the site for the longest periods of time. During the Middle Formative B, considerably more people began to use the site but for somewhat shorter periods of time. Finally, during the Late Formative B, the largest number of people began to occupy the site but for the shortest periods of time.

Still another possible explanation for the discrepancy has to do with a decoupling through time of the relationship between bifacial technologies and occupation duration at Mescal Wash. Perhaps, as people came to rely more on agricultural foodstuffs, small mammals, and the use of nonbifacial lithic tools for everyday subsistence needs, they tended to rely less on bifacial tools for everyday tasks, even in cases where they were moving residences with greater frequency. Places like Mescal Wash may have been increasingly used for specialized subsistence activities that did not require the use of bifacial tools in minimizing risk, thus resulting in a greater emphasis on core reduction during Middle Formative times, even in cases of decreased occupation duration. The renewed prevalence of bifacial tools at Mescal Wash during the Middle Formative B might suggest a renewed emphasis on activities involving the use of bifacial tools, such as hunting large mammals or perhaps a response to violent conflict.

Occupation Duration and Projectile Point Discard Rates

As Shott (2000) observes, tools can be used in many places but discarded in only one. Thus discarded tools do not necessarily provide a direct record of tool use, but they do indicate how much discard has occurred. As stated above, calculating discard rates is complicated by the fact that we do not know how long different groups of people stayed at Mescal Wash.

If we organize points into Late Archaic or Early Formative types, Middle Formative types, and Late Formative types, it is evident that similar numbers of projectile points were discarded during Late Archaic or Early Formative times (TIE = 38) and Middle Formative times (TIE = 44). Fewer points (TIE = 15) were discarded during the Late Formative B. One might take these TIEs as a rough estimate of the intensity of projectile point discard, but such an estimate takes no account of occupation duration.

If we use the total length of time during which the points could have been discarded (i.e., period length), we see that projectile points appear to have been discarded at the highest rate during the Middle Formative and the lowest rate during the Late Archaic. If we assume that Late Archaic–style points could have been deposited over the course of 1,200 years, than one Late Archaic–style point was deposited every 32 years. If we assume that the Middle Formative lasted approximately 450 years, than one point was deposited every 10 years. If we assume that the Late Formative lasted 300 years, than one point was deposited every 20 years. Again, such estimates are likely to be misleading as they do not account for two important variables: (1) duration of occupation or (2) number of occupants.

In order to study the relationship between occupation duration and projectile point discard, Surovell's M was calculated according to three periods defined as (1) Late Archaic and Early Formative, (2) Middle Formative, and (3) Late Formative. We used these more general periods because some projectile point styles are dated to relatively broad periods and some projectile points from earlier periods evidently were redeposited in later contexts. Dividing projectile TIEs by M provides a different picture of projectile point deposition than is suggested by other methods explored above. If we divide projectile TIEs by M, we can arrive at a kind of relative discard rate for Mescal Wash projectiles. This indicates that projectile points were discarded at the highest rates during the Late Archaic and Early Formative periods. The discard rate for projectile points declined exponentially thereafter $\mathrm{TIE}/(M) = 89.4\,e^{-0.0033\text{end date}}$, $r^2 = 0.9978$. This suggests that projectile points, though never disappearing, were used most frequently during the Late Archaic and Early Formative periods and became less frequent ever after. Possibly, projectile points early on were a regular fixture of subsistence technologies and were relied upon to obtain basic needs. As people supplemented their diets with agricultural products and obtained protein from small mammals obtained closer to home, they may have depended less on projectiles for everyday subsistence practices. Instead, they may have begun to use projectile points for more specialized purposes—such as ceremonies, logistically organized hunting trips, and interpersonal conflict. Possibly, projectile points also began to be made and used by smaller segments of the population because the discard appears to have decreased dramatically through time while the number of people occupying Mescal Wash, as well as the length of stays during certain periods, may have increased.

Contemporaneity Groups

One of the unanswered questions in this chapter is, when during the Middle Formative period did some of these inferred changes in occupation duration and technological organization occur? There appear to have been a number of changes that occurred between the Middle Formative A and B periods, but it is unclear whether the change had been effected by the end of the Middle Formative A or sometime later in the Middle Formative B and whether the change was gradual or more abrupt.

Lengyel was able to assign 40 features to one of six contemporaneity groups for the site as a whole, based on statistical analysis of archaeomagnetic dates directly associated with use of the features (see Chapter 2, Table 11). To some degree, these temporal groups allow us to more finely assess the timing and nature of change in flaked stone technology and mobility during the Middle Formative period. Groups 1 and 2 generally correspond to the Middle Formative A period, and Groups 3–6 generally correspond to the Middle Formative B period. Garraty and Heckman's (see Chapter 3) analysis of ceramic dates from the contemporaneity groups, suggests that Group 3 may overlap the boundary between the Middle Formative A and B periods.

Unfortunately, Group 2 consists of only two features, so conclusions drawn regarding change during this period may be suspect. Fortunately, as most of the flaked stone artifacts were discovered in Middle Formative period contexts, roughly a third of all analyzed proximal flakes, debris, and tools were found within the features assigned to one of the six contemporaneity groups. This allows us to examine fine-scale temporal change in a few key variables discussed earlier in this chapter, but sample size issues probably affect observed patterns to some degree, because after being reduced by two-thirds, these samples are further split into one of six groups. This is particularly the case for tools, as sample sizes for individual tool types were relatively small and unevenly distributed among contemporaneity groups (Table 90). Thus, it is probably most useful to consider a few fairly general and relative measures in assessing the nature of change in flaked stone technology during the Middle Formative period, according to contemporaneity groups.

The first measures we examined were the percents of biface and core flakes according to contemporaneity group (Figure 91 and Table 91). The general trend established earlier in the chapter remains evident, with biface flakes decreasing percentagewise as core flakes increase, but there was evidently more variability than could be seen with more general periods. Some of this variability could be the result of sampling vagaries, but it could be that variation in emphasis on bifacial or core technology occurred within a larger and more consistent directional trend of increasing emphasis on core reduction. The higher percentage of biface flakes in Group 2 is potentially interesting if it suggests that there was a temporary increase in emphasis on biface reduction, but as noted, this group was represented by only two features, and the result may be strongly affected by sample size.

The next measures we examined were the percentages of platforms that were ground, faceted, or plain (Figure 92 and Table 92). The general trend of decreasing investment in platform preparation over the course of the Middle

Table 90. Flaked Stone Tool Types by Contemporaneity Group

Tool Type	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Total
Arrow point	16	1	3	2	—	4	26
Biface	4	2	—	—	—	—	6
Core	13	4	4	2	2	11	36
Core/chopper	—	—	—	—	—	1	1
Dart point	6	—	2	—	1	3	12
Drill	8	1	2	—	—	3	14
Flaked cobble (chopper)	—	—	—	—	1	—	1
Flaked cobble (denticulate)	—	—	1	—	—	—	1
Hammerstone	4	1	3	—	3	3	14
Hammerstone/core	4	—	—	—	2	1	7
Pièce esquillée	1	—	1	—	—	—	2
Retouched chunk	—	—	—	—	—	1	1
Retouched flake	12	6	—	1	1	10	30
Uniface	2	2	1	—	3	2	10
Utilized flake	10	2	3	—	2	10	27
Total	80	19	20	5	15	49	188

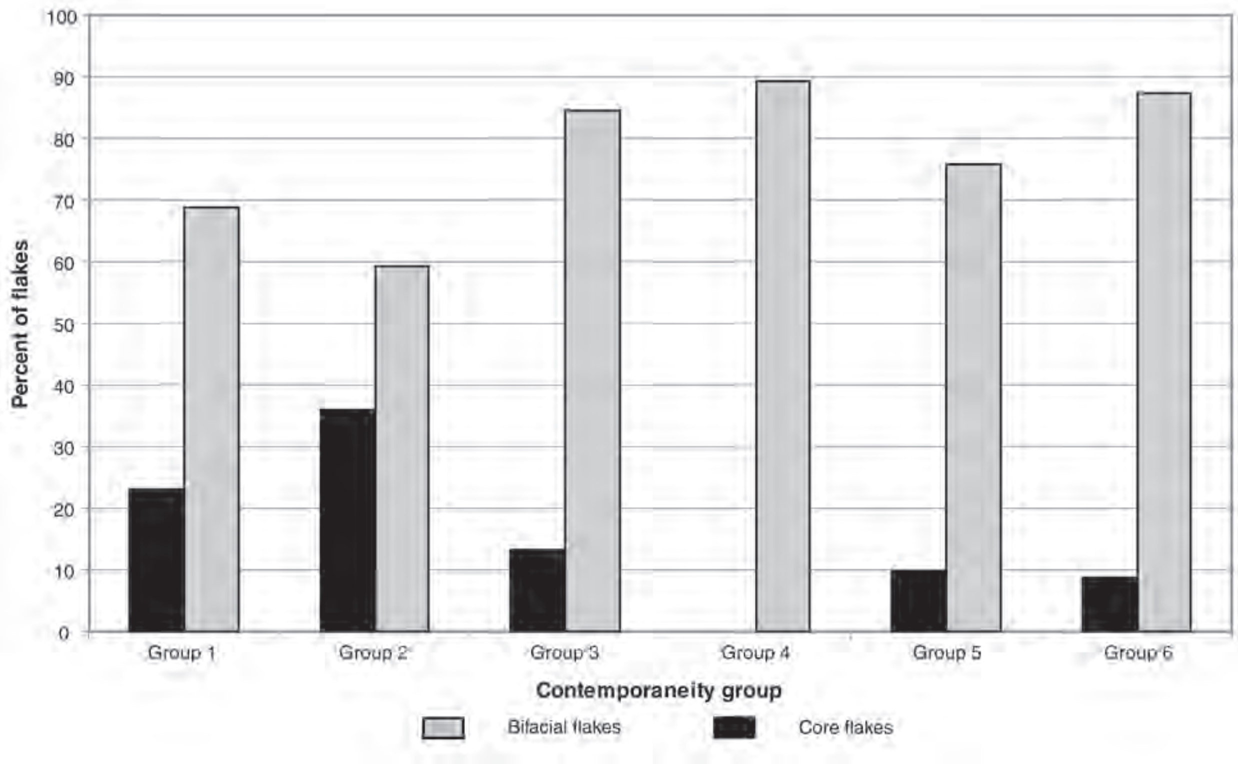


Figure 91. Percentage of bifacial- and core-reduction flakes, by contemporaneity group.

Table 91. Bifacial vs. Core-Reduction Index by Contemporaneity Group

Flake Type	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Total
Unknown	4	2	2	—	—	1	9
Biface	73	52	29	—	2	19	175
Bifacial shaping	9	18	6	—	2	2	37
Bifacial thinning	12	10	4	—	—	6	32
Core	128	51	130	19	16	143	487
Disk core	153	81	122	14	15	126	511
Unifacial retouch	30	9	6	4	6	12	67
Total	409	223	299	37	41	309	1,318
Biface flakes %	23.0	35.9	13.0	0.0	9.8	8.7	18.5
Core flakes %	68.7	59.2	84.3	89.2	75.6	87.1	75.7
Retouch %	7.3	4.0	2.0	10.8	14.6	3.9	5.1
Core-reduction index(c/bt)	23.4	13.2	63.0			44.8	31.2

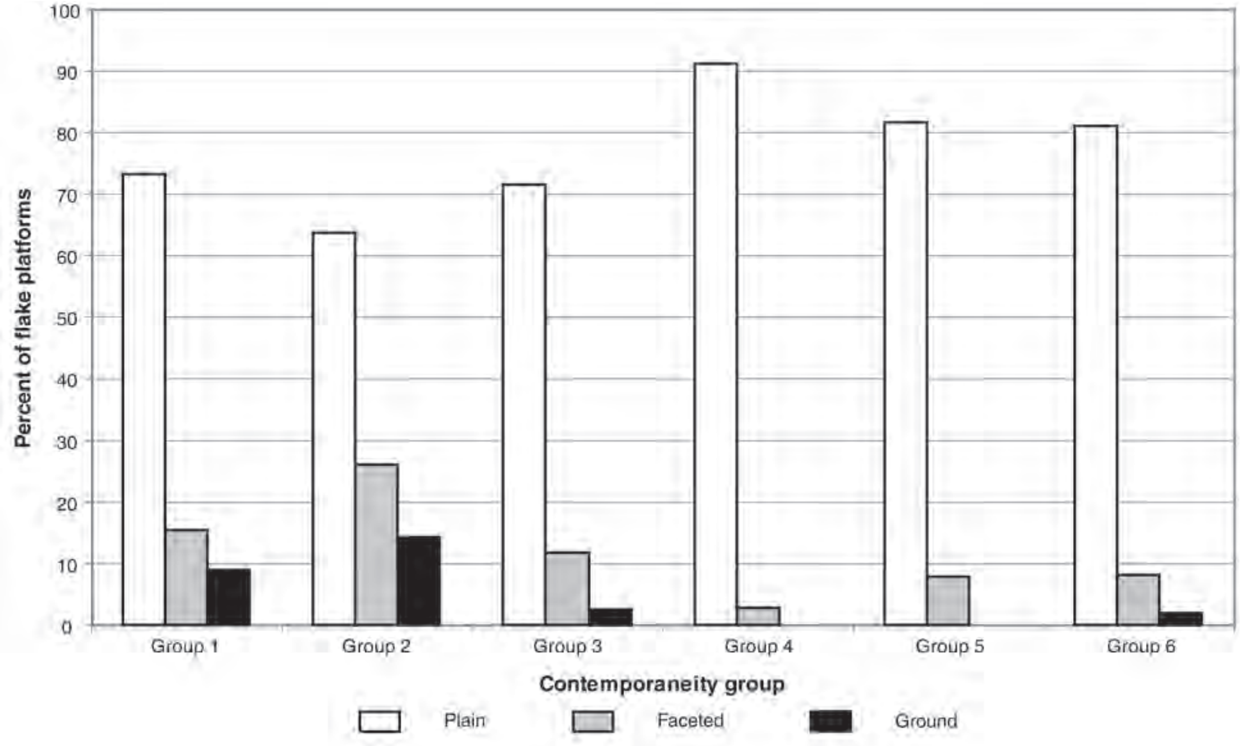


Figure 92. Percentage of plain, ground, and faceted flake platforms, by contemporaneity group.

Table 92. Flake Platform Types by Contemporaneity Group

Platform Attribute	Group 1		Group 2		Group 3		Group 4		Group 5		Group 6		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Dihedral	45	11.7	22	10.2	45	16.9	2	5.9	4	10.5	32	10.9	150	12.2
Plain	281	73.0	137	63.7	190	71.4	31	91.2	31	81.6	237	80.9	907	73.7
Faceted	59	15.3	56	26.0	31	11.7	1	2.9	3	7.9	24	8.2	174	14.1
Reduced	44	11.4	36	16.7	23	8.6	1	2.9	5	13.2	27	9.2	136	11.0
Ground	34	8.8	31	14.4	7	2.6	—	0.0	—	0.0	6	2.0	78	6.3
Total observed platforms	385	100.0	215	100.0	266	100.0	34	100.0	38	100.0	293	100.0	1,231	100.0

Note: The counts for each platform attribute correspond to the number of observed platforms with that attribute and an individual platform could have multiple attributes, e.g., both ground and faceted. The total number of observed platforms is the total number of platforms exhibiting one or more of the listed attributes. Percentages are by column.

Formative period was evident, with a general increase in the percentage of plain platforms and a general decrease in faceting or grinding. However, the greatest change appears to have occurred between the latter part of the Middle Formative A period and the early part of the Middle Formative B period, with a slight return towards earlier levels in the latter part of the Middle Formative B period.

The final measures we examined were Surovell's M and his core-reduction index (Figure 93 and Table 93). Again, the basic trends remained the same, but more variability was evident. Furthermore, change in Surovell's M across contemporaneity groups suggests that the trend of apparently increasing occupation during the Middle Formative A period may have continued into the Middle Formative B, until occupation duration decreased, perhaps more dramatically than was suggested by examining the measure according to more general periods. The trend suggests that sometime during the latter portion of the Middle Formative A period, duration of occupation dramatically increased and continued to increase into the early part of the Middle Formative B period, after which time duration of occupation may have decreased to earlier levels. The core-reduction index also increased into the early part of the Middle Formative B period and declined later in the period. Together, these two measures suggest the possibility that the most dramatic increase in duration of occupation occurred across the boundary between the Middle Formative A and B periods and that perhaps much of the overall signatures for flaked stone technology that we have observed for general periods represent a pulse of more intensive occupation that occurred in the latter part of Middle Formative A and the early part of Middle Formative B, followed by a decrease in occupation intensity sometime during the Middle Formative B period. Other trends in flaked stone technology, as indicated by the measures examined earlier, are generally consistent with these trends, but appear to follow a somewhat different timing, as if an emphasis on core reduction continued to increase even as duration of occupation appears to have decreased. Given sampling vagaries, it is probably prudent to not place too much significance on these changes, but it might be the case that fairly expedient core-reduction technology remained important during the Middle Formative B period, even as the site may have come to be occupied for shorter stays.

Discussion and Conclusions

In many areas of the world, reliance on formal, carefully produced cores and tools decreased over time and reliance on informal, expedient flake tools and unstandardized cores increased as societies became more dependent on food production. In western Europe, for instance, Paleolithic and Mesolithic artifacts have been "described according to a series of recognizable types since the tools conform to fairly standardized forms and were produced by a limited number of techniques so that even the waste could be classified" (Torrence 1989:58). In contrast, later Neolithic assemblages were composed of "amorphous, unstandardized and highly variable artifacts [that] tend to be very poorly produced using an extremely wide range of raw materials, many of which can be classified as very low quality resources" (Torrence 1989:58). Similar change in lithic technology occurred across North America and Australia (Jeske 1989; Parry and Kelly 1987; Schiffer 1976; White and O'Connell 1982). A change from an early emphasis on formal bifacial tools and standardized cores to later emphasis on informal, expedient flake and core tools has been documented in the Eastern Woodlands, the Plains, Mesoamerica, and the Southwest. In the Eastern Woodlands, the Plains, and the Southwest, this change began to occur in the Early Formative period, or perhaps earlier in select contexts where early agriculture was

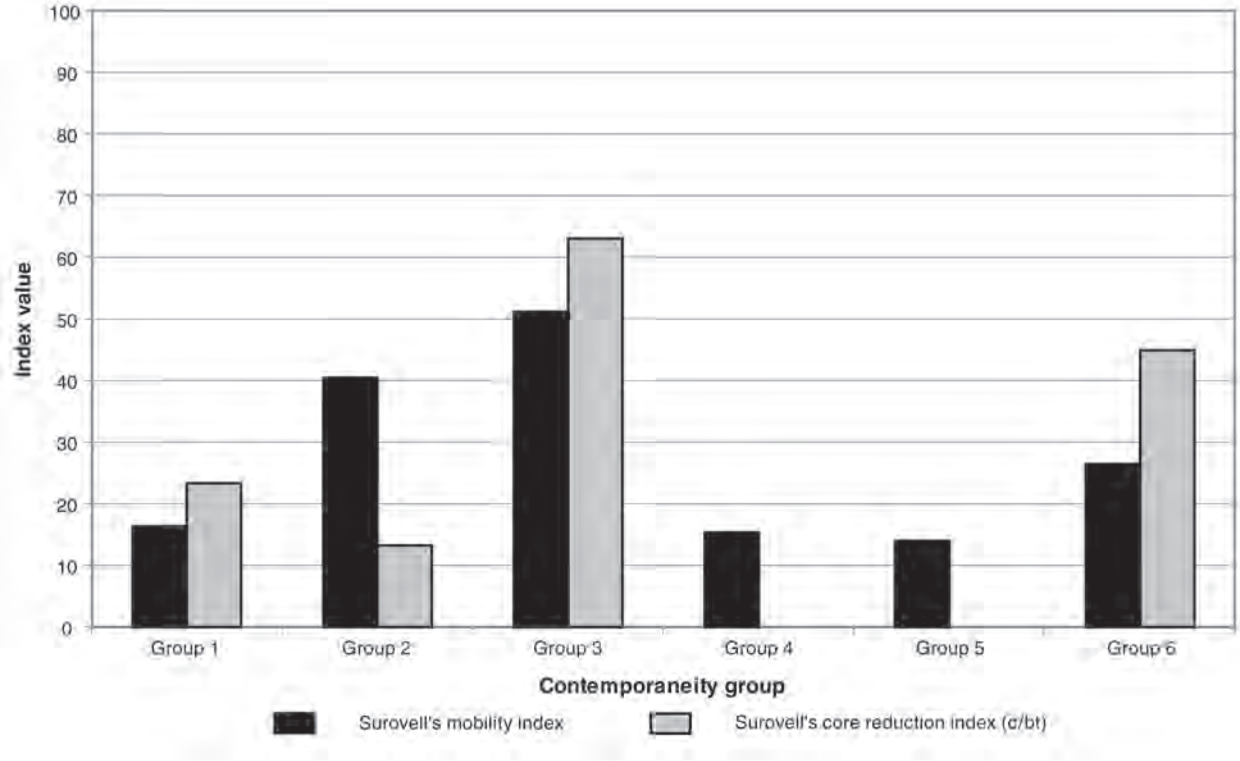


Figure 93. Relationship of Surovell's mobility index (M) with Surovell's core-reduction index (c/bt), by contemporaneity group.

Table 93. Surovell's Mobility Index (M) by Contemporaneity Group

Group	Tools		Proximal Flakes			Debris	Total Debitage	Local/ Nonlocal	Debitage/ Nonlocal Tools	Surovell's M	C/Bt
	Local Material	Nonlocal Material	Local Material	Nonlocal Material	Total						
Group 1	51	29	301	108	409	459	868	2.6	29.9	16.3	23.4
Group 2	13	6	163	60	223	246	469	2.7	78.2	40.4	13.2
Group 3	13	7	220	79	299	397	696	2.7	99.4	51.1	63.0
Group 4	2	3	31	6	37	44	81	3.7	27.0	15.3	
Group 5	12	3	31	10	41	33	74	3.3	24.7	14.0	
Group 6	36	13	247	62	309	330	639	3.8	49.2	26.5	44.8
Total	127	61	993	325	1,318	1,509	2,827	2.9	46.3	24.6	31.2

performed. In Mesoamerica, the change occurred earlier than in North America, between 1500 and 1000 B.C. (Parry and Kelly 1987). Some investigators have referred to this process as the "devolution in the complexity of stone tool assemblages and in the efficiency of raw material use and manufacturing techniques" (Torrence 1989:58). Other investigators, however, argue that fundamental change in stone tool technology is best understood "in a context of changing needs and changing allocation of resources" (Parry and Kelly 1987:304).

Torrence (1989) attributes this change in stone tool production to change in strategies for coping with risk. To Torrence, people that rely on mobile resources, such as hunted game, have limited opportunities to capture game. People that rely on more temporally and spatially predictable resources, such as plant foods, do not have equally short windows of opportunity for obtaining targeted resources. According to this argument, food producers are not at risk of losing subsistence opportunities on account of stone tool technology. Food producers have to cope with risks, such as crop or storage failures, but technologies other than flaked stone may be more important to mitigating risks. Torrence argues that the risk of losing subsistence opportunities changes as subsistence strategies change (Jeske 1989). According to this argument, foragers that depend on mobile resources operate according to a different risk matrix than food producers. How flaked stone tool technologies factor into that risk matrix also changes.

Parry and Kelly (1987) argue that change from formal bifacial technology to expedient flake technology resulted from changes in mobility. In all the cases they studied, the change coincided with formation of the earliest more-permanent villages. They argue that reduction in residential mobility is the key factor affecting change in stone tool technology. More-mobile people cannot carry around a lot of raw material and they need to make tools and have raw materials available when needed. The shift from formal biface technology to more expedient flake and core technology is not a state change, however. Instead, the change appears to occur gradually over time.

Parry (1987) observed fundamental changes in lithic technology at Late Archaic and Anasazi sites in northern Black Mesa, Arizona. At northern Black Mesa sites, there was a gradual shift through time from greater emphasis on formalized, retouched, and intentionally shaped tools to informal, casually made, unintentionally shaped tools. Over time, less effort was expended on platform preparation, retouched tools decreased in abundance, and expedient tools increased in abundance. Flaked stone reduction at Late Archaic sites focused on the production of bifaces and retouched tools made on local and nonlocal materials. At later sites, "tools of both local and nonlocal materials were manufactured elsewhere and brought into the sites in finished form, which held true even at the largest and most formalized habitation sites" (Parry 1987:225). Flaked stone reduction at later sites focused on the production of expedient flake and core tools, and bifaces were no longer made on materials that were common during the Late Archaic period (i.e., baked siltstone). Parry suggested that fundamental changes in the organization of flaked stone technology were associated with changes in subsistence and mobility—increased reliance on cultigens, decreased residential mobility, and "possibly expanding regional interaction networks and political alliances" (Parry 1987:226). The same general trends occurred at Mescal Wash.

Despite changing emphases in stone tool manufacture, bifacial tools do not disappear with increased sedentism. As Parry and Kelly (1987:296) observe, the shift did not involve the replacement of one technology by another, or the abandonment of formalized tools. Rather, the shift was one of emphasis, with the proportion of formal tools decreasing but never vanishing. Elaborate or technologically costly tools do not disappear, but they may have begun to serve different symbolic, social, or other more specialized functions. In some cases, elaborate, standardized, or complex flaked-stone tools may have become important components of social activities, such as burial ceremonies. Remarkably, stone projectile points from Snaketown are some of the most compelling evidence for craft specialization among the Hohokam and this is partly because many of them are standardized or finely crafted (see Haury 1976). Clearly, many of these points required investments in labor or energy that transcend those of the typical projectile point. The value of that cost may not have been functional in a purely economic sense. At least in some prehistoric contexts in the Southwest, increasing reliance on "expedient" flake technologies coexisted with elaborate bifacial technologies. At Mescal Wash, flakes indicate decreasing reliance on bifacial technologies over time but bifacial tools actually became more abundant during the Late Formative B times, when bifacial tools represent over 60 percent of all flaked stone tools. The percentage of flaked stone tools that were bifacial was close to 60 percent during the Late Archaic period and decreased during the Middle Formative period to a low of 20 percent. Increase in the measure during the Late Formative B period to a level comparable to the level during the Late Archaic suggests a renewed emphasis on bifacial tools late in the sequence. However, this change should not be taken to indicate a return to Late Archaic technological strategies, as bifacial tools were manufactured on-site during the Late Archaic period and off-site during the Late Formative B and were components of different technological systems (e.g., darts vs. arrows).

The proportion of bifacial tools to flake tools also decreased from Late Archaic through Middle Formative times but increased to the highest level during the Late Formative B. From the Late Archaic through Middle Formative periods, this percentage decreased in a linear fashion, suggesting that flake tools really did become more common than bifacial tools during the Middle

Formative period at Mescal Wash (bifacial tools / flake tools = -0.0014 × (end date) + 2.3493, $r^2 = 0.9925$). During the Late Formative B period, however, the quantity increased dramatically to a ratio of 3.9 to 1.

The selection and use of flakes as tools increased through time at Mescal Wash. The minimum number of flakes per flake tool (FT) (MNF/FT) is one way to assess the change in the use of flakes as tools over time. We expect that MNF/FT should decrease with increased expedience, because more flakes are being used as tools rather than removed as debris to produce more formal tools. Indeed, the number of flakes per flake tool decreased linearly from Late Archaic through Late Formative times. Plotted against the end date of each period, the MNF/FT decreased by 1 every 19.2 years (MNF/FT = -0.0443 × [end date] + 68.084, $r^2 = 0.9903$). In Late Archaic times, there was only around 1 flake tool for every 69 flakes. No flake tools were discovered in Early Formative contexts. By the Late Formative, there was 1 flake tool for every 6 flakes. Despite the possibility that used flakes might go under-recognized, there was a clear trend over time in the selection and use of flakes at Mescal Wash.

Many other variables examined in this chapter indicate a long-term, gradual decrease in emphasis on bifacial-reduction technology and a long-term gradual increase in emphasis on expedient core technology. Evidence of increasing emphasis on expedient technology at Mescal Wash includes change in the technological attributes of flaked stone debitage. Change in the ratio of bifacial-reduction to core-reduction flakes, for instance, indicates that the amount of bifacial reduction steadily declined through time, with a slight increase above the Middle Formative B level during the Late Formative period. Biface flakes represented over half the total number of flakes during the Late Archaic and Early Formative periods. By Middle Formative A times, the percentage of biface flakes dropped to approximately 30 percent of the total flakes, with less than 8 percent during Middle Formative B times. Late Formative B times, however, showed a slight increase in the percentage of bifacial flakes, with slightly less than 10 percent of the total number of flakes. Similarly, noncortical flakes decreased in relative frequency through time, with a slight increase in Late Formative B times, suggesting an increased focus on primary core reduction through time, with fewer flakes removed from the interior of cores. Evidence for platform preparation also decreased over time, with relatively fewer reduced, ground, faceted, and lipped platforms found after the Early Formative period. Fewer prepared platforms over time suggest less investment in core reduction and tool manufacture. It also suggests changing reduction strategies, such as infrequent use of soft-hammer percussion in later periods. This trend is also apparent with the analysis of hammerstones, which were absent in Late Archaic period contexts and most common in Middle and Late Formative contexts. Relative frequencies of pressure flakes also decreased over time, suggesting a decreased emphasis on late-stage tool manufacture and maintenance. The above evidence clearly indicates a gradual decrease through time in the manufacture and maintenance of bifacial tools at Mescal Wash and an increasing emphasis on the production of flake tools. However, as we have already noted, a renewed reliance on bifacial tools emerged during the Late Formative B, but likely in a different organizational context. Bifacial tools increased in abundance during that period, possibly indicating an increase in mobility or an increased emphasis on hunting or violent conflict, but on-site production of flaked stone tools continued to emphasize expedient flake tools, with some occasional maintenance of bifacial tools imported into the site.

The intensity of core reduction is also important in evaluating change in flaked stone technology through time. The intensity of core reduction was moderate during the Late Archaic, increased to its highest level during the Middle Formative A period, and decreased to its lowest level thereafter. At face value, this suggests that less and less primary core reduction occurred on-site after the Middle Formative period or perhaps that site occupants had become less and less selective about the attributes of flakes used as tools.

The modification and use of flakes corresponds to an increasingly expedient technology at Mescal Wash, particularly during the Middle Formative period. For example, retouched flakes were most common in Middle Formative A deposits (i.e., 48 percent of all retouched flakes from all contexts). Similarly, all unifaces analyzed in this sample were discovered in Middle Formative period contexts. Used flakes also increased in relative frequencies through time. Increase in the use of flakes was slow between the Late Archaic and Middle Formative, but as much as 5 times faster between the Middle and Late Formative period. Occupants of Mescal Wash evidently became less selective about which flakes to use, and damage intensity was typically low or moderate, suggesting flakes were discarded with remnant use life. In this sense, used flakes may indicate the number of uses, rather than the amount of material worked (Shott and Sillitoe 2005). Middle Formative A used flakes were typically larger in every dimension than Middle Formative B used flakes. The especially large size of Middle Formative A used flakes may be related to the use of Middle Formative A flakes as handheld expedient scrapers. A comparison with the overall size of core flakes shows that especially large flakes were selected for use during the Middle Formative period. The largest used flake was 3.4 times the size of the smallest used flake, a figure that is remarkably consistent with Surovell's (2003, 2009) observation on relative sizes of Folsom scrapers. As in the Folsom case, this does not conform to the theoretical expectations of the Kuhn (1994) model for minimum and maximum sizes of transported tools. Because used flakes at Mescal Wash were likely struck expediently from local cores and used on-site, mobility constraints were probably not an issue. Large flakes could be used without concern for transport costs. One-third of used flakes were found in floor contexts or in hearths, which could suggest that many used flakes may have been utilized in the performance of domestic activities occurring within structures.

Summary

To sum up, there are a number of interesting trends in flaked stone technology across time at Mescal Wash. Principal among these is a trend observed across North America and in other parts of the world that has been widely associated with the emergence of sedentism and decreased residential mobility. As residential mobility decreased, formal tools and standardized cores decreased in abundance, and informal, expedient flake and core tools increased in abundance. To some, this change is interpreted as a kind of "lithic dark ages" or a "devolution" in the complexity of stone tool manufacture. More likely, this trend represents the reorganization of stone tool technology as a result of changing patterns of mobility and land use. Despite change in relative frequencies of artifacts suggesting bifacial or core-reduction technology, this change does not necessarily mean a decrease in discard rates of bifacial tools and waste products. Rather, it may signal a relative increase in discard rates of expedient technologies.

At Mescal Wash, as at other sites in the Southwest, Plains, and Eastern Woodlands, the material consequences of nonbifacial, expedient core technologies began to swamp the material consequences of more-formal bifacial technologies as people occupied the site for longer periods. Flakes, flake tools, and cores became more prevalent and evidence of biface manufacture became less common. Relative discard rates for projectile points suggest that projectile points were discarded at the highest rate per capita in the Late Archaic and Early Formative periods and at low rates during the Middle Formative.

Clearly, bifacial tools continued to be manufactured and used, but over time they were less often manufactured or maintained at the site. The production and discard of flake tools increased during the Middle Formative, and the Late Formative B period saw an increasing dependence on bifacial tools but with little evidence for the manufacture of bifacial tools on-site. These patterns seem to indicate that the organization of flaked stone technology changed gradually over time from the Late Archaic period through the Middle Formative period as expedient flake tools increased in use, and again during the Late Formative, as bifacial tools were imported into the site. Unfortunately, the sample does not pertain to the Late Formative A period (ca. A.D. 1150–1300), so we cannot gauge whether the change inferred for the Late Formative B period was part of a larger trend that began earlier. Archaeological evidence from many sites in the region, however, suggests widespread reorganization beginning around A.D. 1150. The change in lithic technology seen at Mescal Wash during the Late Formative may be a register of other kinds of changes that had begun earlier elsewhere in the region.

It may come as little surprise to some archaeologists that expedient technology became more prevalent over time at Mescal Wash. Given the widespread occurrence of this phenomenon, it is a pattern that is now expected for Formative period lithic technology. The fact that this pattern emerges so clearly and unambiguously in the Mescal Wash data, however, is a testament to application of multiple lines of evidence in inferring the relative ages of Mescal Wash deposits. Despite the complexity of Mescal Wash site formation and the potential for mixed deposits and disturbance, there is clear evidence of technological change over time.

Change in flaked stone technology over time also provides some greater understanding of change in how Mescal Wash was used over time. Application of Surovell's M suggests that the occupation duration per capita increased through the Middle Formative A period and into the early part of the Middle Formative B period and declined thereafter. The core-reduction index remained high into the Middle Formative B period, perhaps because of the availability of stockpiled raw materials. By the Late Formative B period, there was a clear shift in the organization of lithic technology at Mescal Wash, suggesting that people were using the site differently from how they had used it in the past. Most tools were bifacial and may have been imported into the site. Along with other evidence, this could mean that, despite the presence of substantial residential structures during the Late Formative B period, Mescal Wash was more of a logistic camp used by large task groups, perhaps for the purpose of hunting artiodactyls and other large game in order to provision aggregated villages with meat and other materials.

CHAPTER 5

Ground Stone

Dawn M. Greenwald and Bradley J. Vierra

This chapter presents the results of the analysis of ground stone artifacts recovered from the Phase 1 and 2 data recovery investigations at the Mescal Wash site. A total of 1,308 ground stone items were analyzed from 188 features and from various other contexts, ranging from manos and metates to pestles and ornaments. Eight additional artifacts or minerals from 5 burials were repatriated during fieldwork, without detailed analysis. An analytical system was developed that would provide an adequate description of the artifact collection, in order to address the project research issues. These issues include Mescal Wash as a persistent place, subsistence, activity organization, and cultural interaction and exchange (see Chapter 1). The site has a long history of occupation, with the investigated portions dating from ca. 1200 B.C. to A.D. 1450; therefore, this dataset provides us with an opportunity to study long-term changes in site use. The analytical variables recorded during the analysis include information on morphological, technological, and functional attributes, such as production techniques and energy investment; material type and texture; use-wear type, location, and intensity; and artifact shape and measurements.

Traditional lithic analyses have tended to focus on the flaked stone component, with less-detailed work on the ground stone artifacts, but recent studies have also begun to focus on ground stone implements as important sources for understanding past subsistence activities (Adams 1999, 2002). Although limited work has been done on ground-stone-artifact production (but see Van Pool and Leonard 2002), most analysts have emphasized tool function based on the artifact's form and the presence of use wear (see Adams 1988, 1989, 1999, 2002; Calamia 1991; Hard 1986, 1990; Lancaster 1984; Morris 1990). Adams's (2002) study separated ground stone implements into three major groups: grinding and pulverizing; abrading, smoothing, and polishing; and percussion tools (hafted and nonhafted).

Manos and metates generally form the primary basis for ground-stone-artifact analysis. They provide the technological means of milling various plant seeds into flour, which is something that southwestern peoples have been doing for thousands of years. In the U.S. Southwest, one-handed cobble manos and milling stones or basin metates have been the hallmarks of the Archaic period and are associated with generalized grinding activities. In contrast, agriculturally dependent communities required two-handed manos and specialized slab or trough metates for processing maize (see Bartlett 1933; Haury 1975; Woodbury 1954). Researchers have begun to understand the data potential represented by this history and have used the information to help clarify the forager-to-farmer transition. For example, the overall sizes of the mano and metate grinding surfaces have been used to indicate the degrees of grinding efficiency (e.g., amount of time spent milling) and grinding intensity and as a proxy measure for the importance of maize to the diet (Adams 1993; Diehl 1996; Hard 1986, 1990; Hard et al. 1996; Horsfall 1987; Lancaster 1986; Mauldin 1993; Morris 1990), whereas other studies have involved understanding the effects of the variety of maize, the crop yield, or the tool design on grinding efficiency (Adams 1999; Murrell 2007) or tool design and tool life in regard to site occupational history (Adams 2005; Nelson and Lippeier 1993; Schlanger 1990, 1991).

The present ground stone analysis incorporated more artifacts than just those that had been ground by production or use. It also included minerals, whether utilized or not. The tabular-tools category was also included in the ground stone analysis, accommodating all edge-utilized tabular tools, because most edges were ground. In this way, all tools within a single morphological-type category were treated similarly during analysis, providing comparable data. A similar strategy was employed for the category of hammerstones, with both flaked and nonflaked specimens included in the flaked stone analysis.

Each tool/mineral sample was analyzed individually, with each tool use surface separately recorded for use-wear and surface-texture attributes. The analysis was conducted by Dawn Greenwald and Sharon Brown of Four Corners Research.

Methods

The ground stone analytical system comprised 15 variables: morphological type, artifact shape, mano cross-section or profile, use-wear type, wear intensity, wear extent, wear location, artifact condition, material type, grinding-surface texture, production investment, production techniques, recycling and reuse, surface adhesions, and artifact dimensions. Other significant attributes, such as heat alteration, unusual modifications, or design characteristics, were noted when present.

Morphological Type

Most of the ground stone types in the site collection were typical southwestern forms. Because of site location, a wide range of artifact forms were expected, from the Mogollon and Hohokam traditions and from culture areas in present-day northern Mexico. Some morphological types may be associated with one or the other of these traditions, so that their presence in the collection would provide helpful information regarding the cultural affiliation of site inhabitants or interaction/exchange. Morphological type was also useful in providing information on the range of activities, particularly in evaluating the relative level of functional diversity within the site.

Artifact Shape and Mano Profile

Artifact shape was determined from the plan view of each object. Shape was only evaluated if the artifact was complete or its condition was such that shape could be confidently determined. Artifact shape is sometimes associated with general function, such as the rectangular mano associated with more-intensive food processing, like corn grinding, and the round/oval mano associated with the grinding of small seeds (Adams 1999; Greenwald 1990). It is also a helpful descriptive attribute. The profile or cross section of each mano is a variable designed to determine patterns of use wear on grinding surfaces and surface preparation. It was recorded as plano-convex, biplanar, etc. The profile was determined from the mano end or across the latitudinal aspect.

Use Wear

Each unit of wear on each artifact was evaluated for use-wear type, wear intensity, wear extent, and wear location. Wear units were identified as discrete areas of continuous-edge or surface damage. Wear types included different forms of grinding damage, such as polish or striations, cutting/sawing, pitting, and battering. Wear intensity indicated the relative amount of use (light, moderate, or heavy) that was evident on tools, and wear extent indicated the amount of a surface or edge covered by use (percentage per surface/edge). Wear location documented whether use was focused or clustered in particular areas of a tool, such as the center, edge-to-edge (rocking motion), high spots, etc., or whether an entire surface had been utilized. These data provided information on pattern, range, and intensity of tool utilization; the relative importance of various activities; wear-management strategies; and function.

Artifact Condition and Dimensions

Artifacts were assessed for condition as a percentage of completeness. Those too fragmentary to determine percentage of completeness were documented merely as fragments of indeterminate completeness. Artifact condition provides information on discard behavior, intensity of use, and recycling (Adams 2005). Measurements were recorded for complete maximum dimensions using a metric tape and sliding metric board. In addition to constituting a descriptive variable, artifact dimensions may also be useful in evaluating the amount of surface area used to process plant materials and, therefore, the types and relative dietary importance of these foods. In addition, general temporal trends might also be identified, involving the shifting importance of generalized versus specialized seed processing (Adams 1999; Diehl 1996; Hard et al. 1996; Murrell 2007).

Material Type

Material types were identified both macroscopically and, when necessary, microscopically (20×), so that the most precise identification could be made. A wide variety of materials and material sizes would have been available prehistorically near the Mescal Wash site, from the Pleistocene terrace above Mescal Wash and Cienega Creek. Wedged between the Rincon Mountains to the north and the Empire Mountains and Whetstone Mountains to the south (see Chapter 1, Figure 4), site residents had access to a variety of sedimentary, igneous, and metamorphically raw materials. These rock types provide a source of textural variation that can have an important affect on the grinding efficiency of a milling implement (see Fratt and Biancaniello 1993; Murrell 2007).

Grinding-Surface Texture

Milling stones and other grinding tools were assessed for grinding-surface texture (fine, medium, or coarse). Prehistoric period tool users artificially roughened tool surfaces to achieve a desired texture or chose a raw material appropriate for the desired texture (see Murrell 2007). Therefore, texture classification was based on the material grain size, as well as any surface pecking. Smooth surfaces were classified as fine grained. Medium-grained surfaces were slightly rough, with pecks less than approximately 2 mm in diameter. Coarse-grained surfaces were rough, with vesicles or pecks greater than or equal to approximately 2 mm in diameter.

Production Investment and Techniques

All ground stone artifacts were assessed for production investment, or the amount of shaping each artifact had undergone. A "minimally altered" metate had been pecked only on the grinding surface. A "shaped" metate had been flaked and/or pecked on less than half of its entire form, including edges, ends, and faces. A well-shaped metate had been flaked and/or pecked on half or more than half of its form, and a metate with evidence of production over all or nearly all of its form was considered to be "completely shaped." These categories represent the amount of energy invested in the manufacturing process and can indicate whether the energy investment correlates with artifact type, function, or other factors (see Van Pool and Leonard 2002). Production techniques, such as flaking, pecking, and grinding, were determined from traces of manufacture left on the artifacts.

Multiple Functions and Surface Adhesions

Multiple functions were described as either similar use ("reuse"), different shape ("reshaped"), different uses at different times ("recycled"), multiple uses that possibly occurred simultaneously ("multiple use"), indeterminate, or a combination of these. Tool or material curation and maintenance are important criteria for investigating technological organization, as well as for understanding prehistoric period tool-function decisions and site-occupation histories (Schlanger 1991).

Each artifact was scanned briefly under low power (20×) for the presence of surface adhesions that might provide further information regarding tool function. Common surface adhesions were pigments. Others included clay, oil, phytoliths, and indeterminate types.

The Collection

The ground stone collection was composed of a variety of artifact types, material types, and production strategies representing a diversity of activities (Tables 94 and 95). Description of the collection follows, according to artifact-type categories or groupings of categories.

Materials

The ground stone collection was primarily composed of sandstones, with some granite and other felsic-igneous types, as well as metamorphic rock, quartzite, schist, and metasediment (see Table 94). These were locally available materials. Sandstone is certainly a good material for general grinding activities, whereas smooth materials, like quartzite, igneous, or metamorphic rocks, would reflect a lower degree of grinding efficiency. Murrell (2007:44) suggested that sandstone is an effective material for processing a variety of plant materials, whereas vesicular basalt is more efficient at processing maize. In addition, the use life of an artifact made of sandstone is much shorter than one made of vesicular basalt. That is, grinding-surface maintenance can remove a substantial portion of the artifact (also see Horsfall 1987; Stone 1994). Sandstone can be found in the Bisbee Group (Willow Springs Formation) and in the secondary deposits associated with the Pantano Formation (see Chapter 2, Volume 1). Although vesicular basalt is also present in the Bisbee Group, very little is present on the site.

Manos

A mano is the active partner of the metate and is used primarily for food grinding. Mano shape is usually standardized by shaping or by selecting an appropriate cobble form, often rectangular or oval. Wear patterns are also regular, as a result of daily food processing, typically back-and-forth or rotary grinding systems. Manos are frequently categorized by plan shape, profile shape, or size: round, oval, or rectangular/loaf; convex (cobble), trough, or flat; and two-handed or one-handed. Shape and wear distinguish these tools from hand stones, which are informal, smaller, and more generalized grinding tools. Manos at Mescal Wash were made primarily of sandstone (81.1 percent), although a variety of sedimentary, igneous, and metamorphic types were also present (Table 96).

A total of 454 manos were recovered. Of these, 234, or 51.4 percent, were complete, and the rest were fragments. Manos that were complete or nearly complete could be evaluated for production investment, shape, measurements, and other attributes that require at least one complete

Table 94. Ground Stone Material Types

Material Types	Count	Percent[a]
Andesite	1	0.1
Azurite	1	0.1
Azurite and malachite	2	0.2
Basalt	1	0.1
Chrysocolla	7	0.5
Concretion	2	0.2
Conglomerate	3	0.2
Diorite	1	0.1
Felsic-igneous NFS	61	4.7
Fossilized shell	1	0.1
Galena	1	0.1
Granite	25	1.9
Gypsum	1	0.1
Hematite	28	2.1
Hematite and limonite	1	0.1
Igneous NFS	52	4.0
Indeterminate	69	5.3
Jet	2	0.2
Limestone	5	0.4
Limonite	2	0.2
Malachite	4	0.3
Metamorphic NFS	19	1.5
Metasediment	3	0.2
Mica	20	1.5
Mudstone/siltstone	2	0.2
Quartz	1	0.1
Quartz crystal	3	0.2
Quartzite	54	4.1
Rhyolite	9	0.7
Sandstone	866	66.2
Schist/phyllite	33	2.5
Sedimentary NFS	22	1.7
Steatite	2	0.2
Turquoise	3	0.2
Vesicular basalt	1	0.1
Total	1,308	100.0

[a] Rounded to the nearest tenth.
Key: NFS = not further specified.

Table 95. Artifact Types within the Ground Stone Collection

Artifact Type	Count	Percent[a]
Mano	454	34.7
Hand stone	56	4.3
Grinding slab	42	3.2
Metate	107	8.2
Mortar	6	0.5
Pestle	44	3.4
Palette	12	0.9
Palette blank	4	0.3
Polishing stone	33	2.5
Tabular tool	28	2.1
Censer	14	1.0
Stone bowl	1	0.1
Indeterminate vessel	1	0.1
Reamer	5	0.4
Ornament	13	1.0
Shaft straightener	1	0.1
Axe	2	0.2
Stone ring	1[b]	0.1
Pipe/tube	2	0.2
Figurine	1	0.1
Cruciform	1	0.1
Pot lid	2	0.2
Stone ball	1	0.1
Biconcave object	1	0.1
Mineral	68	5.2
Indeterminate nether stone	69	5.3
Indeterminate active grinder	32	2.4
Other stone	18	1.4
Indeterminate ground stone	289	22.1
Total	1,308	100.0

[a] Rounded to the nearest tenth.

[b] Two refitted pieces counted as a single artifact.

artifact dimension. Those that were too fragmentary were not evaluated for these types of attributes and were, instead, given an indeterminate value.

Rectangular was the most frequent mano shape, accounting for 42.9 percent of the mano collection (Table 97; Figure 94a). Rectangular manos had a mean length of 16 cm, width of 10.6 cm, and thickness of 5.2 cm. They were usually well shaped or completely shaped (51.8 percent) (see Table 97), with a higher frequency of plano-convex than biplanar profiles (54.9 percent versus 38.5 percent, respectively), although there were similar numbers of single and two (opposing) grinding surfaces for this mano type. Production techniques were primarily pecking (95.9 percent), although pecking was sometimes accompanied by other techniques, such as grinding (28.7 percent), flaking (11.8 percent), or both flaking and grinding (4.1 percent). Only a small percentage (8.3 percent) had additional battering on mano ends; a higher percentage (11.8 percent) had been reused, reshaped, and/or recycled. Seven specimens (3.6 percent) had pigment adhering to tool surfaces (PDs 618, 843, 1559, 2789, 5780, 7069, and 7938), one had an indeterminate phytolith adhering (PD 7455), and one had oil residue on its grinding surface (PD 2039).

Oval manos were the second-most-frequent mano shape, accounting for about 20 percent, with a mean length of 14 cm, width of 9.8 cm, and thickness of 4.8 cm (see Figure 94b). Other shapes were present, but in very low frequencies. Oval manos usually had either very little or no production investment (none + minimal = 48.9 percent) (see Table 97). Oval manos were almost equally divided between biplanar (41.8 percent) and plano-convex (40.7 percent) profiles. When manufactured to shape, most were produced by simply pecking (37.4 percent), and 16.5 percent were produced by pecking and grinding. Almost a third (29.7 percent) had battered ends, and very few (4.4 percent) had been reused, reshaped, and/or recycled. Seven specimens (7.7 percent) had pigment adhering to tool surfaces (PDs 711, 2780, 3338, 5869, 6810, 6866, and 8440). Two specimens were unusual, in that each had also been used as a grinding slab on the surface opposite the mano surface (PDs 5736 and 7915). Although both of these manos were oval, they were also long and broad, with lengths of 16.5 and 18.4 cm, widths of 11.5 and 11.7 cm, and thicknesses of 3 and 3.8 cm. The larger of the two had distinctive end wear typical of use in a trough metate.

Looking more closely at the difference between the two primary mano shapes (rectangular versus oval), Tables 98 and 99 present data on wear unit and grinding-surface texture. Rectangular manos had slightly more single surfaces, and oval manos had a greater percentage of multiple surfaces. Grinding surfaces on oval manos were usually fine

Table 96. Mano Material Types

Material Type	Count	Percent[a]
Conglomerate	2	0.4
Felsic igneous	20	4.4
Granite	11	2.4
Igneous NFS	13	2.9
Indeterminate	12	2.6
Limestone	1	0.2
Metamorphic NFS	2	0.4
Quartzite	15	3.3
Rhyolite	1	0.2
Sandstone	368	81.1
Schist/phyllite	1	0.2
Sedimentary NFS	8	1.8
Total	454	100.0

[a] Rounded to the nearest tenth.

Table 97. Mano Shape, by Production Investment

Shape	None	Minimal	Shaped	Well Shaped	Completely Shaped	Indeterminate	Total
Rectangular	9	3	19	52	49	63	195
Oval	36	7	21	9	10	5	88
Round	—	1	2	1	4	1	9
Triangular	1	—	1	2	5	1	10
Square	—	—	1	—	1	—	2
Diamond	1	—	—	1	—	3	5
Irregular	3	2	2	1	—	—	8
Oblong	8	2	1	—	—	—	11
Semicircular	1	1	1	—	—	—	3
Indeterminate	8	2	2	—	1	110	123
Total	67	18	50	66	70	183	454

Figure 94. Manos from the Mescal Wash site: (*a*) a rectangular mano from Feature 5612 (Catalog No. 70286, PD 5897) and (*b*) an oval mano from Feature 609 (Catalog No. 70904, PD 370).

Table 98. Mano Shape, by Surface Texture

Surface Texture	Rectangular	Oval	Round	Triangular	Square	Diamond	Irregular	Oblong	Semicircular	Indeterminate	Total
Fine grained	61	69	6	2	1	3	7	10	2	60	221
Medium grained	69	13	2	6	—	1	1	—	—	25	117
Coarse grained	63	5	1	2	1	1	—	1	1	10	85
Indeterminate	2	1	—	—	—	—	—	—	—	28	31
Total	195	88	9	10	2	5	8	11	3	123	454

Table 99. Mano Shape and Ground Surfaces

Ground Surface(s)	Rectangular	Oval	Round	Triangular	Square	Diamond	Irregular	Oblong	Semicircular	Indeterminate	Total
Single surface	102	27	2	5	1	2	4	4	—	52	199
Multiple surfaces	93	61	7	5	1	3	4	7	3	71	255
Total	195	88	9	10	2	5	8	11	3	123	454

textured, whereas surface textures on rectangular manos were more evenly distributed among fine, medium, and coarse. When multiple grinding surfaces did occur, they were usually of different textures on rectangular manos and of similar textures on oval manos.

In general, there were slightly more manos overall (without regard to shape) with multiple grinding surfaces (55.8 percent) than with single grinding surfaces (44.2 percent) and a very small percentage of manos with three grinding surfaces (1.5 percent). Manos with single grinding surfaces were more often plano-convex in profile (49.5 percent), reflecting the altering of only one surface area, and manos with two grinding surfaces were usually biplanar in profile, reflecting the alteration of two opposing surface areas. Manos with three wear units did not exhibit any particular patterns of latitudinal profile.

During analysis, use wear was most often recognized as a form of surface reduction that changed a surface landscape into a more regularized gradient or plane. Striations were the most-frequent evidence of use wear and were noted on 87.4 percent of all manos. Bidirectional striations were more common than multidirectional striations (65.4 percent versus 22 percent, respectively) and were more common on rectangular manos than on oval manos (78.5 percent versus 59.3 percent, respectively). Oval manos, on the other hand, had higher frequencies of multidirectional striations (35.2 percent on oval manos and 16.4 percent on rectangular manos), although sometimes both multidirectional and bidirectional striations were noted on the same surface, often with bidirectional striations dominant. Polish was not common, noted on only 4.2 percent of all manos (6.2 percent of rectangular manos and 1.1 percent of oval manos), and did not always indicate heavy-intensity use wear. Heavy intensity was determined by a demonstrable change in the morphology of a surface as a result of grinding, such as curving of mano ends in response to the shape of the metate on which it was being used or from rocking wear on mano edges as a result of the milling motor patterns of the grinder. Moderate-intensity use wear was determined by macroscopic evidence of use wear (readily visible to the naked eye, but not enough to modify surface morphology), and light-intensity use wear was determined by microscopic evidence of use wear (not readily visible to the naked eye). Most manos exhibited at least one surface with moderate-intensity use wear (64.3 percent), with about half as many showing heavy-intensity use wear (27.8 percent) and fewer with light-intensity use wear (7.7 percent). Table 100 presents use-wear intensity by mano type/shape. Data indicated that, although most use wear was of moderate intensity, many of the rectangular manos exhibited some heavy-intensity grinding. In fact, 76.5 percent of all single-surface manos and 62.5 percent of all two-surface manos with heavy-intensity grinding were rectangular. Oval manos had twice the relative frequency of light-intensity grinding surfaces than rectangular manos, suggesting differences in foods that were ground and/or differences in grinding strategies. Similar grinding intensities (light, moderate, or heavy) were twice as frequent on oval manos as on rectangular manos.

Mano grinding location and extent are also summarized in Table 100. The majority of the manos were each ground over an entire surface, rather than in the center or off center, and were ground over 100 percent of the surface. According to traditional perspectives, rectangular manos were used to grind the maximum amount of food product, so that the entire use surface was utilized to its maximum extent. These mano types were usually longer, with a generally flat use surface, and were probably best used with two hands. The longer surface provided a greater use-surface area, yielding more ground meal per grinding stroke than did smaller manos. Oval manos were generally smaller; so, although most of the use surface was also ground, they would not have produced a yield of ground foodstuff as high as that produced using longer manos. But because of

Table 100. Mano Shape, by Grinding Intensity, Location, and Extent

Wear Attribute	Rectangular	Oval	Other Shapes
Grinding intensity[a]			
Light-intensity surface wear only	8	8	2
Moderate-intensity surface wear only	74	47	29
Heavy-intensity surface wear only	57	7	1
Multiple wear units with the same intensity	40	38	52
Multiple wear units with different intensities	53	25	19
Grinding location[a]			
Center only	—	6	2
Entire surface only	163	52	33
Rocking wear (over edge) only	6	5	1
Off center only	1	—	—
High spots only	—	3	2
Grinding extent[a]			
Entire surface only	178	64	53
50–90% of surface only	8	21	12
25–49% of surface only	—	1	—

[a] Total number of tools; does not include indeterminate cases.

the smaller, more-convex surface, the oval mano could be rotated slightly up and down with each stroke, providing a slightly larger use-surface area per grinding stroke (see Adams 2002).

When use-wear type was considered as a criterion for mano classification, two use-wear types were found to display discrete attributes: those with trough wear on mano ends and those with only multidirectional grinding on use surfaces. Trough wear is the intensive grinding wear seen on the ends of manos used in concert with trough metates and whose ends abrade frequently against the trough wall (Figure 95a). This constant abrasion produces a flattening or faceting and polishing adjacent to and at the ends of the primary grinding surface. A comparison between these two groups was conducted for all whole manos (Table 101). Results indicated that important factors in distinguishing between the groups were bidirectional versus multidirectional grinding patterns, heavy versus light grinding intensity, fine versus coarse surface texture, production-investment value, and multiple functions. Although manos with trough wear were usually rectangular in shape, multidirectional-grinding manos were either rectangular or oval in shape, and although trough-wear manos usually had a single use surface and multidirectional-grinding manos usually had two grinding surfaces, the difference did not appear significant. Multidirectional-grinding manos are usually smaller than trough-wear manos, but group distributions of length and surface area overlapped. Both types are usually plano-convex in profile and are usually made of sandstone.

Trough-wear manos are primarily bidirectional-grinding implements, and use surfaces usually exhibit heavy-intensity grinding. Grinding surfaces are often coarse textured, and manos have high production values. None of the trough-wear manos from Mescal Wash were informal tools; all specimens had some evidence of production modification. Therefore, it is presumed that these tools were more expensive equipment than the multidirectional-grinding manos, which were often unshaped. Very few trough-wear manos exhibited multiple use attributes (reuse, recycling, etc.). Attributes of trough-wear manos, such as heavy intensity, bidirectional grinding, high production-investment values, and coarse-textured surfaces, are mirrored in the characteristics of trough metates (see below).

Multidirectional-grinding manos usually exhibited moderate-intensity grinding and had a relatively high frequency of fine-textured surfaces. Approximately one-third were unshaped, and the same amount had high production-investment values, suggesting variability in overall tool value, but because most of these tools were multiuse, perhaps their value was determined by functional versatility rather than by a large amount of production investment. They constituted a frequent mano type found in Loci A, C, and D.

A third type of mano was noted during analysis. This was a relatively long, rectangular mano with ends that curved gradually, but distinctly, in the same direction, forming a convex-shaped longitudinal profile (see Figure 95b). These manos would have functioned well in concert with concave metates, described below, but they also appeared to represent early trough-wear-mano forms. They have characteristics similar to trough-wear manos (see Table 101), including bidirectional grinding, heavy-intensity grinding, and high investment values. Only 13 complete specimens were noted during the analysis, all within Locus D.

Hand Stones

Hand stones are small, often irregularly shaped, active grinders that do not conform to typical mano shapes or sizes. Hand stones often exhibit no production investment and may display adhesions, such as pigment, and multidirectional, irregular striations. In other Southwestern collections, these small grinders are generalized grinding tools that are sometimes associated with nonfood processing (Adams 2002; Fratt 1991:69; Greenwald 1993a), but for almost half of the Mescal Wash collection, hand stones appeared to represent handheld grinding stones that had been broken and subsequently reused; the latter tools did not resemble the standard mano size and shape after breakage.

Fifty-six hand stones were analyzed; of these, 48, or 87.3 percent, were in complete condition. Mean measurements were 7.9 × 5.3 × 3 cm. Sandstone was the primary material type, composing 67.3 percent of hand stones, compared to 81.1 percent of the manos. Other material types included indeterminate sedimentary (7.3 percent), indeterminate igneous (7.3 percent), indeterminate (7.3 percent), quartzite (5.5 percent), felsic igneous (3.6 percent), and schist (1.8 percent). Irregular, oval, and oblong were the three most common tool shapes (41.8 percent, 21.8 percent, and 16.4 percent, respectively), and biplanar was the most frequent (45.5 percent) latitudinal profile. Very few specimens exhibited evidence of manufacture; 80 percent had no production modification and were naturally shaped cobbles.

Use-wear attributes were similar to those on oval manos. Multidirectional striations were the primary wear type (63.6 percent), grinding surfaces were usually of fine-grained texture (90.9 percent), and use wear was usually of moderate intensity and covering the entire surface (76.4 percent). Adhesions were present on 12.7 percent of all hand stones and included pigment, clay, and indeterminate adhesion types. Battering was exhibited on 27.3 percent of all hand stones, and the same percentage represented hand stones that had been reused and/or reshaped from broken tools, the most common of which were manos and hammerstones. One hand stone was a multifunctional tool, used for both grinding and reaming. It was a small, oblong, flattened igneous cobble with rotary wear on both ends.

Figure 95. Manos from the Mescal Wash site (*continued*): (*a*) a rectangular mano with trough wear, one side used as a grinding slab, from Feature 7697, Subfeature 30 (Catalog No. 70716, PD 7915); (*b*) a convex mano with three grinding surfaces, from Feature 609 (Catalog No. 70903, PD 370).

Table 101. Comparisons among Whole Manos with Trough Wear,Curved Ends, and Multidirectional Grinding

Attributes	Trough Wear (n = 38) (percent)	Curved Ends (n = 13) (percent)	Multidirectional Grinding Only (n = 44) (percent)
Rectangular shape	84.2	84.6	40.9
Oval shape	7.9	7.7	38.6
Biplanar profile	34.2	15.4	34.1
Plano-convex profile	45.5	76.9	57.9
Bidirectional grinding only	63.2	76.9	—
Multidirectional grinding only	7.9	—	100.0
Light-intensity grinding only	—	—	9.1
Heavy-intensity grinding only	65.8	76.9	13.6
Fine-textured surface only	5.3	15.4	47.7
Coarse-textured surface only	36.8	15.4	15.9
Well or completely shaped (production investment)	86.8	84.6	34.1
No production modification	—	—	34.1
Sandstone material type	84.2	76.9	81.8
Multiuse tools	18.4	—	56.8
Pigment adhering	7.9	7.7	11.4
One grinding surface	65.8	23.1	40.9
Two grinding surfaces	31.6	76.9	59.1
Mean length (range [cm])	16.9 (10.2–24.4)	17.9 (14.2–25.1)	12.6 (6.5–21.1)
Mean area (range [cm])	178.8 (104–281.2)	195.9 (123.5–326.3)	121.6 (41.6–242.4)

Metates

Metates are the nether grinding or milling stones used in concert with manos, primarily for food production (grain processing). They are relatively large tools, often referred to as "stand-alone equipment," implying relatively long-term use, because their large size and great weight would make mobility difficult. Four different types of metates were identified in the ground stone collection: slab, basin, trough, and concave. Slab metates have a relatively flat (usually less than 1 cm deep) grinding surface that extends, more or less, over the entire metate surface. Slab metates (or milling stones) in the southern portion of the Southwest are usually generalized grinding tools that are unshaped or minimally shaped and are often present in Archaic period collections, as well as some Formative period collections (Figure 96a). These are not to be confused with formal slab metates, which are found in the northern Southwest and are commonly associated with milling bins. Basin metates exhibit a round or oval depression in the approximate center of the tool, formed by circular and/or reciprocal mano grinding; they are usually associated with the grinding of wild or small plant seed (see Figure 96b). Shallow basins are less than or equal to approximately 3 cm in depth, and deep basins are greater than 3 cm in depth. Basin metates are often unshaped or minimally shaped and are widely associated with the Archaic period, although there is residual reuse of these metates during later periods. Trough metates have large, rectangular depressions produced from preparation by pecking and from a reciprocal (back-and-forth) grinding pattern (Figure 97a). Trough metates are associated with the Formative period, when corn and other domesticates were added to the prehistoric period diet. Concave metates have a gentle U-shaped grinding surface that curves from edge to edge with no discernable wall, although the grinding pattern is bidirectional (see Figure 97b).

A total of 107 metates and metate fragments were recovered and analyzed. Of these, 20 were complete specimens (10 slab, 8 trough, and 2 basin). The majority of metates were produced from sandstone (67.9 percent), although nearly half of the informal slab metates were composed of other materials (Table 102). Only 5 specimens had more than one wear unit (grinding surfaces): 2 slabs (PDs 7392 and 7546), 1 basin (PD 8009), and 2 indeterminate fragments (PDs 1538 and 7392). Multifunctional

Figure 96. Metates from the Mescal Wash site: (*a*) a slab/flat metate from Feature 3756 (Catalog No. 70356, PD 3361) and (*b*) a basin metate from Feature 3756 (Catalog No. 70355, PD 3361).

Figure 97. Metates from the Mescal Wash site (*continued*): (*a*) a trough metate from Feature 4683 (Catalog No. 70358, PD 5029) and (*b*) a concave metate from Feature 801 (Catalog No. 70354, PD 802).

Table 102. Metate Type, by Material Type

Material Type	Slab	Basin	Trough	Concave	Indeterminate	Total
Andesite	—	—	1	—	—	1
Conglomerate	1	2	—	—	—	3
Felsic igneous	—	1	2	—	5	8
Granite	—	—	2	—	2	4
Indeterminate	2	—	1	—	2	5
Indeterminate igneous	1	—	1	—	2	4
Indeterminate metamorphic	—	1	—	—	1	2
Limestone	—	—	—	—	2	2
Quartzite	2	—	2	—	1	5
Sandstone	7	9	28	1	28	73
Total	13	13	37	1	43	107

tools included 2 reused slab metates (PDs 1165 and 7546), 1 reused trough metate (PD 888), 1 reshaped basin metate (PD 1729), and 1 trough metate that was a reshaped/reused metate (PD 1003).

Slab-metate (n = 13) attributes followed traditional patterns (see Figure 96a). Many had very little or no production modification (Table 103). Grinding usually extended over the entire surface (76.9 percent), with use wear composed of bidirectional striations (38.5 percent), multidirectional striations (38.5 percent), or both (15.4 percent). Use-wear intensity varied over the full range of possibilities—light (15.4 percent), moderate (61.5 percent), and heavy (15.4 percent)—and one specimen (PD 7546) had moderate- and heavy-intensity wear on two different surfaces. Grinding-surface texture was either fine or medium; there was only one specimen with a coarse-textured surface. The slab metates had a mean length of 35.7 cm, width of 26.7 cm, and thickness of 13.4 cm. One slab metate (PD 1538) had a use surface that was at a 30° angle from the tool base. Most of the grinding on this metate was centrally located and slightly concave, with heavy, bidirectional striations. The height at the bottom end of the use surface was 14 cm, and the height at the top was 21.2 cm. It resembled grinding slabs at the site of Cerro de Trincheras that had distinctively sloped, flat grinding surfaces with slight concavities in their centers (see Bowen n.d.; McGuire and Villapando Canchola 1993). Whether the resemblance is coincidental is unknown.

Basin metates (n = 13) were generally larger than the slabs, with a mean length of 52 cm, width of 33.8 cm, and thickness of 12.4 cm (see Figure 96b). Only four basin metates could be evaluated for production investment, and these tools were either shaped or minimally shaped, but all but two specimens (PDs 2391 and 3361) exhibited production techniques (flaking and/or pecking) on tool surfaces, suggesting that basin metates were usually manufactured to some extent, although the level of investment was low. Basins ranged in depth from 2.8 to 6.7 cm. Although multidirectional-grinding striations constituted the primary type of use wear (61.5 percent), bidirectional striations did occur on 23.1 percent of the specimens, and grinding intensity was always heavy. Basin textures were varied; most were medium (53.8 percent), followed by fine (23.1 percent). Only one specimen (PD 8009) was coarse textured. It was also bifacial, with one medium-textured basin and one coarse-textured basin.

Trough metates (n = 37) were between slab and basin size, with a mean length of 39.8 cm, width of 28.1, and thickness of 15.7 cm (see Figure 97a). Trough depths were widely variable and ranged between 2.4 and 25 cm. When trough metates could be identified to shape and type, most were full-trough metates (22.2 percent of all trough-metate types), with grinding surfaces extending from one end to the other on each. Only one specimen (PD 3361) was identified as a closed-end trough, the grinding surface of which extended only partially across the length of the metate. In this case, only one end was “open” (that is, the metate was ground over one end). It was smaller than most trough metates (length = 29 cm, width = 31.2 cm, and thickness = 2.5 cm) because it had been broken and then subsequently reused in a small portion of the trough use surface. Trough metates followed traditional type patterns, with primarily bidirectional-grinding striations (94.4 percent), heavy grinding intensity (100 percent), coarse-textured use surfaces (52.8 percent) (medium textures accounted for 22.2 percent), and higher production-investment values than either slab or basin metates (see Table 103). A sandstone trough metate and rectangular mano (PD 250) were found associated with one another in Feature 231, Locus C. An unknown yellowish-brown

Table 103. Metate Type, by Production Investment

Production Investment	Slab	Basin	Trough	Concave	Indeterminate	Total
None	5	—	—	—	—	5
Minimal	5	2	1	—	—	8
Shaped	2	2	6	—	—	10
Well shaped	—	—	3	—	—	3
Indeterminate	1	9	27	1	43	81
Total	13	13	37	1	43	107

substance adhered to one side of the mano and to the metate grinding surface.

A single concave metate fragment exhibited bidirectional-grinding striations, heavy grinding intensity, and a coarse-grained texture (PD 802) (see Figure 97b).

Indeterminate metate types accounted for 38.7 percent (n = 43) of all metates and metate fragments. This category consisted of broken metates that were too fragmentary to determine type. Analysis notes suggest that trough-, basin-, and concave-metate types were possibly contained in the indeterminate metate category.

Grinding Slabs

Grinding slabs are small, passive grinders (lap sized or smaller) with a relatively flat use surface. These were probably generalized tools used to grind a variety of materials (Fratt 1991:68; Greenwald 1993b:327). Twenty-nine out of 42 grinding slabs (67.4 percent) were complete specimens, with a mean length of 21.7 cm, width of 13.5 cm, and thickness of 5.7 cm—much smaller than the average slab metate. Most grinding slabs exhibited bidirectional striations and moderate-intensity grinding on fine-textured use surfaces. They were often naturally thin, sandstone slabs with very little or no production modification. A relatively large percentage (16.3 percent) were reused, recycled, or reshaped and/or had evidence of multiple functions. For example, one specimen had been recycled from a rectangular mano, and several specimens exhibited pitting, possibly from anvil use. One grinding slab (PD 7813) had its use surface at a 20° angle from the tool base, similar to Trincheras grinding slabs and to the slab metate with a tilted use surface (see above) (Figure 98). Five grinding slabs (11.6 percent) had pigment adhering to use surfaces: PDs 2499, 4506, 5353, 5869, and 6977.

Mortars and Pestles

Of the mortars recovered from Mescal Wash, five were complete, with a mean length of 39.8 cm, width of 35.3 cm, and thickness of 19.4 cm; the sixth mortar was a burned fragment. Bowl depths ranged from 4.5 to 14 cm, and aperture diameters ranged between 13 and 25 cm. Use-surface texture was medium, and grinding intensity was heavy. Production investment was low, with only minimally shaped and shaped values for these tools.

Two mortars are “gyratory crushers,” as first known from the Sierra Pinecate in northwestern Sonora, Mexico (Hayden 1967, 1969). Of each, the bottom has been punched through, the opening trimmed to form an even circle, and the rims of the hole pecked to form a smooth, rounded surface, polished further from wear (Figure 99a). Using a wooden pestle, mesquite pods would have been crushed in the mortar, with the reduced material falling into a container beneath the hole (Hayden 1969:155–156). The artifacts came from a structure (Feature 2192) in Locus A (PD 6446, Catalog No. 70859) and a stripping unit in Locus D (PD 2900, Catalog No. 70357). On the bottom of the second was a small, round mano (PD 2900, Catalog No. 75005), reshaped by flaking around three-quarters of the edge, perhaps in an attempt to fit the stone in the hole (see Figure 99b).

There were seven times as many pestles as there were mortars; it is typical in most ground stone collections to have a high ratio of pestles to mortars, possibly because of the lack of preservation of wooden mortars or the use of bedrock mortars (Russell 1975:75). Pestles were often multipurpose tools (72.1 percent of all pestles), with other functions consisting of use as hand stones, manos, reamers, hammerstones, and nether stones, such as grinding slabs. Pestles came in nearly every conceivable shape, including rectangular, oval, triangular, cylindrical, conical, irregular, and oblong (the most frequent, at 51.2 percent) (Figure 100). They exhibited a mean length of 8.6 cm and width of 8 cm, with two “mini” pestles measuring 7.2 cm and 9.6 cm in length.

Palettes

Palettes are specialized nether stones that are small, often rectangular, tabular, stone slabs. Summary data for the 12 palettes and 4 possible palette blanks found at Mescal Wash are provided in Appendix 5A. Palettes range from

Figure 98. Grinding slab from Feature 7692, Subfeature 22 (Catalog No. 70544, PD 7813).

Figure 99. Gyratory crusher from Stripping Unit 2493: (*a*) a mortar of "gyratory crusher" type (Catalog No. 70357, PD 2900), (*b*) the same mortar with reworked mano (Catalog No. 70505, PD 2900) in place.

Figure 100. Pestles from the Mescal Wash site: (*a*) Stripping Unit 1592 (Catalog No. 70085, PD 1593), (*b*) Feature 290 (Catalog No. 70173, PD 1216), and (*c*) Feature 1575 (Catalog No. 70174, PD 1769).

the naturally thin forms of most southwestern Formative period cultures to the elaborately shaped and ornamentally carved artifacts of the Hohokam. They are typically associated with pigment processing and were often used for ceremonial functions. Hematite and other colored adhesions were noted on several of the Mescal Wash palettes (see Appendix 5A).

Palettes from Mescal Wash were both formal and informal types. Six of the 12 specimens had been completely shaped by grinding and were decorated through incising (PDs 5548, 5725, 7078, 7392, 8454, and 9635) (Figures 101 and 102). Three had been somewhat shaped by grinding (PDs 521, 5574, and 7512) (Figure 103), 1 by grinding and pecking (PD 3010) (Figure 104), and 2 were naturally shaped cobbles with no production modification (PDs 1720 and 1941) (Figure 105). Palette material types included schist (n = 5, or 42 percent), sandstone (n = 4, or 33 percent), indeterminate igneous (n = 2, or 17 percent), and indeterminate (n = 1, or 8 percent). Nine palettes were complete or nearly complete, with mean measurements of 13.6 by 7.5 by 1.5 cm. Textures were usually fine, and use wear was variable. Both bidirectional and multidirectional striations were observed, and light, medium, and heavy grinding intensities were noted.

Four possible palette blanks or palettes in various stages of production were identified (PDs 1751, 1758, 7546, and 9575) (Figure 106). Additionally, a very small or miniature, formal palette (PD 9635) (one of the six shaped and incised palettes listed above) was modified into a pendant by drilling a hole through the artifact near one of the edges (Figure 107).

Polishing Stones

Polishing stones are smooth pebbles or small cobbles that exhibit evidence of polish or nonabrasive grinding. They are associated with ceramic manufacture and have been interpreted as polishing tools that were used to smooth the plastic clay of ceramic vessels prior to the ceramic firing process. Interpretations as ceramic polishers are based on both ethnographic evidence (Colton 1931; Colton 1952; Hill 1937) and archaeological associations (Geib and Callahan 1988; Sullivan 1988). Adhesions, such as pigment and/or clay, sometimes remain on the tool surfaces as evidence of their use during the ceramic manufacturing process; therefore, polishing stones were not washed prior to analysis. Instead, each tool was carefully scanned, microscopically, to determine the presence of adhesions. If a specimen was too dirt encrusted for scanning, it was lightly dry brushed or lightly rinsed with water and air dried. These methods proved successful for almost a quarter of the polishing stone collection.

A total of 33 polishing stones were analyzed. Lengths of the 29 complete specimens ranged from 2.1 to 6.4 cm, with a mean length of 4.3 cm. Mean width was 3.4 cm, and mean thickness was 2.2 cm. Polishing stones were composed primarily of sandstone cobbles (40.6 percent), and all of the specimens were naturally smooth (fine-grained texture), with no production modification. Shapes were mostly oval or round (78.1 percent), with one distinct polishing-wear surface (including one continuous-wear area that covered the entire cobble surface) (65.6 percent) or two distinct wear surfaces (34.4 percent). Polish was present on 65.6 percent of all polishing stones, multidirectional striations were present on 75 percent, and bidirectional striations and indeterminate grinding were exhibited on one specimen each. Use wear was usually noted on an entire surface, although a few times it was present only in the center or on one end of a tool, and wear intensity was either moderate (68.8 percent) or light (31.3 percent). Clay was found adhering to 15.6 percent of all polishing stones, and pigment was found adhering to 6.3 percent (also see Geib and Callahan 1988).

Tabular Tools

Tabular tools constitute an artifact class that may incorporate various functional types, although the entire collection may be morphologically similar. They are thin, tabular slabs utilized on tool edges, rather than on tool surfaces, as noted for palettes and grinding slabs. Tabular tools can be unshaped, tabular materials with naturally sharp edges used for the purpose at hand, or they can be well-shaped to completely shaped artifacts whose surfaces have been ground and whose edges have been flaked, ground, and/or incised to produce an effective edge. The most common function of tabular tools was use as knives; other functions included uses as scrapers and hoes. Tabular knives are often associated with agave-plant processing, with supporting functional studies from ethnographic analogy, phytolith analysis, and microscopic use-wear analysis. It has been documented that tabular knives were used historically for removing or trimming agave leaves (Castetter et al. 1938; Russell 1975). Ethnographic data, in addition to experimental and use-wear analyses of tabular knives (Bernard-Shaw 1983, 1984, 1985; Greenwald 1988:172–187) and their association with features related to agave cultivation (Fish, Fish, and Madsen 1985; Fish, Fish, Miksicek, and Madsen 1985), suggest that tabular knives were used in the initial processing of plants or plant parts, especially agave, although agave may not have been the only economic plant that was processed with these tools.

There were 28 tabular tools in the Mescal Wash collection. Of these, 26 exhibited cutting/sawing wear along tool edges, providing evidence of their use as knives. One of these tools was a hoe that had been reshaped and recycled from a tabular knife (PD 1957). Its chopping use wear was found on one end, with residual cutting/sawing edge wear typical of knives. One of the tabular knives (PD 1760) had

Figure 101. Palettes shaped by grinding and decorated through incising: (*a*) Feature 6098 (Catalog No. 70346, PD 8454) and (*b*) Feature 6095 (Catalog No. 70348, PD 7392).

Figure 102. Shaped and incised palettes and palette fragments from Feature 7880, a structure in Locus D: (*a*) Catalog No. 70333, PD 5548; (*b*) Catalog No. 70335, PD 7078; and (*c*) Catalog No. 70336, PD 5725.

Figure 103. Palettes shaped by grinding: (*a*) Feature 245 (reassessed as a natural depression) (Catalog No. 70294, PD 521) and (*b*) Feature 5612 (Catalog No. 70205, PD 7512).

Figure 104. Palette shaped by grinding and pecking, collected as PP 3010 (Catalog No. 70321, PD 3010).

Figure 105. Palettes made from naturally shaped cobbles: (*a*) Feature 1571 (Catalog No. 70080, PD 1720) and (*b*) Feature 3680 (Catalog No. 70036, PD 1941).

Figure 106. Palette blanks: (*a*) Feature 5994 (Catalog No. 70350, PD 7546), (*b*) PP 1751 (Catalog No. 70352, PD 1751), and (*c*) SU 1757(Catalog No. 70345, PD 1758).

Figure 107. Miniature drilled palette used as a pendant from Feature 8655 (Catalog No. 70349, PD 9635).

hematite powder adhering to the tool edge, to approximately 0.5 cm from the edge on either surface—further evidence of tool reuse. One tabular tool had scraping wear (PD 5780).

Six tabular tools were complete specimens (PD 1760, 1957, 5780, and three tools from PD 6444). Material types were dominated by schist and phyllite (64.3 percent), followed by sandstone (10.7 percent), quartzite (7.1 percent), metasediment (7.1 percent), siltstone (3.6 percent), indeterminate sedimentary (3.6 percent), and indeterminate metamorphic (3.6 percent). These artifacts exhibited a mean length of 15.1 cm, width of 8.1 cm, and thickness of 0.7 cm, with a variety of shapes represented (e.g., rectangular, triangular, crescent, or irregular). All of the tools that were complete enough for production-investment evaluation were shaped, well shaped, or completely shaped. None appeared to be lacking production modification.

Censers

Censers are stone vessels used in association with palettes and thought to have functioned as specialized containers for burning substances relating to ritual (Haury 1976:288–289). Specialized function is implied by the good quality of manufacture, the high frequency of decoration/design, and the small volume and use-surface area.

Fourteen censers of fine-grained sandstone were recovered from the site (Figures 108–114). Of these, 1 was found in a burial and only analyzed cursory before repatriation. Nine were complete specimens, and 2 were miniature examples (PDs 6995 and 11443) (see Figures 108a and 109a). Most censers had evidence of burning, and some were extremely burned and friable. Nearly all were found in Locus D; only 2 were found elsewhere, and both of these were recovered in Locus A, including one fragment found on the surface. Six of the censers were found in three caches (Features 1545, 7501, and 11442) identified at the site. One cache of 3 censers (Feature 1545) was in a nonthermal pit within Feature 799, an irregularly shaped, trash-filled depression in Locus D. All 3 were decorated, to greater or lesser extents (Table 104). A single censer was found in Feature 7501, a second cache identified in Locus D. A third cache in Locus D produced 2 more censers (Feature 11442).

Mean measurements (not including miniatures) were as follows: vessel diameter = 7.6 cm; vessel height = 3.8 cm; bowl (use-basin) diameter = 5.0 cm; and bowl depth = 2.1 cm. Censer data are available by individual specimen in Table 104. All censers exhibited some design attributes, even if it was only a single incised line around the vessel rim. Common design elements included cross-hatching, chevrons, zigzags, triangles, and dots; two specimens had differentiated panels, separated by an incised line (PDs 1547 and 6995) (see Figures 110a and 108a), and one specimen had undifferentiated panels, separated only by space between the design patterns (PD 7547) (see Figure 111a). Vessel forms included globular, circular, barrel shaped, and cylindrical. All of the censers were completely shaped artifacts. A specimen from Locus D, Feature 3617 (PD 1923) (see Figure 111b), had a few yellowish, indeterminate fibers adhering to the interior of its bowl-shaped use surface. The large, decorated censer coated with ochre from a primary cremation (Feature 4069) is discussed below.

Figure 108. Censers from Feature 7880: (*a*) Catalog No. 70300, PD 6995, and (*b*) Catalog No. 70318, PD 5312.

Figure 109. Censers from Feature 11442 (PD 11443): (*a*) Catalog No. 70332 and (*b*) Catalog No. 70301.

Figure 110. Censers from the Mescal Wash site, Feature 1545: (*a*) Catalog No. 70322, PD 1547; (*b*) Catalog No. 70304, PD 1546; and (*c*) Catalog No. 70305, PD 1546.

Figure 111. Censers from the Mescal Wash site: (*a*) Feature 834 (Catalog No. 70317, PD 7547) and (*b*) Feature 3617 (Catalog No. 70315, PD 1923).

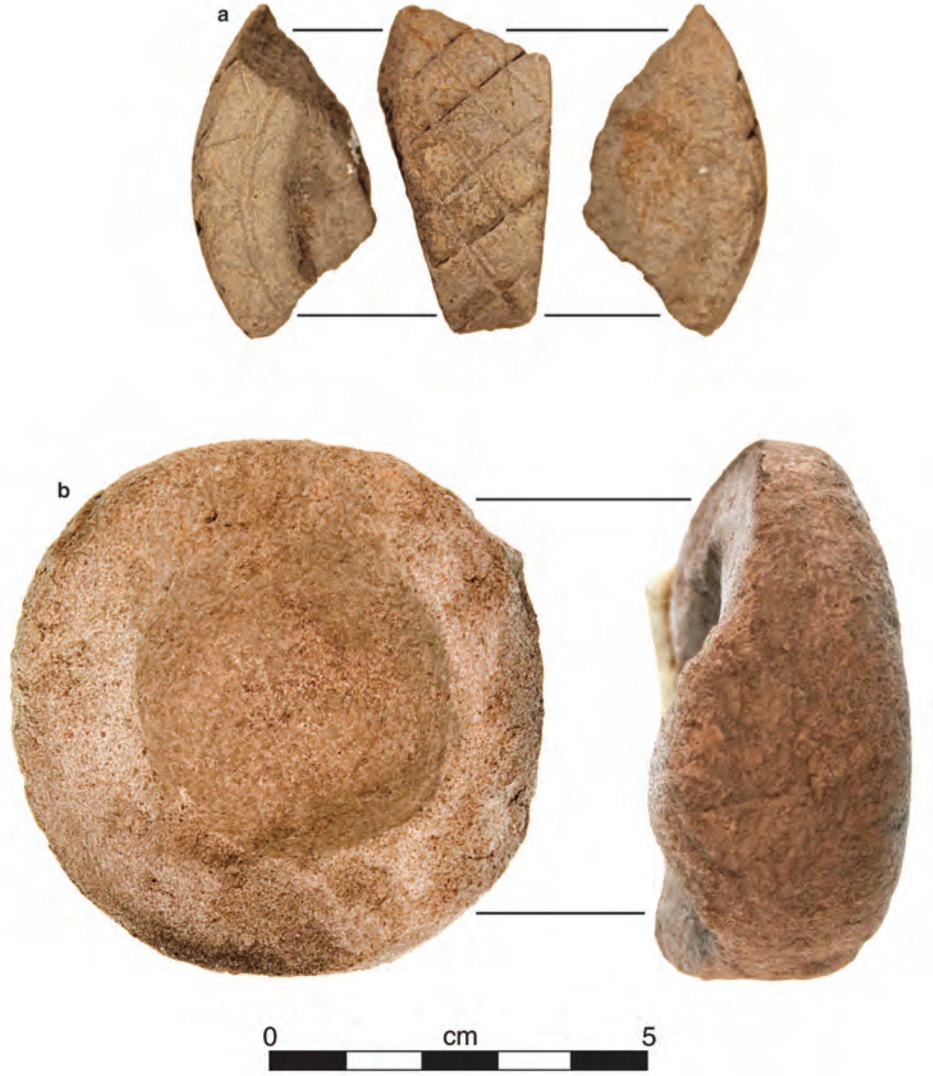


Figure 112. Censers from the Mescal Wash site (*continued*): (*a*) Feature 1923 (Catalog No. 70313, PD 1375) and (*b*) Feature 3681 (Catalog No. 70303, PD 3124).

Figure 113. Censers from the Mescal Wash site (*continued*): (*a*) Feature 3870 (Catalog No. 70302, PD 2457) and (*b*) Feature 7501 (Catalog No. 70314, PD 7502).

Figure 114. Censers from the Mescal Wash site (*continued*), PP 25 (Catalog No. 70320, PD 25).

Table 104. Censer Data

PD No., Locus, and Unit	Body		Bowl		Design
	Diameter (cm)	Height (cm)	Diameter (cm)	Depth (cm)	
PD 25, Locus A, PP 25	n/a	3.0	n/a	1.4	possible effigy (very weathered); chevrons (see Figure 114)
PD 1375, Locus A, Feature 1189	7.0	n/a	n/a	n/a	flat basal fragment; few diagonal lines (see Figure 112a)
PD 1546 (1), Locus D, Feature 1545, Catalog No. 70304	8.0	4.9	5.3	2.5	crosshatching with incised rim; incised line and parallel diagonal lines around rim (see Figure 110b)
PD 1546 (2), Locus D, Feature 1545	7.5	3.5	5.2	2.1	incised line on rim; plain body (see Figure 110c)
PD 1547, Locus D, Feature 1545	7.3	4.2	4.5	2.5	2 differentiated[a] horizontal panels of zigzags, or continuous chevrons; incised line on rim; globular with rounded base (see Figure 110a)
PD 1923, Locus D, Feature 3617	6.7	3.8	3.5	1.5	irregular crosshatching (see Figure 111b)
PD 2457, Locus D, Feature 3870	n/a	2.9	n/a	1.3	body fragment; crosshatching and “dots”(deeply incised) (see Figure 113a)
PD 3124, Locus D, Feature 3681	n/a	2.5	n/a	1.3	body/rim fragment; crosshatching; triangles and incised line on rim (see Figure 112b)
PD 5312, Locus D, Feature 7880	7.8	1.8	5.7	1.0	vertical lines on rim and partial base, barely extending onto body (otherwise plain) (see Figure 108b)

PD No., Locus, and Unit	Body		Bowl		Design
	Diameter (cm)	Height (cm)	Diameter (cm)	Depth (cm)	
PD 6995, Locus D, Feature 7880	4.9	3.0	3.4	2.0	“mini” censer; 3 differentiated[a] horizontal panels of vertical lines (extending onto rim and partially onto base); globular (see Figure 108a)
PD 7502, Locus D, Feature 7501	8.7	4.8	6.0	4.0	crosshatching extends partially to base as continuous chevrons (deeply incised)(see Figure 113b)
PD 7547, Locus D, Feature 834	9.5	n/a	5.8	3.2	2 undifferentiated[a] horizontal panels of chevrons in raised relief and depressed “dots” associated with the upper panel (see Figure 111a)
PD 11443, Locus D, Feature 11442	6.1	6.2	4.3	1.8	diamonds and triangles/chevrons; cylindrical (see Figure 109a)
PD 11443, Locus D, Feature 11442	3.6	1.6	2.5	?	“mini” censer; (see Figure 109b)

[a] Differentiated = divided by an incised line; undifferentiated = not divided by incising.

Other Bowls/Vessels

One vessel (PD 5770) (Figure 115) and one vessel fragment (PD 7936) were also recovered. They were made of sandstone and were indeterminate in function, possibly used as containers, mortars, or censers. The complete vessel was approximately round, measuring 9.2 cm in height, 8.5 cm in width, and 2.2 cm in thickness. It exhibited a few faint, incised lines on a small portion of the body wall, possibly representing a partially obliterated design. Fresh rim grinding on this artifact suggested that it may have been reshaped. The vessel fragment was approximately one-third to one-half complete. It was 2.2 cm in height, and the basin was 0.8 cm deep and approximately 3 cm in diameter at the rim.

Reamers

Reamers are handheld abrading tools used with a rotary motion to shape other artifacts (Figure 116). Use wear on these tools suggests that they were used to bore into other materials, producing holes or depressions. Haury (1976:284) associated these tools with the production of “rings,” which may mean ornament rings or larger stone rings or “donuts,” although the size of the tool and the tool projection, which can be irregular or tapered, may be more indicative of a tool’s function. Reaming tools from Snaketown varied widely in size and shape and were more common during in the Sacaton phase.

Three reamers (PDs 1259, 1905, and 3009) and two multifunctional reaming tools (PDs 7088 and 7397) were analyzed under this category (see Figure 116). Three, and possibly four, reamers were analyzed as secondary-use tools under the pestle category (see mortars and pestles discussions, above). Reamers as primary-use tools were usually oblong in shape, tapering slightly to a relatively wide, blunted end. They were made of sandstone (40.0 percent), schist/phyllite (40.0 percent), or indeterminate (20.0 percent) materials, with diverse manufacturing strategies; one was an unmodified cobble (PD 7397), one was shaped (PD 1259), and three were completely shaped (PDs 1905, 3009, and 7088). Tool lengths ranged from 7.4 to 12.9 cm, with a mean length of 10.2 cm, width of 2.9, and thickness of 1.7 cm. Multifunctional tools also exhibited evidence of polishing, scraping, and pestle wear as secondary use. The reamer/polishing stone had clay adhering to its polishing surface.

Ornaments

Stone ornaments of various materials included beads, pendants, and one nose or ear plug. Although 14 ornaments were recovered, 1 was classified as a palette (see above); therefore, only 13 are listed in Table 95.

Of the remaining 13 ornaments, 9 were beads, 3 were pendants, and 1 was a nose or ear plug (Table 105). Beads included various forms, including disc, barrel, square, rectangular, “mini,” biconvex, and effigy (Figure 117a–i). Jet and chrysocolla were the most common material types, although argillite, steatite, turquoise, and fossil also were present. Chrysocolla and turquoise materials were identified by hardness testing, as these types have similar superficial qualities. The nose/ear plug (PD 9329) (Figure 118a) was a cylindrical, plain, completely ground ornament of chrysocolla that measured 1.7 cm in length. Pendants consisted of 2 circular and 1 subrectangular. One of the circular pendants

Figure 115. Stone bowl from Feature 448 (Catalog No. 70319, PD 5770).

Figure 116. Reamers and multifunctional reaming tools: (*a*-*b*) reamers: (*a*) Stripping Unit 3008 (Catalog No. 70050, PD 3009) and (*b*) Feature 200 (Catalog No. 70295, PD 1259); (*c*-*d*) multifunctional reaming tools: (*c*) Feature 379 (Catalog No. 70299, PD 7397) and (*d*) Feature 2160 (Catalog No. 70221, PD 7088).

Table 105. Stone-Ornaments Data

PD No., Locus, and Feature	Artifact Type	Material Type	Description
PD 1202, Locus A, Feature 200	bead	jet	Round/biconvex; 1.2 × 1.2 × 0.6 cm (see Figure 117a).
PD 1234, Locus A, Feature 200	pendant	jet	Circular, with hematite, azurite, and pitch adhering; 2.0 × 1.6 × 0.3 cm (see Figure 118b).
PD 8161, Locus A, Feature 2192	bead	jet	"Mini" disc; 0.4 × 0.4 × 0.1 cm (see Figure 117f).
PD 7029, Locus C, Feature 379	bead	fossil (crinoid stem)	Disc; 0.8 × 0.8 × 0.4 cm (see Figure 117d).
PD 7136, Locus C, Feature 379	bead	argillaceous	Bird motif; 2.4 × 0.9 × 0.2 cm (see Figure 117b).
PD 7397, Locus C, Feature 379	bead	turquoise	Disc; 0.7 × 0.7 × 0.3 cm (see Figure 117c).
PD 7419, Locus C, Feature 379	pendant	steatite	Circular, with wide, central perforation; resembles a shell bracelet; 1.4 ×1.1 × 0.2 cm (see Figure 118c).
PD 9329, Locus C, Feature 9327	plug	chrysocolla	Plain; 1.7 × 0.7 × 0.5 cm (see Figure 118a).
PD 3408, Locus D, Feature 3869	bead	chrysocolla	Disc; 0.6 × 0.6 × 0.4 cm (see Figure 117h).
PD 5212, Locus D, Feature 825	bead	jet?	Square; 0.6 × 0.5 × 0.5 cm (see Figure 117e).
PD 5550, Locus D, Feature 4729	bead	chrysocolla	Approximately rectangular; tabular; 1.3 ×1.1 × 0.4 cm (see Figure 117i).
PD 6887, Locus D, Feature 4683	bead	steatite	Barrel; 0.4 × 0.5 × 0.5 cm (see Figure 117g).
PD 8679, Locus D, Feature 825	pendant	turquoise	Subrectangular; 1.2 × 0.6 × 0.3 cm (see Figure 118d).

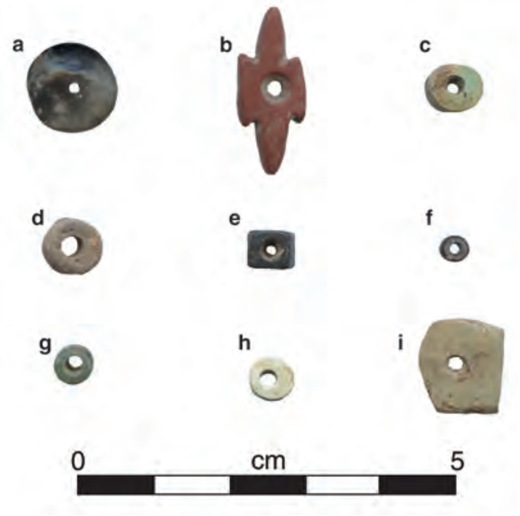


Figure 117. Beads from the Mescal Wash site: (*a*) Feature 200 (Catalog No. 70343, PD 1202); (*b*-*d*) Feature 379: (*b*) Catalog No. 70338, PD 7136; (*c*) Catalog No. 70342, PD 7397; and (*d*) Catalog No. 70344, PD 7029; (*e*) Feature 825 (Catalog No. 70307, PD 5212); (*f*) Feature 2192 (Catalog No. 70309, PD 8161); (*g*) Feature 4683 (Catalog No. 70308, PD 6887); (*h*) Feature 3869 (Catalog No. 70306, PD 3408); and (*i*) Feature 4729 (Catalog No. 70351, PD 5550).

Figure 118. Ornaments from the Mescal Wash site: (*a*) a nose or ear plug from Feature 9327 (Catalog No. 70347, PD 9329); (*b-d*) pendants: (*b*) Feature 200 (Catalog No. 70341, PD 1234), (*c*) Feature 379 (Catalog No. 70339, PD 7419), and (*d*) Feature 825 (Catalog No. 70340, PD 8679).

had a wide, central perforation and morphologically resembled a shell bracelet (PD 7419) (see Figure 118c). The second circular pendant was a solid circle, with a small, round protrusion that contained the drilled hole (PD 1234) (see Figure 118b). Pitch was adhering at the edge of the constricted area (between the drill hole and the pendant "body") and on the surface, near the perforation. Residue of hematite powder was adhering to one surface opposite the perforation, and azurite powder/granules were adhering to the pitch and to the surface of the pendant in the same area as the pitch. The presence of pitch in the constricted area and near the perforation suggested that pitch may have been used to attach something to the pendant (and painted with azurite), making this a composite ornament. The hematite may have been used as color decoration on the pendant or on the attachment. Three of the beads and a pendant were recovered in the fill of one structure, Feature 379, and a bead and a pendent were found in Feature 825, a structure.

Analysis uncovered some evidence for on-site production of ornaments. A scored piece of raw material (PD 9497) that had been used to produce ornament blanks by the cut-and-snap technique of manufacture was found in the fill of Feature 7461 (Locus C) (Figure 119). An irregular and broken piece of schist, 4.3 cm in length, had several lines incised on one surface, with two remnants of previously incised lines snapped off. One surface and the edges of the small slab were ground. A rectangular bead (PD 5550) (see Table 105; Figure 117i) also exhibited the cut-and-snap technique on one edge, showing similar techniques of manufacture on finished ornaments. This technique was common prehistorically and was summarized and illustrated by Jernigan (1978) and H. S. and C. B. Cosgrove (1932:62–63) (also see Cummings 1940).

Figure 119. Ornament blank from Feature 7461 (Catalog No. 70334, PD 9497).

Other Artifacts

Artifacts that did not fit into any of the above categories included a shaft straightener, axes, stone rings/donuts, pipes, a phallus-shaped object, a cruciform, pot lids, a possible stone ball, a biconcave object, and indeterminate passive and active grinding stones.

A circular mano collected from the surface of Locus E (PP 796) had a secondary use as a shaft straightener (Figure 120). A U-shaped groove had been abraded into one ground surface of the mano. The groove ran 5.6 cm long, the entire length of the mano. It was 1.1 cm wide in the center and approximately 0.3 cm deep.

Two complete axes were analyzed as ground stone. One (PD 7397), from Feature 379, Locus C, was a mostly naturally shaped sandstone cobble (Figure 121a), with pecking on a small portion of the tool. The other axe (PD 365), from Feature 364, Locus B, was a well-made $^3/_4$-grooved axe of diorite (see Figure 121b). It was highly polished, 13.9 cm in length, and was a ridged-and-grooved type of axe. Adams (2003) considered $^3/_4$-grooved axes to be hallmarks of the Hohokam.

Two sandstone stone-ring ("donut") fragments (PD 3124) from Feature 3681 (Locus D) fit together to form a larger fragment with a maximum diameter of 9.2 cm (Figure 122). Both sides of the ring were flat, the outer edge was flat, and the perforation (3–4 cm in diameter) was beveled. The fragments appeared completely shaped, and there was no apparent use wear. Stone rings occur in low frequencies at prehistoric period sites. There have been various functional interpretations for these artifacts, including uses as game elements (Haury 1976:290–291), corn shellers (Haury 1976:291), and digging-stick weights (Rodgers 1987:163) (also see Adams 2002:201–204).

Two pipe-bowl fragments came from Features 799 and 1575 (PDs 1549 and 1618, respectively), Locus D; neither

Figure 120. Circular mano/shaft straightener collected as PP 796 (Catalog No. 70290, PD 796).

Figure 121. Axes from Mescal Wash: (*a*) an axe from Feature 379 (Catalog No. 70298, PD 7397) and (*b*) a 3/4-grooved axe from Feature 364 (Catalog No. 70297, PD 365).

Figure 122. Stone ring or donut stone from Feature 3681 (Catalog Nos. 70021 and 70075, PD 3124).

Figure 123. Pipes or tubes: (*a*) Feature 799 (Catalog No. 2229, PD 1549) and (*b*) Feature 1575 (Catalog No. 70117, PD 1618).

fragment had intact ends (Figure 123). One was made of an indeterminate igneous material. All of the intact surfaces were altered by either grinding (exterior) or reaming (interior), there was no evidence of burning, and the bowl appeared to taper toward the bottom end, as do "cloud blowers," ceremonial pipes of the Southwest. The exterior diameter was approximately 4.2 cm, and the interior bowl diameter was approximately 2.2 cm. The second pipe-bowl fragment was made of fine-grained sandstone or some other sedimentary material and was similar in morphology to the first pipe fragment. Bidirectional grinding was evident on both interior and exterior, with an approximate exterior diameter of 3.3 cm and an approximate interior diameter of 1.8 cm. Pipes have been recovered from Late Archaic period sites in the Tucson Basin and are rare at Hohokam sites (Adams 2002:205–208, 2005; Haury 1976). On the other hand, they have been found at Formative period sites in the Mogollon region, at Casas Grandes (Di Peso et al. 1974:304), and in other Mexican contexts (McGuire and Villalpando Canchola 1993:50).

Figure 124. Phallus-shaped object from Trench 97 (Catalog No. 70293, PD 528).

A complete phallus-shaped object (PD 528) was recovered from Trench 97, Locus C (Figure 124). It was made from a natural concretion and, through grinding and incising over most of the artifact, was shaped into a phallus. The object was 6.1 cm long and 1.9 cm in diameter.

One cruciform (PD 9873), whole and completely shaped, was recovered from Feature 8655, Locus D (Figure 125). It was made of a black, indeterminate material that, although ground and polished all over, was slightly dull instead of lustrous. It was a square, symmetrical example, with each of the four corners slightly flattened and equidistant from the others, and had a length of 2.2 cm, a width of 2.2 cm, and a thickness of 0.4 cm. Surfaces were slightly convex, and edges were concave between corners; early examples have been termed "four-pointed objects" (Haury 1975). Flaked cruciforms have been found associated with Late Archaic period sites in the Tucson Basin (Adams 2005). Five cruciforms similar to the Mescal Wash example were recovered from the Paquimé site (Medio period, A.D. 1060–1340) in Mexico. Two were found in a medicine man's kit, although associations at other sites have been with dice-game paraphernalia and with burials (Di Peso et al. 1974:289; Ferg 1998).

Cruciform data from in and around the El Paso, Texas, region has been compiled and presented by Phelps (1966). Square cruciforms, similar to the one recovered at Mescal Wash, were identified as Type I (rectangular examples were Type II) and were associated most prominently with the State of Chihuahua, Mexico (31 out of 39 examples). Although Type II cruciforms were usually made of obsidian, only 15 percent of Type I cruciforms were obsidian; other materials were various types of igneous (felsite, andesite, rhyolite, basalt, etc.), agate, chert, and bone; very few were polished. Helps' (1966) study determined that, of 37 specimens of Type II cruciforms, 11 (29.7 percent) were recovered from sites with ceramics and 26 (70.3 percent) from nonceramic sites. Statistics were similar for Type II cruciforms (28.2 percent and 71.8 percent, respectively).

Two approximately oval ceramic-vessel pot lids (Figure 126) were recorded from Locus D (Features 437 and 3681) (PDs 1905 and 3290, respectively). Both specimens

Figure 125. Cruciform from Feature 8655 (Catalog No. 70337, PD 9873).

Figure 126. Pot lids: (*a*) Feature 437 (Catalog No. 70046, PD 1905) and (*b*) Feature 3681 (Catalog No. 70296, PD 3290).

were complete; one was sandstone, and the other was schist. The sandstone lid was well shaped by flaking, pecking, and grinding and measured 10.9 cm in length. The schist lid was shaped by flaking and grinding and measured 9.3 cm in length.

One stone ball (PD 1760), or possible stone ball, was recovered from Locus D, Unit 1759. This object was complete and consisted of a more or less round sandstone cobble measuring 11.6 cm long by 10.5 cm wide and 10.3 cm thick, possibly shaped by light pecking.

A round, biconcave object (PD 6818) was found in Locus D (Feature 5518) (Figure 127). This piece was made from sandstone and pecked and ground into an oval, flattened shape, with pecked concavities on the opposite surfaces. It was spalled and weathered. The maximum length of the piece was 7.1 cm, the width was 6.2 cm, and the thickness was 4.4 cm. The concavities measured 1 cm, 1.5 cm at maximum depth. It may be a blank, perhaps used as a censer, or may have had another function.

Minerals

Sixty-eight minerals were analyzed within the ground stone system. Of these, 13, or 19.1 percent, were ground, presumably for pigment (Table 106). Minerals included hematite, a hematite/limonite mixture, an azurite/malachite mixture, and malachite. Hematite, limonite, azurite, and malachite may have been used for ceramic paint or for body or other decorative paint. Hematite and azurite powder were found on the pendant from Feature 200, Locus A (see ornament discussion, above), and hematite was noted on a number of hand grinders and polishing stones. Mica was sometimes added to ceramic temper or was used in mosaic ornaments (Mitchell 1988:219). Galena may have been chosen for its lead component, for ceremonial use (Haury 1976:278).

Ground Stone in Mortuary Features

A few additional ground stone pieces were found with burials (Table 107). As per the project's burial agreement, these artifacts were briefly examined in the field, described, and in some cases drawn. They were repatriated together with all buried contents while fieldwork was still going on and are not part of the present analysis. Most seem to have been intentionally interred, and others may have

Figure 127. Biconcave object from Feature 5518 (Catalog No. 70316, PD 6818).

Table 106. Minerals, by Modification

Material Type	Ground	Unmodified	Total
Hematite	9	19	28
Limonite	—	2	2
Hematite/limonite	1	—	1
Gypsum	—	1	1
Mica	—	20	20
Azurite	—	1	1
Azurite/malachite	1	1	2
Malachite	2	2	4
Quartz crystal	—	3	3
Galena	—	1	1
Concretion	—	1	1
Indeterminate	—	4	4
Total	13	55	68

Table 107. Artifacts Recovered from Mortuary Features

Feature No.	PD No.	Locus	Date	Cremation or Inhumation	Age	Sex	Type	Pigment, Stains, or Residue	Comments
220	277	A	n/a	cremation, primary	indeterminate	indeterminate	bead, turquoise	n/a	Found in back dirt; may not be part of the burial.
320	327	C	n/a	cremation	indeterminate	indeterminate	polishing stone	n/a	
6191	6196	C	>A.D. 700	inhumation	adult	female	unidentified ground stone	n/a	Found in fill.
4069	2512	D	>200 B.C.	cremation, primary	adult	indeterminate	mineral (hematite?)	n/a	Level 1, upper fill.
4069[a]	2587	D	>200 B.C.	cremation, primary	adult	indeterminate	censer	ochre-covered exterior	Incised exterior and rim (see Figure 128).
10645	10677	D	1200 B.C.–A.D. 600	inhumation	adult	male	basin metate	reddish stain, possibly ochre	Inverted over skull.
10645	10674	D	1201 B.C.–A.D. 600	inhumation	adult	male	metate fragment	n/a	Inverted under body.
10645	10675	D	1202 B.C.–A.D. 600	inhumation	adult	male	mineral, crystal	n/a	Recovered in screen.

[a] Subfeature 2.

been included incidentally. Among the latter type were a turquoise bead from the back-dirt pile near Feature 220, a primary cremation, and a crystal of an unknown material found in the fill of an inhumation of an adult male (Feature 10645). In addition to the crystal, two metates were found in Feature 10645. The individual was buried with a basin metate inverted over his head, and the basin of the metate and the area around the basin were stained with a reddish material, possibly ochre. Another metate fragment was found below the body. According to field notes, the fill above the burial contained cobbles and pieces of ground stone.

A mineral, possibly hematite, was found in the upper fill of Feature 4069, another primary cremation. Although the hematite may have been only incidentally included, a censer is unambiguously associated with the burial event. The censer was cylindrical in shape, its exterior carved and then painted with ochre (see Chapter 11). Ground stone of an unknown type was found in the fill of Feature 6191, an inhumation of an adult female. A polishing stone was recorded in Feature 320, a cremation.

Addressing the Research Issues

Mescal Wash as a Persistent Place

The Mescal Wash site has a long history of occupation dating from ca. 1200 B.C. to A.D. 1450, with a hiatus ca. A.D. 1200–1300. The occupations are distributed across the site, with some spatial distinctions. That is, the earlier Late Archaic period phase (ca. 1200 B.C.) and Middle Formative A period (A.D. 750–950) occupations are represented in Locus D, whereas the Middle Formative B period (A.D. 950–1150) occupation is situated in Loci A, B, C, and F, with only limited evidence of Late Formative B period (A.D. 1300–1450) occupation in Loci D and E. A variety of features are associated with these occupations, including structures, extramural pits, various thermal features, middens, and burials that represent a long sequence of residential site occupation.

Schlanger (1992:97) defined persistent places as “places that were repeatedly used during long-term occupations of regions.” She identified three types of persistent places: (1) places with unique qualities on the landscape, (2) locations where specific cultural features are already present, and (3) locales where artifact assemblages are already present. As Binford (1982) pointed out, specific locales will be increasingly reoccupied, with increasing sedentism, given a reduction in the number of economically important places. These reoccupied locales become palimpsests that, over time, can exhibit complicated occupational histories, including distinct and overlapping occupational episodes of varying intensity and duration (Bailey 2007; Schlanger 1992).

Adams (2003, 2005) has undertaken studies involving the intensity, duration, and continuity of Late Archaic and Formative period residential site occupations through the study of ground stone collections. She noted that occupation intensity can be measured by artifact density and artifact-type richness. That is, “values in this category should be higher for settlements that were intensively occupied and lower for settlements that were not” (Adams 2005:115). On the other hand, site duration can be measured by the degree of investment in artifact production and the intensity of artifact use, reuse, recycling, and exhaustion (e.g., breakage). Sites occupied for longer periods of time will exhibit an increase in the presence of artifacts exhibiting these characteristics, whereas sites with limited occupation spans will exhibit the opposite pattern. Continuity refers to the continued use of the site area over time.

It has been suggested that artifact-class richness is a reflection of the duration of site occupation, but site function can also affect the richness value. For example, given the range of activities conducted at residential sites, it can be expected that artifact-class richness increases with length of site occupation and sample size. In contrast, a limited range of activities are conducted at a logistical site; therefore, collection-class richness is not expected to increase to the same degree as it does at residential sites (Thomas 1988; Vierra 1995:55–56; Yellen 1977). Plotting the relationship between collection size and artifact richness (i.e., number of tool classes), one would expect a steeper slope for regression lines with greater artifact-class richness and increasing sample size, versus lower-sloping regression lines with decreased class richness. In either case, artifact-class richness increases as a function of sample size, but the rate of increase varies. In summary, not only artifact-class richness but the regression slope of richness with sample size can provide some productive insights into the nature of these occupations.

Figure 128 graphically illustrates the relationship between sample size and class richness for the five time periods, with the addition of the undated contexts. Late Formative B period, Early to Middle Formative period, and Middle Formative B period are all situated along the regression line, whereas the Archaic period and Middle Formative A period have less than expected, and the undated contexts have more than expected. It is not surprising that the Archaic period ground stone collection has less than expected, because it is dominated by manos and metates. It is also not surprising that the undated contexts exhibit higher class richness than expected, because this sample was collected from a variety of contexts across the site. On the other hand, the Middle Formative A period

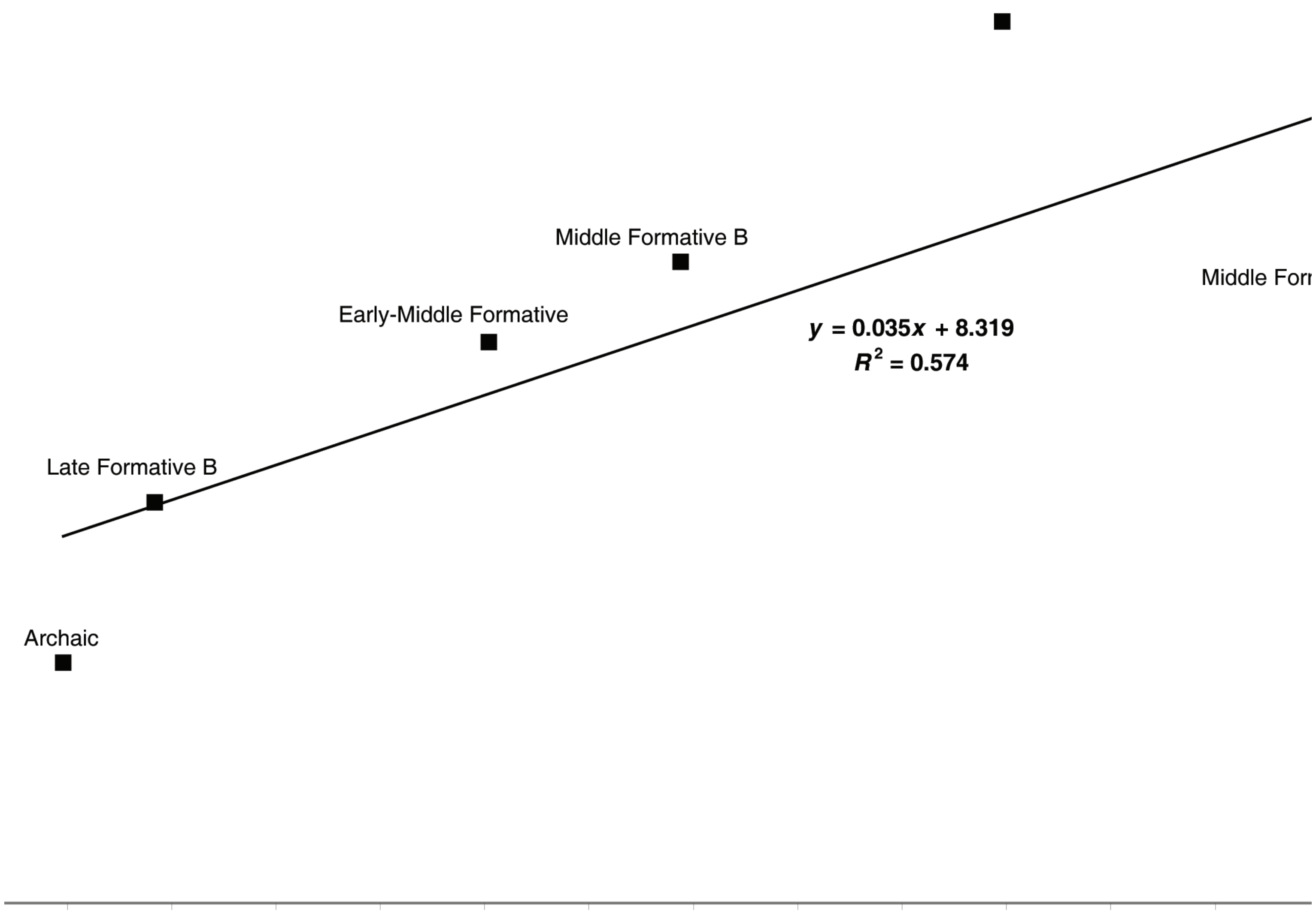


Figure 128. Sample size versus richness for five time periods and undated contexts.

collection exhibits a richness value similar to that of the Middle Formative B period but has fewer expected artifact classes, given the larger sample size. This presumably indicates that a similar range of activities are represented, with the increase in sample size having little effect on richness, beyond the presence of the 16 artifact classes. Extremely rare items that only included a single artifact are represented in the undated collection, which accounts for the greater richness value. Removing the undated collection from the regression analysis does little to change the pattern. Overall, the Formative period collections reflect a general increase in artifact-class richness with sample size, reflecting a longer period of residential site occupation. In contrast, the limited nature of the Archaic period collections indicates a shorter, seasonal site occupation.

As previously noted, proxy measures of site duration include the amount of investment in the production of ground stone artifacts and the degree of wear on these items. For example, oval manos, slab metates, and basin metates are characterized by a lower investment in production and shorter use lives, whereas rectangular and trough manos and trough metates reflect a greater investment in production, in anticipation of using them over longer periods of time. Indeed, slab metates have grinding surfaces that are less than 1 cm in depth, basin metates are 3–7 cm in depth, and trough metates are 6–25 cm in depth. The last group obviously reflects a range from initial to long-term use. Table 108 presents the information on production investment by time period. There was little investment in shaping ground stone artifacts during the Archaic period, with complete shaping characterizing the various Formative periods.

The degree of wear provides information on the intensity of use for an artifact and on the potential duration of site occupation. In regard to the Formative period, oval-shaped manos are mostly characterized by a moderate amount of wear (70 percent), whereas rectangular-shaped manos are divided between moderate (53 percent) and heavy (40 percent) wear. On the other hand, slab metates mostly exhibit moderate wear (66 percent), with both basin (92 percent) and trough (100 percent) metates primarily exhibiting heavily ground surfaces. Table 109 segregates the information on wear intensity by time period. In general, the distribution of wear is quite similar across the time periods, although the Late Formative period collection includes a somewhat lower percentage of moderate wear.

As Murrell (2007) pointed out, metates made of sandstone tend to be reduced more easily during maintenance of the grinding surface, which would effectively reduce the artifact's use life. Therefore, the consistent selection of sandstone versus basalt for metates would presumably reflect a lower use intensity, or possibly the increased costs of procuring basalt over sandstone; that is, sandstone metates would have been characterized by a shorter use life and a relative decrease in grinding intensity, compared to basalt metates. Table 110 presents the information on material types by time period. Only the most common lithic types are noted. It is clear that sandstone was the most common material type selected for ground stone production. All the other material types have relatively similar proportions across the various time periods, although there are somewhat more igneous rocks represented in the Late Formative period collection. Most of the artifacts consisted of undetermined pieces of ground stone, with a few other items (i.e., grinding stone, hand stone, and mano). Nonetheless, the sample size is small, but this pattern could represent a shift to more-intensive milling activities during the Late Formative period. Although sandstone did dominate the ground stone collection, most of the artifacts were characterized by a fine texture, with fewer medium- and coarse-grained materials. This is also the case across the various time periods (Table 111).

Table 112 presents the information on ground-stone-artifact type by time period. The sample sizes were generally similar, although some tentative patterns could be identified. For example, most of the Archaic period manos were oval shaped, with fewer during the Early to Middle Formative period and the least during the Late

Table 108. Production Investment, by Time Period

Type	Late Archaic Period	Early to Middle Formative Period	Middle Formative Period A	Middle Formative Period B	Late Formative Period B	Total
Minimal	1 (4)	5 (3)	9 (2)	4 (2)	1 (1)	20
Less than half	3 (12)	13 (9)	13 (4)	14 (7)	3 (5)	46
Greater than half	0 (0)	10 (7)	23 (6)	12 (6)	5 (8)	50
Complete	1 (4)	17 (12)	33 (9)	27 (13)	5 (8)	83
None	3 (12)	29 (20)	81 (22)	62 (31)	21 (36)	196
Indeterminate	17 (68)	69 (48)	205 (56)	82 (41)	23 (40)	396
Total	25	143	364	201	58	791

Note: Numbers in parentheses indicate column percentages.

Table 109. Wear Intensity, by Time Period

Type	Late Archaic Period	Early to Middle Formative Period	Middle Formative Period A	Middle Formative Period B	Late Formative Period B	Total
Light	0 (0)	16 (11)	27 (7)	18 (9)	6 (10)	67
Moderate	14 (56)	49 (34)	125 (34)	76 (38)	15 (26)	279
Heavy	2 (8)	19 (13)	38 (10)	21 (10)	5 (8)	85
Other/not applicable	9 (36)	59 (41)	174 (48)	86 (43)	32 (55)	360
Total	25	143	364	201	58	791

Note: Numbers in parentheses indicate column percentages.

Table 110. Material Type, by Time Period

Type	Late Archaic Period	Early to Middle Formative Period	Middle Formative Period A	Middle Formative Period B	Late Formative Period B	Total
Igneous	3 (12)	16 (11)	30 (8)	12 (6)	11 (19)	72
Granite	1 (4)	2 (1)	6 (2)	2 (1)	1 (2)	12
Metamorphic	0 (0)	5 (3)	8 (2)	1 (1)	2 (4)	16
Quartzite	2 (8)	5 (3)	16 (4)	7 (3)	3 (5)	33
Sandstone	16 (64)	97 (68)	241 (7)	120 (60)	27 (47)	501
Other	5 (20)	18 (13)	61 (17)	59 (29)	14 (7)	157
Total	25	143	364	201	58	791

Note: Numbers in parentheses indicate column percentages.

Table 111. Material Grain, by Time Period

Type	Late Archaic Period	Early to Middle Formative Period	Middle Formative Period A	Middle Formative Period B	Late Formative Period B	Total
Fine	8 (32)	55 (38)	113 (31)	73 (36)	21 (36)	270
Medium	2 (8)	16 (11)	36 (10)	20 (10)	4 (7)	78
Coarse	2 (8)	16 (11)	21 (6)	19 (9)	5 (8)	63
Other/not applicable	13 (52)	56 (39)	194 (53)	89 (44)	28 (48)	380
Total	25	143	364	201	58	791

Note: Numbers in parentheses indicate column percentages.

Table 112. Artifact Type, by Time Period

Type	Late Archaic Period	Early to Middle Formative Period	Middle Formative Period A	Middle Formative Period B	Late Formative Period B	Total
Hand stone	1 (4)	10 (7)	23 (6)	15 (7)	4 (7)	53
Oval mano	5 (20)	13 (9)	32 (9)	25 (12)	3 (5)	78
Rectangular mano	1 (4)	31 (22)	52 (15)	37 (18)	12 (21)	133
Grinding slab	0 (0)	4 (3)	15 (4)	7 (3)	6 (10)	32
Basin metate	1 (4)	3 (2)	2 (1)	0 (0)	0 (0)	6
Slab metate	1 (4)	0 (0)	2 (1)	1 (1)	1 (2)	5
Trough metate	0 (0)	3 (2)	7 (2)	5 (2)	0 (0)	15
Nether stone	5 (20)	6 (4)	25 (7)	5 (2)	3 (5)	44
Censer	0 (0)	0 (0)	7 (2)	1 (1)	0 (0)	8
Palette	0 (0)	2 (1)	6 (2)	2 (1)	0 (0)	10
Pestle	0 (0)	6 (4)	10 (3)	10 (5)	3 (5)	29
Mortar	0 (0)	1 (1)	0 (0)	2 (1)	0 (0)	3
Tabular tool	0 (0)	0 (0)	6 (2)	16 (8)	1 (2)	23
Polishing stone	0 (0)	6 (4)	13 (4)	8 (4)	0 (0)	27
Ornament	0 (0)	1 (1)	2 (1)	8 (4)	2 (3)	13
Mineral	1 (4)	5 (3)	21 (6)	16 (8)	8 (14)	51
Indeterminate ground stone	7 (28)	26 (18)	107 (29)	26 (15)	12 (20)	178
Other	3 (12)	26 (18)	34 (9)	17 (8)	3 (5)	83
Total	25	143	364	201	58	791

Note: Numbers in parentheses indicate column percentages.

Formative period. In contrast, the majority of the Formative period manos were rectangular shaped. Both basin and slab metates are represented in the Archaic period collection, with mostly trough metates in the Formative period collections. Nonetheless, basin and slab metates were also present during this time period. Otherwise, the relative proportions of the remaining ground-stone-artifact types are quite similar, with the exception of a few items. There were relatively more "other" artifacts in the Early to Middle Formative period collections, indeterminate ground stone in the Middle Formative A period collections, tabular tools in the Middle Formative B period collections, and grinding slabs and minerals in the Late Formative period collections. Overall, the Formative period reflects a greater degree of occupational duration and continuity among the various time periods.

A detailed review of the segregated temporal groups in Loci C and D indicates a similar range in activities from the Middle to Late Formative periods. A total of five occupational episodes were identified in Locus C, and seven in Locus D (see Chapter 2, this volume), but only five of the seven Locus D collections and four of the five Locus C collections contained ground stone. The individual sample sizes were small, with relatively more rectangular manos and somewhat more trough metates represented across the varying occupations (Table 113). This supports the previous pattern identified for the Formative period.

A review of reuse, recycling, and breakage patterns indicates that oval manos did exhibit evidence of secondary use as hammerstones, with rectangular manos exhibiting greater reuse and recycling. In addition, hand stones often represented broken items that were also recycled. A review of ground stone artifacts that were reused for multiple functions—but during the same time, versus recycled for different functions at different times—shows little difference over time, but reuse appears to have been more common than recycling.

Overall, most of the oval manos were whole (85 percent), with rectangular manos having somewhat fewer whole artifacts (66 percent). On the other hand, the majority of the basin and trough metates were broken (92 percent and 78 percent, respectively), whereas most of the slab metates were whole (77 percent). A review of structure-fill versus floor contexts indicates that the manos were roughly equally distributed between broken and whole for the fill, whereas there were more whole manos present on the floors. The metates had a similar pattern for fill contexts but were mostly broken in floor contexts. Two hundred and nine ground stone items were reused in roasting pits, and 13 in hearths/fire pits. Most of these were made of sandstone (67 percent), with less igneous (6 percent)

Table 113. Ground Stone Type, by Loci C and D Temporal Groups

Type	C1	C2	C3	C4	D1	D3	D4	D5	D7	Total
Oval mano	1	3	—	3	—	2	1	—	—	10
Rectangular mano	1	10	2	3	1	12	2	4	—	35
Slab metate	—	—	—	—	1	—	—	—	1	2
Basin metate	—	—	—	—	1	—	—	1	—	2
Trough metate	1	1	—	—	1	2	—	—	—	5
Total	3	14	2	6	4	16	3	5	1	54

and granite (2 percent). Otherwise, an additional 107 artifacts were discarded into pit features. In contrast, a total of 511 artifacts were recovered from structures.

The previous discussions appear to indicate that there was long-term continuity in ground stone technology across the Formative periods. Manos were consistently the prevalent items, with fewer metates. Adams (2003) suggested that the general dominance of manos over metates may be due to the increased value of the metates, which were either removed during site abandonment or later scavenged from the site. Of course, manos have a shorter use life than metates, which can also affect this pattern (Schlanger 1991). Manos composed 29, 39, and 34 percent of the Middle Formative A period, Middle Formative B period, and Late Formative B period collections, respectively (including undetermined mano fragments). In contrast, metates only represented 7, 5, and 4 percent of these respective collections (including undetermined metate fragments). These relative proportions were similar to the ones represented in feature fill. That is, manos composed 38 percent of the collections, and metates composed only 7 percent. This supports the contention that many of the items recovered from floor contexts simply represented abandoned refuse.

Other indications of continuity included the presence of site furniture and caches. Site furniture consists of items that go with the place and are left in anticipation of future site reuse (Binford 1979). Floor assemblages are good examples of possible site furniture, but very few artifacts were recovered from floor contexts. No artifacts were recovered from Archaic period structures, whereas only 152 items were found on the floors of Formative period structures. Manos constituted the most common item type present, representing 35 percent of the floor collection. Undetermined ground stone (10 percent) and hand stones (10 percent) were the next-most-common item types, with few pestles (6 percent), metates (5 percent), and polishing stones (5 percent). It appeared that these artifacts mostly represented discarded items. A similar pattern was represented within structure or feature fill. That is, manos (38 percent) composed the majority of the collection (38 percent), with fewer undetermined ground stone (23 percent) and few metates (7 percent). This reinforces the interpretation that most of the items found in floor contexts actually represented discarded artifacts, although relatively more fragmented pieces of ground stone were discarded into abandoned features. Schlanger (1991) noted that manos and metates increase in structure-fill versus floor contexts as site-occupation duration increases. Indeed, there were 261 versus 54 manos, and 28 versus 9 metates in fill versus floor contexts, respectively. This pattern also follows Schlanger's (1991) suggestion that manos are more commonly discarded because of their shorter use lives, in contrast to metates, which are less commonly discarded because their use lives are longer.

All the ground stone items associated with the Archaic period occupation were recovered from pit fill. Five of the nine manos and both metates were whole. Therefore, these items might have been cached for future use.

Subsistence

The Mescal Wash ground stone collection represented a variety of activities (Table 114). For example, polishing stones implied ceramic manufacture, palettes and censers indicated ceremonial activity, axes were used for construction, ornaments and minerals suggested personal adornment or other decoration, and manos, metates, tabular knives, and pestles reflected food-processing activities. Preparation of foodstuffs prior to consumption was a procedure integral to prehistoric period subsistence, and the frequency and distribution of equipment used to process food can provide insights into the structure of these day-to-day activities.

Manos and Metates

Manos constituted the most common artifact category recovered from the site (34.8 percent of the collection). Characteristics of manos that exhibited trough wear on tool ends were rectangular shape, biplanar or plano-convex profile, one grinding surface (each), bidirectional-grinding patterns, heavy grinding intensity, coarse-textured grinding surfaces, and high production-investment values (well or completely shaped), with little evidence of multiuse. They were longer,

Table 114. Ground Stone Activity Groups, by Time Period

Group	Late Archaic Period (%)	Early to Middle Formative Period (%)	Middle Formative Period A (%)	Middle Formative Period B (%)	Late Formative Period B (%)	Undated (%)
Food processing	92	89	61	65	49	79
Nonutilitarian	—	5	17	17	27	10
Specialized	—	5	6	5	—	2
Generalized	8	2	15	12	24	8

with larger grinding surfaces, than manos used in multidirectional-grinding patterns. Many trough-mano patterns were mirrored by trough-metate characteristics of bidirectional grinding, planar grinding surfaces, heavy grinding intensity, primarily coarse-textured surfaces, and relatively high production-investment values, compared with other metates. As Adams (1993) pointed out, trough metates have an advantage over basin metates in their ability to place greater force on the mano and, therefore, to facilitate grinding with larger manos and more grinding surface. This is an important characteristic for milling maize. For example, it is estimated that a kilogram of maize can be ground in an hour using a trough metate, with approximately 2 hours needed to provide sufficient flour to feed a family of four on a daily basis, although the time spent milling also depended on the required fineness of the final product (Hayden and Cannon 1984:68).

Nontrough grinding equipment (e.g., informal slab and basin metates and round/oval or one-handed manos) typically was used only for the processing of small seeds or wild plants. Nonetheless, all three metate types had the advantage of being portable. To evaluate grinding tools that were not used in association with the trough system, manos exhibiting only multidirectional grinding were compared to manos with trough wear (see Table 101). This criterion was chosen, rather than oval manos or one-handed manos, to reduce bias and to determine what factors composed a nontrough system in this area of the Southwest and how they compared with those of a trough system. Data indicated that multidirectional manos were rectangular in shape about as often as they were oval; that they were usually plano-convex in profile, with moderate-intensity grinding and fine-textured grinding surfaces; and that they were unshaped as often as well shaped, were primarily multiuse tools, and had similar frequencies of one or two grinding surfaces. The majority of these tools fit the profile of one-handed manos or oval/round manos that have been associated with the grinding of small seeds and nondomesticated or wild foods in the Hohokam core region (Greenwald 1990, 1991), but the multidirectional-grinding manos at Mescal Wash had a wider range of tool length and a greater diversity of tool shape, perhaps because of the increased use (or reuse) of these tools for a variety of grinding functions.

A number of studies have found a relationship between mano grinding-surface area and the importance of milling maize. That is, a larger grinding-surface area allows more food to be ground at one time (Hard 1986, 1988; Hard et al. 1996; Mauldin 1993). Because grinding is a time-consuming task, it is more efficient to grind more food in less time by expanding the amount of grinding-surface area. Mauldin (1993) used ethnographic, experimental, and ethnohistoric studies to argue that not only mano grinding-surface area but also frequency of multisided manos and changes in metate forms was linked to grinding intensity. More recently, Hard et al. (1996) identified a correlation among mano grinding-surface area, maize ubiquity, stable-carbon-isotope data, and the relative importance of maize to the diet. Based on Hard's (1988) study, the whole manos from all proveniences at Mescal Wash had an average length of 14.9 cm, with 19.7 percent measuring less than 11 cm in length, representing a low emphasis on grinding maize; 66.7 percent represented a moderate degree of milling; and 13.7 percent measured greater than 20 cm in length, representing a high degree of maize processing. Statistics for mano grinding-surface areas are as follows: 153.2 cm^2 was the average area; 52.1 percent had an area of less than 150 cm^2, representing low intensity; 20.9 percent represented moderate intensity; and 26.9 percent had an area of greater than 190 cm^2, representing high-intensity maize processing. Therefore, the mano collection appeared to indicate that a variety of foods were processed at the site, including both generalized seed processing and the intensive processing of maize.

Tabular Knives

A variety of evidence, including ethnographic studies (Castetter et al. 1938; Russell 1975), experimental and phytolith studies (Bernard-Shaw 1983, 1984, 1985), artifact analyses (Greenwald 1988:172–187; Irwin 1990:385–386), and archaeological associations (Ciolek-Torrello and Halbirt 1987; Fish, Fish, and Madsen 1985; Fish, Fish, Miksicek, and Madsen 1985; Kruse 2009), has supported the prehistoric period use of tabular knives for removing or trimming agave leaves. Historically, tabular knives were used in the initial processing of plants or plant parts, especially agave. Although they have been present in artifact collections throughout the desert Southwest, they have occurred in their highest frequencies at sites located outside areas of intensive irrigation or in areas peripheral to large, aggregated settlements. The *bajada* environmental zone is an area where the agave plant grows well, because of the higher elevation and well-drained soils. Rock-pile features, often associated with dry-farming techniques and most common in the *bajada* zones or in ecotones (transitions or interfaces between two major environmental zones), have been found associated with tabular tools and provide evidence of the possible cultivation of agave (Fish et al. 2004; Greenwald and Greenwald 1996:109–110; Kruse 2009).

Only 2.1 percent of the ground stone collection was categorized as tabular tools (26 out of 28, or 93 percent, were tabular knives), possibly because these tools are most common in Classic period contexts that may be associated with an increase in the use of agave. Most of the tabular-tool materials (54.3 percent) were identified as schist or phyllite; although possibly a locally available resource, the abundance of schist/phyllite for this tool type indicates that it was the preferred material for a valued tool. A tool's value was suggested by the high degree of production investment exhibited by the tool. Although relatively few were complete enough for production evaluation (6, or 21 percent, were complete), all of the tools exhibited some form of production modification. In addition, the system for measuring production investment used in this study did not take into account the high level of effort necessary to produce the serrated and beveled use edges of tabular tools, the most common form of edge production at Mescal Wash. When these factors are accounted for, it becomes apparent that considerable effort was invested in the production of tabular tools.

Mortars and Pestles

Six mortars and 44 pestles were recovered from excavations. Based on ethnographic and experimental documentation (Goodyear 1975:165; Russell 1975:75), mortars and pestles were used to pulverize and grind mesquite beans, as well as other resources. The sticky mesquite substance, in particular, was best ground in a mortar, rather than in a metate (Bell and Castetter 1937:23; Underhill 1951:64–65), where the substance could be better contained. Gyratory crushers, such as the two examples from mescal wash, would have been useful to break down the pods before grinding the materials to a flour on a metate (Hayden 1964).

The small number of mortars at the site, compared with pestles, did not mean that mortars were as few as the artifact count implied, because mortars may have been made of wood or some other perishable material. On the other hand, pestle frequency was relatively high at Mescal Wash (3.3 percent of the total ground stone collection), compared with typical Hohokam sites within and surrounding the Salt-Gila Basin (Greenwald 1996:Table 12.4). During a study for interregional comparisons, Greenwald (1996) noted that Hohokam structural sites produced a mean of 1 percent for field houses and farmsteads in the regional periphery, 0 percent for field houses and farmsteads in the regional core, 1.7 percent for hamlets and villages in the regional periphery, and 0.5 percent for hamlets and villages in the regional core. These and other data in the study suggested that food-processing equipment, such as the mortar and pestle, were less frequent in core-area sites, because of the higher frequencies in these same collections of special-function and nonutilitarian tools.

The higher frequency of pestles at Mescal Wash may or may not indicate greater mesquite use by site occupants at Mescal Wash compared to that of people living in the Hohokam region. Various explanations are possible, including that pestles were used communally by Hohokam site residents, either as intrahousehold or interhousehold equipment, or that pestles were made of both stone and perishable materials but that the perishable tools were more common in the Hohokam region. Russell (1975:75) reported that the Pima used large, wooden pestles if there was a large quantity of mesquite beans to prepare; otherwise, a stone pestle was used. Both types of pestles, therefore, were part of the typical household tool kit. Similar percentages of mortars occurred at Mescal Wash and in the Hohokam study area. Mortars made up 0.5 percent of the Mescal Wash collection, whereas they occurred at mean frequencies of 0.4 percent for field houses and farmsteads in the regional periphery, 0.5 percent for field houses and farmsteads in the regional core, 0.1 percent at hamlets and villages in the regional periphery, and 0.1 percent at hamlets and villages in the regional core. The Mescal Wash site mortar frequency compares best with Hohokam sites in the regional periphery, regardless of site size or complexity.

Mescal Wash had an unusually high number of pestles that were used as multipurpose tools (72.1 percent of all pestles). Pestle/mano tools were fairly typical multipurpose tools, but the wide variety of other pestle forms, including reamers, hammerstones, and nether stones was not very typical. With an abundant supply of raw materials near the site, the diverse use of this particular tool type suggests that pestle use was a common activity during food preparation.

Activities and Activity Organization

The ground stone collection also provided data on the general frequency of activities, represented by artifact groupings. The statistic indicated for each artifact group (food-processing activities, nonutilitarian functions, etc.)

was calculated as the relative frequency of particular artifacts within the total collection. Manos, metates, mortars, pestles, and tabular tools represented food-processing activities. Artifacts representing nonutilitarian functions were palettes, stone bowls, censers, ornaments, and minerals. Some of these objects, such as stone bowls, may have had utilitarian functions but generally were very restricted in distribution, were specific in design, and required a large investment of labor for their manufacture—attributes not often associated with objects used for everyday household tasks. Censers and palettes are ritual paraphernalia, evidence of communal or group activities that contributed to group identity and cohesiveness. Special-function tools are those that are generally useful for limited types of tasks. Although they may have been reused in other capacities, their morphology and use-wear patterns imply a similar, primary purpose. Axes, polishing stones, and the shaft straightener are designated as special-function tools for this study. General-purpose tools, on the other hand, are artifacts whose morphology is not standardized and that may be useful for a variety of functions. Hand stones and grinding slabs are in this category.

Year-round occupation, such as that suggested by the food-processing-artifact collection at Mescal Wash, is associated with diversification of activities, with the nongrowing season providing more time for nonsubsistence functions. In addition, the more complex the site structure and intersite relations, the greater the variety of activities and special-function tasks that should be evident in a collection. The other categories—nonutilitarian artifacts, special-function tools, and general-purpose tools—were more within the farmstead ranges of variation, according to the previously mentioned intraregional study (Greenwald 1996). Because farmsteads were not occupied year-round, they do not reflect the full range of activities associated with a year-round, permanent residence and are not represented by as large a number and variety of tools, but they contain more and a larger diversity of tools than do field houses, because of the greater number of activities expected in a residential situation and because of the larger social groups occupying them (also see Adams 2003).

The Mescal Wash site collection was composed of 48.9 percent food-processing tools, 8.7 percent nonutilitarian artifacts, 3.1 percent special-function tools, and 7.5 percent general-purpose tools. The remaining artifacts were not classifiable, because of fragmented condition, indeterminate function, or both. When these data are compared with data from sites in the Hohokam region, the collection from Mescal Wash resembles attributes of residential sites of different sizes and complexities. The percentage of food-processing artifacts is similar to that of hamlets or village sites (Greenwald 1996:Figure 12.1), with frequency ranges between 40 and 50 percent. Field houses and farmsteads, on the other hand, had much higher frequencies, around 65 and 75 percent, respectively. Overall, the percentage of food-processing equipment follows the general temporal trend described by Adams (2003:22). That is, an increase in the presence of food-processing artifacts through time: Archaic period (13 percent), Agua Caliente phase (14 percent), Tortolita phase (28 percent), and Mescal Wash (49 percent)—although, if this is broken down by time period, food-processing equipment actually ranged from 50 to 90 percent, with the Late Formative B period on the low end and the Archaic and Early to Middle Formative periods on the high end (see Table 113). Overall, food-processing equipment composed the most highly represented ground stone tools at the site for all the time periods. On the other hand, nonutilitarian artifacts were most prevalent during the Middle Formative period (A and B) (17 percent) and Late Formative B period (27 percent) and were least represented during the Archaic and Early to Middle Formative periods (0–10 percent). Special-function tools (0–6 percent) are always poorly represented. General-purpose tools were more highly represented during the Middle Formative period (A and B) (12–15 percent) and Late Formative B period (24 percent), with fewer during the Archaic and Early to Middle Formative periods (2–8 percent). Therefore, both nonutilitarian and general-purpose tools exhibited a relative increase through time, presumably as a result of an increase in site-occupation duration, but there were relatively more basalt ground stone items present in the Late Formative B period collections, which could reflect increased emphases on the milling of maize and grinding efficiency. If this small sample does represent a larger pattern, then the paucity of processing equipment could be the result of the increased use life of basalt artifacts.

Cultural Affiliation/ Interaction and Exchange

The Mescal Wash site was close to various cultural areas, including the Hohokam and Mogollon areas and possibly other areas in present-day Mexico. Artifacts were evaluated for evidence that would indicate association with particular cultural regions. Adams (2003) studied long-term changes in ground stone collections for sites dating from the Cienega through the Tortolita phases, in the hope of identifying the “evolutionary trajectory” for items that would characterize the Hohokam. Artifacts that were considered hallmarks of the Hohokam included trough metates, bordered palettes, and $^3/_4$-grooved axes. Trough metates represented a new technology for processing maize, as did grooved axes for procuring wood. Both represented attempts to reduce energy expenditure and increase tool efficiency. This would especially be true for flaked versus ground stone axes (see Hayden 1981). Trough metates, axes, and palettes were all represented at Mescal Wash. The two informal palettes recovered at the site consisted of unshaped cobbles (PDs 228 and 7512) and were not typical Hohokam palettes, with both having pigment on their use surfaces. In addition, censers that have been identified with the Hohokam (Haury 1976:286) were also present, but only three of these had exterior designs.

Concave metates are well-shaped, very large metates associated with coarse-grained surface textures, similar to the trough metate (Greenwald n.d.). They were used in concert with long manos that may have been slightly longer than the metate surfaces, so as to deter the formation of metate walls (also see Adams 2002:103). Although the concave metate in the Mescal Wash collection was similar in morphology to the Trincheras concave metates, there was no evidence that the Mescal Wash specimen was related to these southern forms, particularly because it was the only example in the collection. More clearly, the two gyratory crushers represent a type of mortar primarily known from Mexico.

Stone pipes were identified at the site, consisting of two bowl fragments of the cloud-blower type of pipe, both from different specimens. The specimens both came from Locus D, Features 799 and 1575, the former a test pit and the latter a Late Formative period structure. Stone pipes have been recovered from an early agricultural site in the Tucson Basin, but they are otherwise rare at Hohokam sites and more common at Mogollon sites (Adams 2005:112; Euler and Gregory 1988; Rinaldo 1964).

Although it is difficult to determine the origins of artifacts associated with nonlocal cultures, there was some evidence of local production of some of these products. Indirect evidence, including raw materials, palette blanks, and palettes in various stages of production, suggested that Hohokam-type palettes were manufactured locally. Other evidence of local production of nonaffiliated artifact types, such as tabular knives and ornaments (beads), was also present.

There was little evidence of trade, although nonlocal raw materials may have been products of exchange. Because a variety of raw materials were locally available, nonlocal items represented were few and included turquoise, chrysocolla, gypsum, schist, and steatite.

Conclusions

A total of 1,308 ground stone items were analyzed. Although a variety of artifact types were identified, the vast majority of these consisted of manos (35 percent) and indeterminate pieces of ground stone (22 percent). Metates, grinding slabs, pestles, tabular tools, minerals, and various other types were also represented. These data span a period of site occupation from ca. 1200 B.C. to A.D. 1450. Together they have provided a wealth of information on the nature of past site history, subsistence, activity organization, and cultural affiliation and exchange.

Mescal Wash has been posited to represent a persistent place with a long history of occupation. Various methods were used to evaluate site intensity, duration, and continuity. For example, sample size and richness indicated an increased period of occupation duration for the Formative period collections, versus a short-term, limited occupation for the Archaic period site component. The Archaic period collection contained oval-shaped manos with slab and basin metates, whereas the Formative period collection contained mostly rectangular-shaped manos with trough metates. The latter reflect a greater investment in artifact production, in anticipation of using the tools over longer periods of time, and medium to high use intensity, which reflects a greater degree of occupational intensity. In regard to duration of occupation, oval manos were often reused as hammerstones, whereas rectangular manos exhibited a greater degree of reuse and recycling. In addition, ground stone items were often reused in roasting pits. Lastly, ground stone artifacts were commonly discarded into feature fill. That is, feature fill contained mostly manos, with fewer metates. These manos were roughly equally distributed between broken and whole, with a similar pattern for the metates. In contrast, manos recovered from floor contexts were mostly whole, whereas most of the metates were broken. Indeed, the relative proportion of ground-stone-artifact types was similar in both fill and floor contexts. That is, many of the items recovered from Formative period floor contexts presumably reflected discarded artifacts, whereas most of the manos and all the metates recovered from Archaic period feature fill were whole, indicating that these items were probably cached for future use. Overall, the Formative period ground stone collections were generally similar through time, reflecting a long sequence of site continuity, although there was a relative increase in nonutilitarian and general-purpose tools that also reflected a pattern of increasing site-occupation duration through time and a relative increase in basalt ground stone items during the Late Formative B period that could be the result of increased tool use life and grinding efficiency.

The Mescal Wash collection was primarily composed of food-processing tools, with fewer nonutilitarian, special-function, and general-purpose tools. This reflects the importance of food processing for the site occupants. For example, manos exhibiting multidirectional-grinding wear patterns were often used for general grinding purposes, including the processing of seeds and other wild foods. In contrast, manos exhibiting trough wear or single-directional wear usually mirrored the use patterns exhibited by trough metates, which were important for milling maize. The size of mano grinding surfaces indicated that the majority exhibited small surfaces, with fewer medium-sized to large surfaces—representing both generalized seed processing and the intensive milling of maize, respectively. But maize was not the only subsistence item being consumed at the site. Tabular knives were presumably used for processing agave, with mortars and pestles used to pulverize and grind mesquite beans. A large number of pestles were also used as multipurpose tools, indicating that pestles were common items used for food processing.

Axes, polishing stones, and shaft straighteners were used in special activities, including felling trees, ceramic production, and arrow manufacturing. Censers and palettes are ritual paraphernalia and provide evidence for communal or group activities. As suggested earlier, a year-round occupation may be represented by the food-processing artifacts, with the nongrowing season providing more time for non-subsistence-related activities.

Evidence of cultural affiliation or trade and exchange was limited at Mescal Wash. There were trough metates, axes, and palettes similar to those present at nearby Hohokam sites. Certainly, the trough metates reflected the increasing importance of maize processing, as did the axes for procuring construction materials and the palettes for ritual purposes. There were also a few nonlocal materials present that could have been obtained from more-distant sources, including turquoise, chrysocolla, gypsum, schist, and steatite.

CHAPTER 6

Shell Artifacts

Amanda Cannon, Christopher P. Garraty, and Arthur W. Vokes

The Mescal Wash site is located in southeastern Arizona on a broad terrace above the confluence of Mescal Wash and Cienega Creek. For nearly 3,000 years, people were drawn to the riparian marshlands and surrounding oak woodland and Chihuahuan grasslands, which supported a variety of terrestrial and freshwater resources. Excavations resulted in the identification of approximately 2,500 features, including structures, burials, extramural thermal and nonthermal pits, middens, and caches, distributed across eight loci (Loci A–H). SRI's Phase 1 investigations included portions of all loci. Phase 2 involved data recovery focusing mainly on Loci A, C, and D, with minor excavation conducted in Locus B. Chronometric evidence indicates a multicomponent occupation at Mescal Wash, with a peak period of occupation during the Middle Formative period (ca. A.D. 750–1150), which we subdivide into two briefer periods: the Middle Formative A period (ca. A.D. 750–950) and the Middle Formative B period (ca. A.D. 950–1150). These two periods roughly correspond to the Colonial and Sedentary periods in the Hohokam sequence. Locus D, which encompassed most of the identified features, was used from the Late Archaic (1500 B.C.–A.D. 1) through the Late Formative (A.D. 1150–1450) period, with an occupational gap during the Late Formative A period (A.D. 1150–1300). Loci A and C were occupied mainly during the Middle Formative B period (A.D. 950–1150). The Middle Formative A period features are concentrated in the southern part of the site, mainly Locus D. The later Middle Formative B period features are mostly located in the north, within Loci A, C, and G. Most of the shell evidence discussed here relates to the Middle Formative period component, although a small number were recovered from features assigned to the Early Formative (A.D. 1–750) and Late Formative B (A.D. 1300–1450) periods.

The analyzed shell and shell artifacts were recovered from intramural and extramural features, as well as surface and subsurface nonfeature contexts. The shell collection consisted of a total of 312 pieces, estimated to represent approximately 270 specimens (Table 115). The collection was composed of a variety of different types of marine, freshwater, and terrestrial taxa, including both gastropods and bivalves. Most of the specimens represented finished artifacts, but shell artifacts in different stages of manufacture, manufacturing debris, and unworked shell also were recovered. Analyzed shell was recovered from Loci A (minimum number of individuals [MNI] = 31 specimens), C (MNI = 47), D (MNI = 190), and F (MNI = 2). No shell was recovered during surface collection excavation in Loci B and E.

The following is a review of the results of shell analysis, as well as a discussion of results within the broader research framework for Mescal Wash (see Chapter 1 and Altschul et al. 2000). We examine past resource-procurement strategies, exchange networks, and cultural affiliation and interactions through the lens of Mescal Wash's geographical location on the "edge" of several regional traditions, including the Hohokam region to the west and north and the Mogollon region to the east (especially the Dragoon and San Simon traditions). As discussed in previous chapters, Mescal Wash contained, in part, unusual architectural features and painted pottery types that underscore a mixture of regional traditions. The shell artifact collection may shed light on whether these cultural traditions are a result of sequential or cohabitation of different cultural groups, a unique local cultural tradition, a group expressing an amalgamation or imitation of different cultural traits (see Chapter 3, this volume), or a combination of more than one of these (or other) scenarios.

Analysis Methods

Each shell specimen was identified to the most specific taxonomic level possible using standard identification guides

Table 115. Summary of Shell Species

Shell Type, by Habitat	Scientific Name	Common Name	MNI	% MNI	NISP	% NISP	Geographic Range
Marine							
Bivalve	*Glycymeris* sp.	bittersweet	4	1.5	4	1.3	Gulf of California
	Glycymeris gigantea	giant bittersweet	179	66.3	185	59.3	Gulf of California
	Argopecten ventricosus	calico scallop	5	1.9	5	1.6	Gulf of California
	Nodipecten nodosus	lion's paw scallop	1	0.4	2	0.6	Gulf of California
	Pecten vogdesi	scallop	11	4.1	11	3.5	Gulf of California
	Pteria sterna	Pacific wing oyster	1	0.4	1	0.3	Gulf of California
	Laevicardium elatum	giant Pacific eggcockle	9	3.3	9	2.9	California coast
	Protothaca sp.	littleneck clam	1	0.4	1	0.3	Gulf of California and California coast
	unidentifiable		6	2.2	15	4.8	
Gastropod	*Olivella dama*	dwarf dama olive	13	4.8	13	4.2	Gulf of California
	Acanthina sp.	unicorn shell	1	0.4	1	0.3	Gulf of California and California coast
	Hexaplex nigritus	black murex	1	0.4	1	0.3	Gulf of California
	Conus sp.	cone shell	4	1.5	4	1.3	Gulf of California and California coast
	Vermetus sp.	worm shell	2	0.7	2	0.6	Gulf of California and California coast
	unidentifiable (neogastropoda)		1	0.4	1	0.3	
	unidentifiable		2	0.7	2	0.6	
Unidentifiable	unidentifiable		4	1.5	14	4.5	
Freshwater							
Bivalve	*Anodonta californiensis*	California floater	16	5.9	18	5.8	freshwater
Terrestrial							
Gastropod	*Succinea* sp.	ambersnail	7	2.6	7	2.2	terrestrial
Unidentifiable							
Bivalve	unidentifiable		2	0.7	16	5.1	
Total			270	100.0	312	100.0	

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

(e.g., Abbott 1974; Bequaert and Miller 1973; Keen 1971; Rehder 2005) and the Arizona State Museum shell-type collection. All shell pieces were then counted and assigned number of identified specimens (NISP) and MNI. Complete or nearly complete worked and unworked shells were assigned a MNI value of one. When possible, fragments of shell artifacts were refitted before assigning MNI values. For unworked shell artifacts, MNI was determined based on diagnostic elements—in the case of bivalves, whole hinges or hinge fragments that were more than 50 percent complete were counted, whereas for gastropods, each whole shell, columella, and apex was counted.

Shell specimens were classified as either unworked or worked and then measured to the nearest one-tenth of a millimeter using digital calipers. Measurements consisted of maximum length, width, and thickness. When a shell was perforated, the minimum perforation diameter was recorded, as well as perforation shape (e.g., straight, conical, biconical, or punched). Modifications to the shells were also noted, included burning, cutting, grinding, chipping, or a combination of more than one of these modifications.

When possible, worked shell specimens were classified according to previously established regional artifact typologies and chronologies. Worked shell classifications were based largely on Emil Haury's shell artifact typology derived from his work at Snaketown (Haury 1976). Chronological information was based on comparisons of similar artifact types recovered from sites in Arizona (e.g., Bennyhoff and Hughes 1987; Haury 1976; R. Nelson 1991; Vokes 1999, 2001, 2009).

Genera and Species

The Mescal Wash shell collection contained 12 marine, 1 freshwater, and 1 terrestrial genera in addition to shell of unidentifiable taxa (see Table 115). The marine shell collection consisted of bivalves and gastropods, whereas the freshwater collection consisted only of bivalves, and the terrestrial shell collection was made up solely of gastropods. Sources for shell included the warm waters of the Gulf of California (also known as the Sea of Cortez) (approximately 350 km away as the crow flies), the cooler waters of the Pacific Ocean along the southern California coast (approximately 700 km away from the project area), and locally available freshwater and terrestrial mollusks. Approximately 80 percent (MNI) of the shell collection likely originated in the Gulf of California, and 6 percent (MNI) may have come from either the Gulf of California or the southern California coast. Another 5 percent (MNI) are marine shell taxa of unknown origins. Freshwater (6 percent [MNI]) and terrestrial (3 percent [MNI]) shell specimens account for another approximately 10 percent (MNI) of the collection.

Glycymeris gigantea composed the bulk (66 percent [MNI]) of the shell collection (see Table 115). Present mainly in shell bracelet form, the *Glycymeris* shells likely originated in the Gulf of California. The remaining shell taxa were recovered in relatively low frequencies, with each taxon comprising 5 percent (MNI) or less of the total collection, except for freshwater *Anodonta californiensis*, which comprised about 6 percent (MNI) of the total collection. *A. californiensis* is a freshwater bivalve with a nacreous interior and was once endemic in most freshwater systems in Arizona prior to damming in the early twentieth century (Bequaert and Miller 1973:220–223). Nearby Cienega Creek likely provided Mescal Wash's prehistoric occupants with a convenient source of *A. californiensis*. The freshwater shell may have been used as a food resource as well as a source of raw material for artifact manufacture (Haury 1976; Howard 1983:77).

Shell taxa recovered in very low frequencies (MNI = 1) included *Nodipecten nodosus*, *Protothaca* sp., *Acanthina* sp., *Hexaplex nigritus*, and an unidentifiable marine gastropod (neogastropoda). One species of note, *Laevicardium elatum*, comprised 3.3 percent (MNI) of the analyzed collection. This marine bivalve inhabits the coast of southern California, with a northern range extending into the San Pedro region, near modern-day Los Angeles (Abbott 1974:486). This species, however, is not found in the Gulf of California. *L. elatum* was often used for artifact manufacture (Haury 1976; R. Nelson 1991).

Another shell taxon of note is *Succinea* sp., which comprised 2.6 percent (MNI) of the collection. This terrestrial snail, inhabiting mesic and well-vegetated areas along marshes and streams, would likely have been found in the site area during prehistoric times (Vokes 2009:377). It is unlikely, however, that prehistoric populations collected *Succinea* sp. for food or raw-material sources. Rather, the terrestrial snail identified in the shell collection was likely inadvertently brought to the site, attached to grasses and mud transported back to the site for manufacturing purposes (Vokes 2009:377).

The Collection

The investigations at Mescal Wash resulted in the recovery of 312 shell pieces (NISP) representing approximately 270 individual specimens (MNI). The entire collection was analyzed, including finished artifacts, artifacts in different stages of manufacture, manufacturing debris, worked shell of unknown form, and unworked shell (Table 116). The shell came from surface and subsurface contexts in four loci (Loci A, C, D, and F) (Table 117). In terms of MNI, the bulk (70 percent) of the collection was recovered from Locus D, followed in decreasing frequency by Locus C (17 percent), Locus A (12 percent), and Locus F (1 percent) (see Table 117).

Finished Artifacts

The review of analysis results begins with the most frequently occurring artifact category, finished artifacts, comprising 73 percent (MNI) of the analyzed collection. The finished shell artifacts consisted of a total of 216 pieces (NISP) estimated to represent 196 specimens (MNI) (see Tables 116 and 117). Finished shell artifact forms included several different styles of beads, pendants, plain and carved bracelets, perforated whole-shell artifacts, and ring/pendants (see Tables 116 and 117). Despite the variety of finished artifacts, *Glycymeris* bracelets made up more than half (57 percent [MNI]) of the entire shell collection, followed in decreasing MNI frequency by pendants (7.0 percent), beads (6.3 percent), ring/pendants (1.9 percent), and perforated shell artifacts (0.4 percent). The latter is a functionally vague category developed by Haury (1937b:146; see below) and should not be confused with the subcategory of perforated whole-shell pendants, which is included within the broader "pendant" category. We discuss each of these finished artifact categories in the following sections.

Table 116. Shell Artifact Types

Shell Type, by Habitat	Scientific Name	Finished Artifact Form										Manufacturing Evidence				Fragmentary Material and Whole Valves			
		Bead		Pendant		Bracelet		Perforated Shell Artifact		Ring/ Pendant		Artifact in Process		Manufacturing Debris		Worked, Unknown Form		Unworked	
		MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP
Marine																			
Bivalve	*Glycymeris* sp.	—	—	—	—	—	—	—	—	4	4	—	—	—	—	—	—	—	—
	Glycymeris gigantea	—	—	9	9	154	160	—	—	1	1	13	13	1	1	1	1	—	—
	Argopecten ventricosus	—	—	1	1	—	—	—	—	—	—	1	1	—	—	—	—	3	3
	Nodipecten nodosus	—	—	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—
	Pecten vogdesi	—	—	2	2	—	—	—	—	—	—	—	—	—	—	2	2	7	7
	Pteria sterna	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—
	Laevicardium elatum	—	—	—	—	—	—	—	—	—	—	1	1	1	1	4	4	3	3
	Protothaca sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
	unidentifiable	—	—	1	5	—	—	—	—	—	—	—	—	—	—	—	—	5	10
Gastropod	*Olivella dama*	13	13	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Acanthina sp.	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Hexaplex nigritus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—
	Conus sp.	—	—	2	2	—	—	—	—	—	—	—	—	—	—	2	2	—	—
	Vermetus sp.	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	unidentifiable (neogastropoda)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
	unidentifiable	—	—	1	1	—	—	—	—	—	—	—	—	—	—	1	1	—	—
Unidentifiable	unidentifiable	—	—	2	11	—	—	—	—	—	—	—	—	—	—	—	—	2	3
Freshwater																			
Bivalve	*Anodonta californiensis*	1	1	1	1	—	—	—	—	—	—	—	—	—	—	2	2	12	14
Terrestrial																			
Gastropod	*Succinea* sp.	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	7	7
Unidentifiable																			
Bivalve	unidentifiable	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	2	16
Total		17	17	19	32	154	160	1	2	5	5	15	15	2	2	14	14	43	65

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

Table 117. Distribution of Shell Artifacts at Mescal Wash

Locus	Finished Artifact Form										Manufacturing Evidence				Fragmentary Material and Whole Valves				Total	
	Bead		Pendant		Bracelet		Perforated Shell Artifact		Ring/Pendant		Artifact in Process		Manufacturing Debris		Worked, Unknown Form		Unworked			
	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP
A	—	—	—	—	19	20	—	—	2	2	3	3	2	2	2	2	3	3	31	32
C	3	3	5	9	17	17	1	2	—	—	5	5	—	—	5	5	11	17	47	58
D	14	14	14	23	116	121	—	—	3	3	7	7	—	—	7	7	29	45	190	220
F	—	—	—	—	2	2	—	—	—	—	—	—	—	—	—	—	—	—	2	2
Total	17	17	19	32	154	160	1	2	5	5	15	15	2	2	14	14	43	65	270	312

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

Beads

The collection included a total of 17 beads (MNI) recovered from Locus C (MNI = 3) and Locus D (MNI = 14) (see Table 117). The beads represented four different styles: spire-lopped, ring, tube, and cut rectangle (Table 118). Bayman (2002:82) has argued that shell beads were probably used as ritual gear throughout the Hohokam sequence in southern and central Arizona. The variable bead shapes and styles, he posited, may implicate different religious concepts and ideas.

The most-common bead type, spire-lopped (MNI = 13), was manufactured from two shell taxa—*Olivella dama* (MNI = 12) (Figure 129a and b) and *Acanthina* sp. (MNI = 1). Spire-lopped beads were relatively easy to manufacture, requiring only minimal grinding to remove the spire for stringing. This bead type was used throughout the U.S. Southwest from the Late Archaic through Late Formative periods (Huckell 1993a:313; Vokes 1999, 2001). Spire-lopped beads were recovered from Loci C and D features, including various structures, an intramural posthole, and an extramural nonthermal pit (Table 119) dating to the Middle and Late Formative periods (Table 120).

The collection also included an *Olivella dama* ring bead (MNI = 1) (see Figure 129c). The bead was manufactured from the wall of the shell—ground along the edges and centrally perforated. Although the temporal range of the use of ring beads is not entirely clear for the U.S. Southwest, Bennyhoff and Hughes (1987:132) reported use of ring beads in California from approximately 600 to 200 B.C. The ring bead from Mescal Wash was recovered from a hearth (Feature 6095) dating to the Middle Formative B period. Considering the discrepancy in time ranges, it is possible ring beads were used later in time in the U.S. Southwest, or the bead may have been an heirloom.

Two (MNI) tube beads were made from *Vermetus* sp. (see Figure 129d). As with spire-lopped beads, the tube beads would have required very little manufacturing effort—simply light grinding along the edges. The tube beads were recovered from two Locus D pit structures (Features 3879 and 8655) dating to the Middle Formative A period (A.D. 750–950) and an indeterminate Middle Formative A/B period (ca. A.D. 800–1050), respectively.

The remaining bead type, an *Anodonta californiensis* cut rectangle (MNI = 1), retained both the epidermis of the shell and the shiny interior or nacre. A single perforation was drilled approximately one-third down from the end. The bead may have been strung on a necklace or perhaps used as a sequin that was attached to another item such as

Table 118. Shell Beads

Shell Type, by Habitat	Scientific Name	Bead Type	MNI	NISP
Marine				
Gastropod	*Olivella dama*	spire-lopped	12	12
	Olivella dama	ring	1	1
	Acanthina sp.	spire-lopped	1	1
	Vermetus sp.	tube	2	2
Freshwater				
Bivalve	*Anodonta californiensis*	cut rectangle	1	1
Total			17	17

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

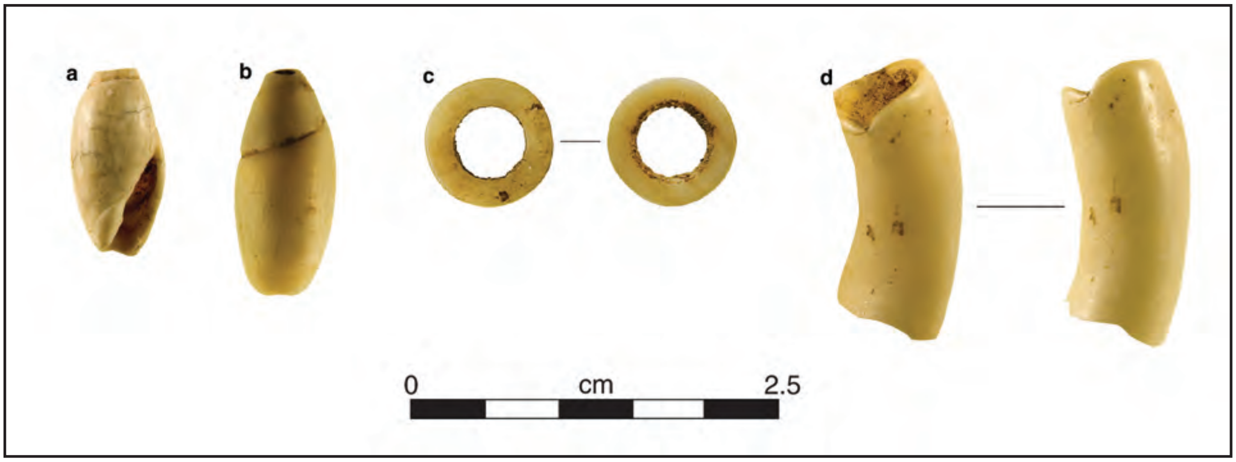


Figure 129. Shell beads: *Olivella dama* spire-lopped beads from two structures: (*a*) Feature 1575 and (*b*) Feature 276; (*c*) *Olivella* sp. saucer bead from hearth Feature 6095; and (*d*) *Vermetus* sp. tube bead from structure Feature 3879.

Table 119. Shell Artifacts by Feature Type

Feature Type	Finished Artifact From										Manufacturing Evidence				Fragmentary Material and Whole Valves				Total	
	Bead		Pendant		Bracelet		Perforated Shell Artifact		Ring/ Pendant		Artifact in Process		Manufacturing Debris		Worked, Unknown Form		Unworked			
	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP
	Extramural Pit																			
Nonthermal pit	3	3	—	—	5	5	—	—	—	—	—	—	—	—	—	—	6	20	14	28
Borrow pit	—	—	—	—	1	2	—	—	—	—	—	—	—	—	—	—	1	1	2	3
Roasting pit	—	—	1	1	5	5	—	—	—	—	1	1	—	—	1	1	5	5	13	13
Fire pit	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	1	1
Horno	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Subtotal	3	3	1	1	12	13	—	—	—	—	1	1	—	—	2	2	12	26	31	46
	Intramural Pit																			
Thermal pit (hearth)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	1
Nonthermal pit	—	—	2	8	5	5	—	—	1	1	—	—	—	—	—	—	3	5	11	19
Subtotal	—	—	2	8	5	5	—	—	1	1	—	—	—	—	—	—	4	6	12	20
	Structure																			
Structure (general)	13	13	11	14	107	111	—	—	2	2	11	11	—	—	6	6	23	24	173	181
Floor groove	—	—	—	—	6	7	—	—	—	—	—	—	—	—	—	—	1	1	7	8
Wall groove	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Posthole	1	1	1	1	8	8	—	—	—	—	1	1	—	—	3	3	1	1	15	15
Recessed hearth area	—	—	1	5	1	1	—	—	—	—	1	1	—	—	2	2	—	—	5	9
Subtotal	14	14	14	21	122	127	—	—	2	2	13	13	—	—	11	11	25	26	201	214
	Miscellaneous																			
Midden	—	—	—	—	—	—	—	—	—	—	—	—	1	1	—	—	—	—	1	1
Inhumation[a]	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	1	2	2
Surface feature	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Nonfeature	—	—	2	2	14	14	1	2	2	2	1	1	1	1	—	—	1	6	22	28
Total	17	17	19	32	154	160	1	2	5	5	15	15	2	2	14	14	43	65	270	312

Note: Does not include shell artifacts recovered from nonfeature contexts.

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

[a] Both shell artifacts were recovered from the fill overlying Feature 9410 (Locus C) and were determined in the field to have been unassociated with the human remains (see Chapter 11, this volume).

Table 120. Shell Artifacts Types by Time Period

Artifact Category	Late Archaic/ Early Formative		Early Formative- Middle Formative A		Middle Formative A		Middle Formative A/B		Middle Formative B		Middle Formative (Indeterminate)		Late Formative B		Indeterminate		Total	
	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP
Bead	—	—	—	—	7	7	1	1	2	2	1	1	2	2	4	4	17	17
Bracelet	1	1	1	1	60	64	11	11	30	31	9	10	5	5	37	37	154	160
Pendant	—	—	—	—	6	15	1	1	5	9	—	—	2	2	5	5	19	32
Ring/pendant	—	—	—	—	—	—	—	—	2	2	1	1	—	—	2	2	5	5
Perforated shell artifact	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	1	2
Artifact in process	—	—	—	—	3	3	2	2	7	7	1	1	—	—	2	2	15	15
Manufacturing debris	—	—	—	—	—	—	—	—	1	1	—	—	—	—	1	1	2	2
Worked shell, unknown form	—	—	—	—	2	2	2	2	8	8	—	—	2	2	—	—	14	14
Unworked shell	—	—	—	—	8	10	1	1	11	12	1	1	8	8	14	33	43	65
Total	1	1	1	1	86	101	18	18	66	72	13	14	19	19	66	86	270	312

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

an article of clothing. The cut rectangle bead was recovered from a Late Formative B period adobe-walled structure (Feature 1575) in Locus D. The same structure also contained one of the *Olivella dama* spire-lopped beads.

Pendants

Pendants comprised 9.7 percent (MNI) of the finished artifact collection, included a total of 32 pieces (NISP) representing an estimated 19 specimens (MNI) (Table 121). As with shell beads, pendants were recovered from Locus C (MNI = 5) and Locus D (MNI = 14) (see Table 117). All but 3 (MNI) of the pendants were recovered from structures (including intramural features) (see Table 119); 1 other was recovered from a roasting pit (Feature 5612), and 2 were recovered from nonfeature contexts. Based on a combination of archaeological and ethnographic information, Bayman (2002) inferred that pendants were used during ritual performances among Hohokam groups, and thus their frequent recovery in domestic contexts in Mescal Wash may indicate a function related to household ritual.

Pendants were manufactured from five different shell genera in addition to marine shell of unknown taxa. *Glycymeris gigantea* (MNI = 9; 47 percent) composed the bulk of the pendant collection, in addition to lower frequencies of *Pecten vogdesi* (MNI = 2; 11 percent), and *Conus* sp. (MNI = 2; 11 percent). One *Argopecten ventricosus* pendant and 1 freshwater *Anodonta californiensis* pendant also were recovered. Compared to other finished artifact types, pendants formed the most-diverse collection, consisting of 11 different types, as well as pendants of unknown form (see Table 121).

Perforated Whole-Shell Pendants

Two (MNI) whole-shell pendant fragments were identified—one manufactured from *Argopecten ventricosus* and the other made of *Pecten vogdesi* (see Table 121). Both pendants consisted of whole shells with perforations and were likely strung and worn as pendants. The *P. vogdesi* pendant was perforated at the shell's umbo as well as the opposite end; however, the latter was drilled by a marine predator (Figure 130a). The *A. ventricosus* pendant was also perforated; however, the fragment was too small to determine the location of the perforation relative to the rest of the shell. The *A. ventricosus* pendant was recovered from a Locus C pit structure (Feature 379) dating to the Middle Formative B period. The *Pecten vogdesi* pendant was found in a stripping unit (Stripping Unit 6801) in Locus D.

The presence of a *P. vogdesi* pendant potentially sheds light on social inequality and leadership in Mescal Wash (Bayman 2002). Whole-shell *P. vogdesi* pendants have been recovered from Late Archaic through Late Formative period contexts throughout the U.S. Southwest (R. Nelson 1991:154–156). Based on their recovery from artifact-rich crematory areas at Snaketown, R. Nelson (1991:49) suggested that *P. vogdesi* pendants may have been used as status markers during the Sedentary period (Middle Formative B period). Bayman (2002:77) further posited that *P. vogdesi* ornaments were worn around the neck by high-ranking members of pre-Classic period Hohokam groups. He interpreted them as insignia of high-ranking political office that were regularly destroyed during mortuary ceremonies, which underscored the personalized and noninherited allocation of political authority among Hohokam groups.

Unfortunately, the nonfeature recovery context of the *P. vogdesi* pendant from Mescal Wash does not permit us to infer a possible high-ranking burial or residence within the site. It is worth noting, however, that Stripping Unit 6801 is located near a Middle Formative A period concentration of burials (mostly cremations) and structures in adjacent Stripping Unit 6795, which Garraty and colleagues refer to as Burial Area 1 (see Chapter 11, this volume). Following Bayman, it is plausible that a high-ranking individual resided in (or was interred in) the vicinity of Burial Area 1 and may have possessed and displayed a *P. vogdesi* ornament as a means of communicating his or her elevated status and political authority.

Needles

The analyzed collection included three (MNI) needle pendants, all consisting of reworked *Glycymeris gigantea* bracelet fragments (see Table 121; Figure 130b). All three needles were recovered from a single feature consisting of multiple overlapping structures (Feature 3501) in Locus D. The dating information for this feature conglomeration is ambiguous, however, The pole-and-brush construction style of these structures suggests a possible Late Archaic or Early Formative period habitation, but chronometric evidence suggests it dates to after A.D. 700 (see Chapter 2, this volume). In the Tucson Basin, shell needles have been recovered from contexts dating to the Middle Formative B period (Vokes 2009:382).

Tinklers

Two (MNI) *Conus* sp. tinkler fragments were recovered from two features in Locus D—an adobe-walled pit structure (Feature 4684) and an intramural posthole in structure Feature 4729, both of which have been assigned to the Late Formative B period (see Figure 130c). Both fragments consisted of the medial portion of the shell with the spire and canal removed. Tinklers are generally associated with the Late Formative period (or Classic period in the Hohokam sequence); however, some have been recovered from Middle Formative B period and transitional Middle–Late Formative period contexts (Bradley 1980:45; Vokes 1986:317). The tinklers recovered from Mescal Wash appear to be temporally aligned with those found at other sites throughout the U.S. Southwest.

Bayman (2002:83) has suggested that *Conus* sp. tinklers adorned ritual costumes among the Hohokam and

Table 121. Shell Pendants

Shell Type, by Habitat	Scientific Name	Perforated Whole Shell		Needle		Tinkler		Cut Pendant															
								Geometric						Zoomorph									
								Sunburst		Oval		Trapezoid		Flying Bird		Pelican/ Heron		Bird (unknown form)		*Cipactli*/ Coyote		Snake		Unknown Form	
		MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP
Marine																									
Bivalve	*Glycymeris gigantea*	—	—	3	3	—	—	—	—	—	—	—	—	1	1	1	1	3	3	—	—	1	1	—	—
	Argopecten ventricosus	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	Pecten vogdesi	1	1	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	unidentifiable	—	—	—	—	—	—	—	—	—	—	1	5	—	—	—	—	—	—	—	—	—	—	—	—
Gastropod	*Conus* sp.	—	—	—	—	2	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
	unidentifiable	—	—	—	—	—	—	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
Unidentifiable	unidentifiable	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	7	—	—	1	4
Freshwater																									
Bivalve	*Anodonta californiensis*	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1
Total		2	2	3	3	2	2	1	1	1	1	1	5	1	1	1	1	3	3	1	7	1	1	2	5

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

Figure 130. **Shell ornaments: (*a*) *Pecten vogdesi* whole-shell pendant fragment from a nonfeature context (Stripping Unit 6801); (*b*) two *Glycymeris gigantea* needles from structure Feature 3501; (*c*) *Conus* sp. tinkler fragment from structure Feature 4684; (*d*) marine nacre shell sunburst ornament from structure Feature 379.**

may have been used in connection with community-level ritual-dance performances. The movement of multiple tinklers affixed to ritual adornments, he pointed out, would have created an audio-sensory component during ritualized dancing. He further noted that *Conus* sp. tinklers have been "most heavily concentrated on Classic period platform mounds and in their surrounding compounds" (Bayman 2002:83). To date, archaeologists have detected no evidence of a platform mound at Mescal Wash. These recovered specimens were thus probably used in connection with household-level ritual performances unrelated to the likely community-level performances that took place on and near the platform mounds.

Cut Pendants

The cut-shell pendant collection consisted of 25 pieces (NISP) representing 12 artifacts (MNI) (see Table 121). The collection included two general designs—geometric (MNI = 25 percent) and zoomorph (MNI = 58 percent). Two fragmentary cut pendants (MNI = 17 percent) could not be identified by form. We discuss these categories separately below.

Geometric-Shaped Pendants

Geometric pendants included a total of 7 fragments (NISP) representing 3 artifacts (MNI) (see Table 121). Each pendant was identified as a different geometric design—a *Pecten vogdesi* oval pendant, a sunburst design made from the nacre of a marine gastropod of unknown taxon (possibly abalone), and a trapezoidal pendant fragment manufactured from a marine bivalve of unknown taxon. All three geometric pendants were recovered from features assigned to the Middle Formative B period, suggesting a possible period of peak use during this period.

The oval-shaped *Pecten vogdesi* pendant had a single perforation drilled off center near the edge of the shell's hinge. The ornament was highly polished, and the edges were ground to a taper to form a sharp point. Both the oval ornament and the sunburst ornament fragment were recovered from a pit structure in Locus C (Feature 379) dating to the Middle Formative B period. As explained above, Bayman (2002) has argued that *P. vogdesi* ornaments signified positions of leadership, and if so, the resident of Feature 379 may have held a high-ranking political office within the community.

The sunburst pendant, manufactured from the nacreous portion of a marine shell, resembled a gear with a central perforation and notches cut into the outer margin (see Figure 130d). Similar style sunburst pendants have been recovered from pit house floors and burials in Arizona dating to the Middle Formative B and Late Formative periods (Vokes 2001:371, 2009:382). Following Bayman's argument, the sunburst image perhaps also symbolizes heightened status and high political office, given its association with the *P. vogdesi* ornament in Feature 379.

The trapezoidal pendant fragment was manufactured from the nacreous portion of a shell, possibly *Pteria sterna*. The layers of nacre were beginning to separate longitudinally; however, at one end of the pendant, there as evidence of a small perforation. The pendant fragment was recovered from the recessed hearth area of a pit structure (Feature 6098) in Locus C that dates to the Middle Formative period.

Zoomorphic Pendants

Seven zoomorphic cut pendants were present, classified as one of three forms: bird (MNI = 5), *cipactli* or coyote (MNI = 1), and snake (MNI = 1) (see Table 121). Zoomorphic pendants were recovered mainly (MNI = 6) from Locus D; one other was recovered from Locus C. Contexts containing zoomorphic pendants have been assigned to the Early Formative and Middle Formative periods, particularly the latter. Notably, all of the zoomorphic pendants were recovered from features assigned to Middle Formative A or Middle Formative A/B periods, a marked contrast with the temporal association for geometric pendants, all of which date to features assigned to the Middle Formative B period. This evidence suggests a possible diachronic trend in pendant design and use from representational zoomorphic motifs to more-abstract geometric motifs.

Bird Designs

The five bird pendants consisted of several different styles, including flying bird (MNI = 1) (sometimes referred to as a thunderbird), heron or pelican (MNI = 1), and birds of indeterminate form (MNI = 3) (see Table 121). All of the bird pendants were manufactured from *Glycymeris gigantea*. Underhill (1993:105–110) has pointed out that bird motifs in Southwestern societies were associated with fertility, curing, and rainmaking rituals, as well as the ritual creation of dreamlike states. The pendants with bird designs thus may have been used in connection with these forms of ritual performance.

The flying-bird pendant was recovered from an intramural pit within structure Feature 3582 in Locus D, which has been assigned to the Middle Formative A period. The pendant was made from a portion of the shell with the radial ribbing intact, incorporating the ribbing to give the appearance of feathers (Figure 131a). A single perforation was used to depict an eye. The flying-bird design, with its outstretched wings, is a common design depicted on Hohokam ceramics predating the Late Formative period. Flying-bird pendants recovered from other sites in Arizona date from the Middle Formative B to the first half of the Late Formative period (Vokes 2001:378–380).

The heron/pelican ornament, which was recovered from a nonfeature context (Stripping Unit 1869) in Locus D, consisted of a reworked bracelet segment. A perforation was drilled through the body of the bird, and grooves at one end were used to depict legs (see Figure 131b). Additionally, the shell collection included three (MNI) carved shell pendants of indeterminate bird form. All three bird pendants appeared to have been reworked bracelet fragments, each with lines or grooves depicting tail feathers, likely representing herons. These ornaments were recovered from three structures: Feature 3617 (Locus D), which was assigned to the Middle Formative A period; Feature 4682 (Locus D) (see Figure 131c), which dates to the transitional Middle Formative A/B period; and Feature 3617 (Locus C), which likely was used during the Middle Formative B period (see Figure 131d).

Cipactli or Coyote

Central Mexican lore describes *cipactli* as a mythical beast, consisting of a combination of a crocodile, fish, and toad, that is believed to have been used to create the earth (Haury 1976). Haury (1976:319) described representations of *cipactli* at Shelltown. However, other researchers (see Jernigan 1978:59; Vokes 1984:496) have suggested this form may represent the coyote—a character described by many Native American groups of the U.S. Southwest and the greater western region. These and other zoomorphic pendants may have had a ritual significance or possibly depicted group totems or other forms of social membership (see Bayman 2002:83).

The *cipactli*/coyote pendant fragment (MNI = 1) from Mescal Wash was manufactured from the nacreous portion

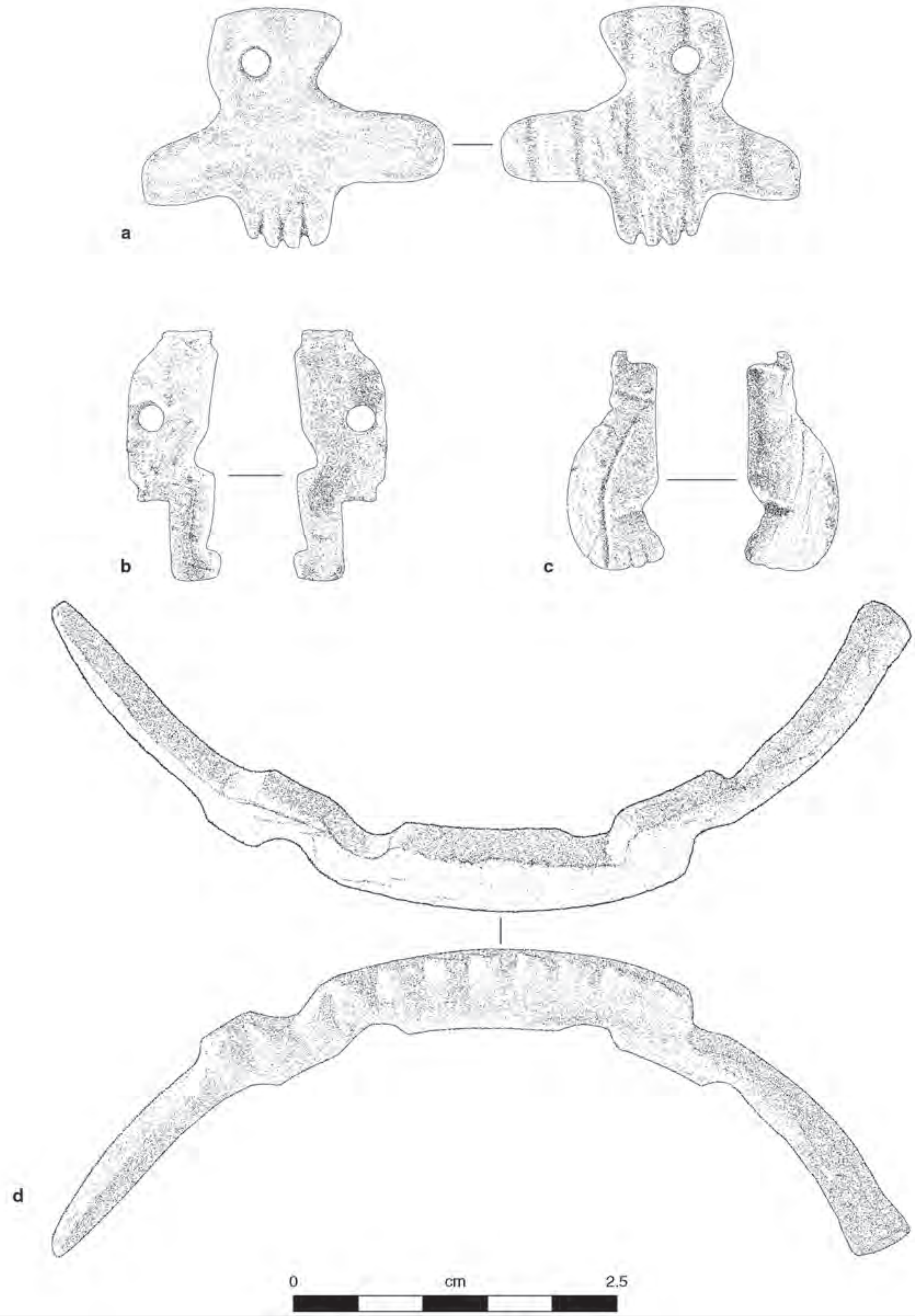


Figure 131. *Glycymeris gigantea* cut shell bird pendants: (*a*) flying bird design from structure Feature 3582; (*b*) heron design from a nonfeature context (Stripping Unit 1869); (*c*) heron design from structure Feature 4682; and (*d*) possible heron design from structure Feature 3617.

of a marine shell of unknown taxa (see Table 121). The fragment had two holes that appeared eyelike, as well as two elongate leglike segments extending from the main body. Recovered from an intramural pit (Subfeature 15) within Feature 3582, the pendant dates to the Middle Formative A period. A *cipactli*/coyote pendant from a house floor at Los Morteros (AZ AA:12:57 [ASM]) site in the Tucson Basin, dated to the Middle Formative B (Sedentary) period (Vokes 2001).

Snake

The zoomorph pendant collection also included a single snake effigy fragment (MNI = 1) manufactured from *Glycymeris gigantea* (see Table 121). The fragment appears to have been a reworked bracelet segment that was cut with a zigzag or sinuous design. One end exhibited the start of a partial perforation that did not completely puncture the surface. The blackened and burned fragment was recovered from a roasting pit (Feature 5612) in Locus D that was assigned to the Middle Formative A period. A similar style snake effigy pendant was recovered from a Middle Formative A period pit structure floor at the Cerro Flojo site (AZ U:3:294 ASM) (Vokes 2001:378). Snake imagery, like bird imagery, was often used to connection with fertility rituals in Southwestern societies, but Bayman (2002:83) also has suggested this symbolism may be connected to group or sodality membership.

Indeterminate Forms

In addition to geometric and zoomorphic designs, the collection included a total of five cut pendant fragments (NISP) representing two specimens (MNI) of unknown form (see Table 121). Both specimens were recovered from a pit structure in Locus D (Feature 3681) assigned to the Middle Formative A period. One cut pendant fragment, manufactured from *Anodonta californiensis,* was too fragmented to determine the original shape. The remaining specimen, consisting of four fragments (NISP) of an unknown marine shell taxon (MNI = 1), had a snake-like appearance with a central perforation. Too little of the pendant remained to determine if it was originally a snake effigy.

Bracelets

Bracelets were by far the most-common artifact form in the collection, comprising 57 percent (MNI) of the total shell collection and 79 percent (MNI) of the finished shell artifacts. The bracelet collection included a total of 160 pieces (NISP) representing an estimated 154 specimens (MNI), all of which appear to have been made from *Glycymeris gigantea* shell. The bracelets were recovered from Loci A (MNI = 19), C (MNI = 17), D (MNI = 116), and F (MNI = 2) (see Table 117). Recovery contexts included structures, intramural and extramural pits, and nonfeature contexts assigned to periods covering the entire occupational sequence: the Early Formative period, the Middle Formative period, and the Late Formative B period (see Table 120). This is not surprising, as the use of shell bracelets appears to have persisted throughout the Hohokam sequence (Bayman 2002). Bayman (2002:79–80) has interpreted bracelets as widely used material media for expressing group membership and social identity.

For all bracelet types, band width collectively ranged from 2.2 to 14.3 mm, with an average width of 4.7 mm. Bracelet thickness ranged from 2.2 to 12.5 mm, with an average thickness of 5.5 mm. Based on his work at Paloparado, Di Peso (1956:97) noted that, for the Late Formative period component, bracelets found in situ on the upper arms of buried individuals measured 10 mm or greater. Bracelets with smaller widths, however, were recovered from the upper arms of buried individuals identified as part of the Tonto Creek Archaeological Project excavations. The bracelets, recovered from Late Formative B period contexts, had widths measuring greater than 7 mm, and in some cases, greater than 5 mm (Vokes 2001:387). Fifty-two (MNI) of the bracelets from Mescal Wash had widths greater than 5 mm, 13 (MNI) greater than 7 mm, and 2 (MNI) greater than 10 mm. The 2 bracelets with widths greater than 10 mm were recovered from an Early Formative/Middle Formative A period context and a Middle Formative A period context. Bracelets with widths greater than 5 mm were found in contexts dating from the Early Formative to Middle Formative periods, with the majority assigned to the latter period. With the exception of the Late Formative B period, there appears to be a slight increase in bracelet width over time.

Only one (MNI) of the bracelets was complete. In most cases (MNI = 71 percent), it was unclear whether the bracelets had originally been decorated (Table 122). Of those in which the presence or absence of decoration was inferable (MNI = 45), 73 percent (MNI = 33) were identified as plain (Figure 132a). It is possible that some of these had once been painted, but no paint residual was evident. Of the 33 (MNI) plain bracelets, one had an umbo that was artificially steepened. Also, approximately 30 percent (MNI) of the plain bracelets and bracelets of unknown form had margins that were artificially steepened, resulting in a vertical surface. Forty percent (MNI) of the bracelets had margins that were artificially steepened, resulting in a faceted profile. In both cases, artificial steepening created a nearly flat band surface when viewed on the arm. Seven (MNI) plain bracelets were perforated (see Figure 132b), which may have been used to string the bracelet for use as a pendant or ornament or for attaching decorative elements, such as tassels or feathers (Haury 1976:313; Officer 1978:117).

Five (MNI) of the decorated fragments contained marginal nicking—a simple design involving cutting notches along the lower edge of the shell margin. Identifiable decorative motifs on bracelets included carved bird and

Table 122. *Glycymeris gigantea* Bracelet Types

Bracelet Type	Modification	MNI	% MNI	NISP	% NISP
Plain	plain	32	20.8	35	21.9
	artificially steep-ended umbo	1	0.6	1	0.6
Marginal nicking		5	3.2	5	3.1
Carved/incised	snake	2	1.3	2	1.3
	bird	3	1.9	3	1.9
	other	1	0.6	1	0.6
	incised	1	0.6	1	0.6
Indeterminate		109	70.8	112	70.0
Total		154	100.0	160	100.0

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

Figure 132. *Glycymeris gigantea* bracelets and ring/pendants: (*a*) complete plain bracelet from structure Feature 7880; (*b*) plain bracelet fragment with perforated umbo from structure Feature 3679; (*c*) ring/pendant from an intramural nonthermal pit (Subfeature 22) in structure Feature 7697; (*d*) ring/pendant from structure Feature 2192.

snake designs. Three (MNI) fragments with carved heron designs were recovered from three structures in Locus D (Features 825, 3710, and 8655) dating to the Middle Formative A and Middle Formative A/B periods. Two (MNI) carved bracelets with snake forms were recovered from Feature 8644, a structure dating to the Middle Formative A period. Bracelets with carved snake designs also have been recovered from other Middle Formative period sites in Arizona, particularly during the Middle Formative B (Sedentary) period (Vokes 2001:388, 2009:386).

Additionally, one (MNI) bracelet fragment recovered from a likely Middle Formative period conglomeration of superimposed structures in Locus D (Feature 4725) (predating A.D. 925), exhibited carved nicks on both the dorsal and ventral surfaces. The placement of the nicks suggest that they were not typical of marginal nicking, indicating that it was likely a more elaborate design. Another bracelet from a multiple-structure conglomeration in Locus D (Feature 437) contained a bracelet fragment with two incised lines adjacent to the broken edge. The bracelet was relatively large (62.8 mm diameter) and likely was fitted for an adult.

Perforated Shells

Haury (1937b:146) created this category to distinguish certain perforated shell artifacts from bracelets based on size, location of perforation, or a combination of the two criteria. The Mescal Wash shell collection included two fragments (NISP) representing one specimen (MNI) of a *Nodipecten nodosus* shell with remnants of an interior perforation (see Table 116). The original size of the specimen is unknown; however, based on the angle of the interior curvature, the shell may have been worn as a pendant or armlet band. The perforated shell was recovered from a nonfeature context (Trench 234) in Locus C. Similar styles of perforated shells, although manufactured from *Argopecten* and *Cardium*, have been recovered from sites in Arizona dating to the Middle and Late Formative periods (R. Nelson 1991:45; Vokes 2009:390).

Ring/Pendants

The collection included five *Glycymeris* spp. ring/pendant artifacts, with only one clearly identified as *Glycymeris gigantea* (see Table 116). The rings or pendants, which are smaller than a bracelet, may have been worn in a variety of manners, including as pendants, rings, or earrings. Di Peso (1956:92) reported finding bands around the necks and heads of buried individuals, indicating that they may have been worn as pedants or earrings, respectively. Additionally, shell bands have been found on the fingers of buried individuals that were likely worn as rings (Fewkes 1896:362; Vokes 2001:389). Ring/pendant artifacts have been reported at a number of sites in Arizona, including mortuary, architectural, midden, and pit structure contexts covering a wide date range from the latter portion of the Early Formative to the Late Formative period. At Mescal Wash, however, this artifact category appears to have peaked during the Middle Formative B through Late Formative periods (see Vokes 1984, 1988, 2001).

The rings or pendants from Mescal Wash were recovered from nonburial contexts, thus making it difficult to interpret how they might have been worn. The collection included specimens recovered from Loci A (MNI = 2) and D (MNI = 3) (see Table 117). One of the rings/pendants from Locus D was recovered from an intramural pit associated with a conglomeration of superimposed structures (Feature 7697) assigned to the Early Formative period. This artifact had a perforated umbo, indicating that it may have been worn as a pendant (see Figure 132c). Two additional rings/pendants were recovered from nonfeature contexts of indeterminate age in Locus D (Stripping Unit 1759 and Test Pit 1166); the former specimen had been severely burned. The two rings or pendants from Locus A were both from Feature 2192, a structure with a recessed hearth area broadly assigned to the Middle Formative period (see Figure 132d).

Manufacturing Evidence

Artifacts representing different stages of manufacture as well as manufacturing debris comprised 6.3 percent (MNI) of the analyzed collection. The collection included 17 specimens (MNI) consisting of *Glycymeris gigantea* (MNI = 14), *Argopecten ventricosus* (MNI = 1), and *Laevicardium elatum* (MNI = 2) (see Table 116). Locus D yielded the largest number of artifacts interpreted as manufacturing evidence (MNI = 7; 42 percent), followed by Locus C (MNI = 5; 29 percent) and Locus A (MNI = 5; 29 percent) (see Table 117).

Artifacts in Process

A total of 15 specimens (MNI) were identified as shell artifacts in different stages of manufacture. These artifacts were recovered from Locus A (MNI = 3), Locus C (MNI = 5), and Locus D (MNI = 7) (see Table 117). Of those contexts with associated dates, most of the artifacts in process were recovered from Middle Formative period contexts (see Table 120).

Beads in Process

A single *Laevicardium elatum* disk bead in process (MNI = 1) was recovered from Feature 1189, a Middle Formative B period pit structure in Locus A. The disk bead had the beginning of a central perforation that did not go all the way through.

Ornaments in Process

An *Argopecten ventricosus* pendant (MNI = 1) in the early stages of manufacture was recovered from Feature 379, a Middle Formative B period pit structure in Locus C. The pendant likely broke during initial drilling of a central perforation.

The collection also included two (MNI) *Glycymeris gigantea* ornament blanks. One was recovered from Feature 3869 in Locus D (Figure 133), a Middle Formative period structure in Locus D; the other was recovered from Feature 1189, a Middle Formative B period structure in Locus A. Both ornaments consisted of circular blanks chipped and ground along the perimeters. These probable blanks may have been intended for manufacture of beads or pendants.

Bracelets in Process

Most (40 percent [MNI]) of the artifacts in process were identified as bracelets in various stages of manufacture. The collection consisted of six (MNI) *Glycymeris gigantea* fragments from pit structures in Loci C and D (Features 379, 438, 3545, and 7461) assigned to the Middle Formative A, B, and A/B periods. This temporal distribution coincides with the time range identified for finished *Glycymeris* bracelets. All of the bracelet fragments exhibited chipping on the margin—likely a result of reducing the shell wall to form an interior ring or opening. One bracelet in process from Feature 438 had the beginning of a perforation on the umbo. The bracelet may have broken during grinding to perforate the umbo.

Reworked Bracelets

In addition to bracelets in process, the analyzed collection included five *Glycymeris gigantea* reworked bracelet segments recovered from Locus D features (MNI = 4) and Locus A (MNI = 1). The Locus D features included one undated roasting pit (Feature 1755) and three structures assigned to the Middle Formative A (Features 3681 and 7880) and Middle Formative A/B periods (Feature 3545). Four of the five reworked bracelet segments each had one end that was ground to a tapered point. The specimen from Locus B had the start of a perforation at one end, possibly intended for the manufacture of a needle pendant. Based on the size and taper at one end, the reworked bracelet fragment from the roasting pit may have been intended for needle production as well. Interestingly, this artifact was not burned, indicating that it was likely deposited following thermal activities, i.e., after it had been no longer used as a roasting pit. The reworked segment from Feature 3545 was burned, however.

Two of the reworked bracelet fragments exhibited zoomorphic carved designs. The specimen from Feature 3681 was ground to a flat surface at both ends and exhibited the unfinished design of a heron or snake. The fragment from Feature 7880 resembled a heron design with what appeared to be a long bill carved at one end and the rough edge of a break on the other end.

Manufacturing Debris

The collection of manufacturing materials also included two (MNI) pieces of manufacturing debris. A single fragment of *Laevicardium elatum* was recovered from a nonfeature context (Collection Unit 6) in Locus A. The fragment consisted of the side panel of the shell that had been cut along the same line from both the dorsal and ventral surfaces. It appears the shell was then snapped to separate the piece from the main body of the shell. The second piece

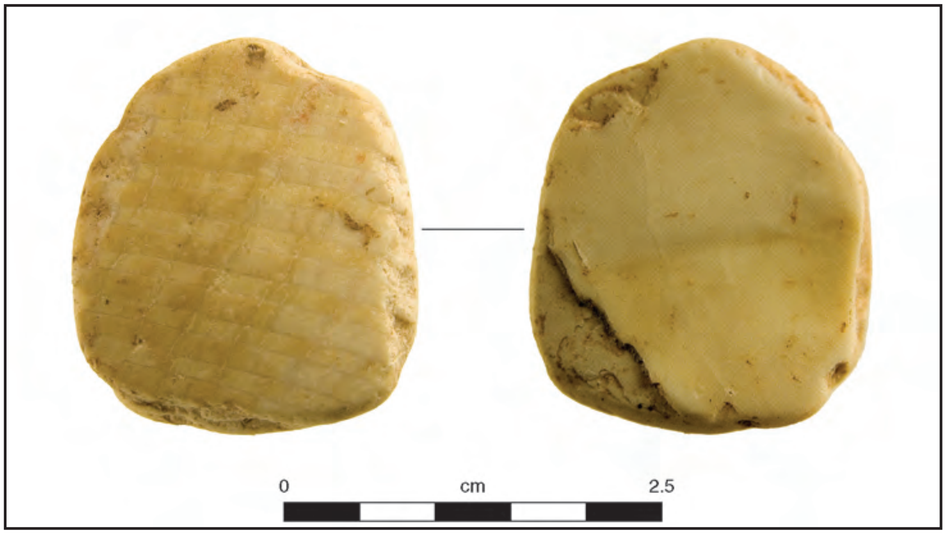


Figure 133. *Glycymeris gigantea* ornament blank from structure Feature 3869.

of manufacturing debris, a *Glycymeris gigantea* fragment, was recovered from a midden (Feature 2143) in Locus A dating to the Middle Formative B period. The fragment consisted of the medial portion of the shell chipped along the interior margin. The fragment was likely bracelet-manufacturing debris.

Fragmentary Material and Whole Valves

The collection included 79 pieces of shell (NISP), representing approximately 57 specimens (MNI) that have been worked but are either too incomplete to be classified in one of the aforementioned artifact categories (MNI = 14) or consisted of fragments or whole valves that did not exhibit evidence of cultural modification (MNI = 43). The fragmentary specimens may represent broken finished artifacts, manufacturing debris, or the accidental breakage of whole unworked valves. Considering that most of the analyzed specimens from Mescal Wash were identified as finished artifacts, the fragmentary collection likely represent broken finished artifacts or unused whole shell that was initially intended for artifact production.

The collection was made up of eight different marine genera in addition to freshwater and terrestrial species and shell of unknown taxa (see Table 116). Freshwater *Anodonta californiensis* dominated the collection (MNI = 14; 25 percent), followed in decreasing frequency by *Pecten vogdesi* (MNI = 9; 16 percent), *Succinea* spp. (MNI = 7; 12 percent), and *Laevicardium elatum* MNI = 7; 12 percent).

As identified for finished artifacts, most of the fragmentary and whole-valve collection was recovered from Locus D (MNI = 36; 63 percent), followed in decreasing frequency by Locus C (MNI = 16; 28 percent), and Locus A (MNI = 5; 9 percent) (see Table 117). The specimens were identified in a variety of intramural and extramural features (see Table 119) dating to the Middle and Late Formative periods (see Table 120).

Worked Fragments

Fourteen worked shell fragments of unknown form were recovered from Locus D (MNI = 7), Locus C (MNI = 5), Locus A (MNI = 2) (see Table 117). Most (MNI = 11) of the shell was found within structures, and lower frequencies recovered from extramural pit features (MNI = 2) (see Table 119) assigned to the Middle and Late Formative periods (see Table 120). One shell specimen was recovered from the fill of Feature 9410, a Middle Formative B period inhumation in Locus C; this specimen was not directly associated with the human remains, however, and was determined to have been translocated into the feature matrix as a result of secondary redeposition. For this reason, this specimen was not repatriated with the materials directly associated with the human remains.

The collection included seven different genera, as well as a marine gastropod of unknown genus (see Table 116). The collection was not dominated by any single taxon and instead was nearly equally divided in frequency by *Laevicardium elatum* (MNI = 4), *Pecten vogdesi* (MNI = 2), *Conus* sp. (MNI = 2), and *Anodonta californiensis* (MNI = 2) (see Table 116). All of the worked shell specimens exhibited evidence of modification in the form of cutting, grinding, chipping, or a combination of these. Although too small to make a determination, one *Glycymeris gigantea* fragment appeared to be either a bracelet in process or a fragment of a finished bracelet. The refitted *Laevicardium elatum* fragments had a slight interior curve indicating that they were likely a reworked perforated shell bracelet. The *Conus* sp. specimen consisted of a wall fragment with the dorsal end ground, likely representing a fragment of a spire-lopped bead or tinkler. The remaining specimens had unknown forms and may have represented fragments of finished artifacts or ornaments in production.

Of note was a fragment of *Hexaplex nigritus* columella (Figure 134). The columella was broken across the shaft and all of the edges had rough breaks. The shell was recovered from a pit structure (Feature 2192) in Locus A, which dates to the Middle Formative period. The function of the shell artifact is unknown; however, it may have been used as the head of a staff. Alternatively, the shell may represent a broken trumpet. Notably, a *Hexaplex nigritus* shell with its apex broken off, indicating it was likely a trumpet, was recovered from a magician's burial in northern Arizona (Boekelman 1936).

Unworked Fragments and Whole Valves

The collection included 65 whole valves and fragments (NISP) of unworked shell, representing 43 specimens (MNI). Locus D contained 67 percent (MNI = 29) of the unworked shell, followed in decreasing frequency by Locus C (MNI = 11; 26 percent), and Locus A (MNI = 3; 7 percent) (see Table 117). Unworked shell was recovered from a variety of feature contexts, including several different types of intramural and extramural pits (MNI = 16; 37 percent); pit house floors and associated floor features (MNI = 25; 58 percent), an inhumation (MNI = 1; 2.3 percent), and a nonfeature context (Trench 234 in Locus C) (MNI = 1; 2.3 percent) (see Table 119). Unworked shell was identified in feature contexts dating to the Middle Formative and Late Formative periods (see Table 120).

Figure 134. ***Hexaplex nigritus*** **columella from structure Feature 2192.**

The shell specimens, all lacking clear evidence of modification, consisted of six genera, in addition to unidentifiable taxa, including marine bivalves and gastropods (see Table 116). Approximately 28 percent (MNI = 12) of the unworked shell was identified as *Anodonta californiensis*, followed in decreasing frequency by *Succinea* spp. (MNI = 7, 16 percent) *Pecten vogdesi* (MNI = 7, 16 percent), and marine bivalve of unknown taxa (MNI = 5, 12 percent) (see Table 116). The higher frequencies of *A. californiensis* and *Succinea* sp. were likely owing to their local availability. The *A. californiensis* specimens may represent food remains, shells reserved for artifact manufacture, or a combination of the two. *Succinea* spp., however, was likely inadvertently brought to the site with collection of nearby mud and grasses, or the terrestrial snails may have migrated to the site during or following site abandonment.

Burned Shell Artifacts

The collection included a total of 91 fragments (NISP) of burned shell, representing a total of 67 specimens (MNI). By far, most of the burned shell was identified as *Glycymeris gigantea* (MNI = 49; 73 percent), followed in decreasing frequency by *Pecten vogdesi* (MNI = 3; 4.5 percent), marine bivalve of unknown taxa (MNI = 3; 4.5 percent), *Argopecten ventricosus* (MNI = 2; 3.0 percent), *Laevicardium elatum* (MNI = 2; 3.0 percent), and *Olivella dama* (MNI = 2; 3.0 percent). Additionally, one specimen each was identified as *Pteria sterna*, *Nodipecten nodosus*, *Glycymeris* sp., *Anodonta californiensis*, and shell of unknown taxon.

Of the burned shell, 91 percent (MNI = 61) was recovered from feature contexts (Table 123). Intramural contexts contained the highest frequency (MNI = 48; 72 percent) of

Table 123. Burned Shell Artifacts from Feature and Nonfeature Contexts

Context	MNI	% MNI	NISP	% NISP
Intramural features				
Floor groove	2	3.0	2	2.2
Nonthermal pit	1	1.5	1	1.1
Posthole	5	7.5	5	5.5
Recessed hearth area	1	1.5	1	1.1
Structure	39	58.2	42	46.2
Subtotal	48	71.6	51	56.0
Extramural features				
Nonthermal pit	3	4.5	17	18.7
Borrow pit	1	1.5	2	2.2
Roasting pit	9	13.4	9	9.9
Subtotal	13	19.4	28	30.8
Nonfeature contexts	6	9.0	12	13.2
Total	67	100.0	91	100.0

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

burned shell in the collection. Within intramural contexts, more than half (MNI = 39, 81 percent) was recovered directly from structure floors or fill. A variety of extramural thermal and nonthermal pit also contained burned shell. Collectively, dated burned shell was collected from features with date ranges from Early Formative through Late Formative; however, the majority of burned specimens are from Middle Formative period contexts.

Overall, burned shell made up 25 percent (MNI) of the total analyzed shell collection. The frequency of burned shell in the collection was relatively small, indicating that shell was not commonly part of thermal processes. Some of the burned shell may have been part of thermal ritual offerings, burned inadvertently (e.g., during a house fire), or discarded as waste and intentionally burned.

Comparisons among Loci

Most of the shell artifacts were from Locus D (MNI = 190; 70 percent), followed in decreasing frequency by Locus C (MNI = 47; 17 percent), Locus A (MNI = 31; 12 percent), and Locus F (MNI = 2; 0.7 percent). We discuss the shell artifacts collected from each locus separately below.

Locus A

Locus A, located on the upper terrace of the site, was characterized as an isolated farmstead primarily occupied during the Middle Formative B period; this locus appears to contain a single, relatively discrete occupational episode dating to that period (see Chapter 2, this volume). Features identified in Locus A consisted of structures, including several with recessed hearth areas, as well as numerous extramural features, including thermal and nonthermal pits, a midden, and a human burial. Locus A had the third highest frequency of analyzed shell artifacts, comprising 12 percent (MNI = 31) of the collection (see Table 117). Most of the shell artifacts (MNI = 25; 81 percent) were recovered from structure features. One artifact (MNI) was recovered from a midden, and 5 (MNI) were recovered from nonfeature contexts.

Similar to the other loci, most of the shell artifacts were identified as bracelets (MNI = 19). However, two artifact types not commonly found in other loci included two (MNI) ring/pendant artifacts, both recovered from a structure with recessed hearth (Feature 2192), and two (MNI) pieces of manufacturing debris (see Table 117).

Locus C

The excavated portions of Locus C included 15 structures, most of which were assigned to the Middle Formative period, as well as numerous extramural features, including thermal and nonthermal pits and 18 mortuary features. This locus yielded the second highest (MNI = 47; 17 percent) frequency of shell artifacts. Compared to Locus A, this locus had a longer span of occupation, which may, in part, account for the relatively high frequency of shell artifacts. Features in Locus C produced chronometric date ranges throughout the Middle Formative period, including multiple occupational episodes (see Chapter 2, this volume). However, most of the features were broadly assigned to the Middle Formative B period.

Shell artifacts were recovered from a variety of features in Locus C, including structures (MNI = 36), thermal and nonthermal extramural pits (MNI = 6), the fill of an inhumation (MNI = 2; see above), and nonfeature contexts (MNI = 3). As with Locus A, Locus C yielded mostly *Glycymeris gigantea* bracelets (MNI = 17). In contrast to Loci A, however, Locus C contained a greater variety of shell artifact types, including pendants, beads, a perforated shell artifact, and indeterminate worked and unworked shell. The cut-shell artifact types—all of which were recovered from Middle Formative B period features in Locus C—consisted of several different designs, including oval, trapezoid, sunburst, and bird design motifs.

Locus D

Locus D was occupied fairly continuously from the Late Archaic through the Late Formative periods (except for the Late Formative A period). Most of the features were assigned to the Middle Formative A period component, and chromomeric data suggest a peak period of occupation from about A.D. 800 to 925. The excavated area in Locus D encompassed an enormous number of excavated, partially excavated, and unexcavated features, including at least 76 structure features, many of which consisted of conglomerations with multiple superimposed structures. Dozens of extramural features also were recorded within the large exposed area in Locus D, including thermal and nonthermal pits, human burials, and middens.

By far, most (MNI = 190; 70 percent) of the shell artifacts were recovered from Locus D (see Table 117). As with the other loci, Locus D features containing shell artifacts included structures and associated features, as well as a wide variety of extramural pits. Loci C and D contained a similar mix of shell artifact types and similar proportions, indicating continuity in shell artifact use from the Middle Formative A period (including most of the features in Locus D) to the Middle Formative B period (including most of the features in Locus C). As with most of the loci, *Glycymeris gigantea* bracelets dominated the Locus D collection. Pendant types were relatively variable, as was the case for Locus C, and included *G. gigantea* needles and *Conus* sp. tinklers, as well as zoomorphic cut pendants and other cut pendants of unknown form.

One exceptional difference relative to the other loci, Locus D contained all (MNI = 11) of the decorated *Glycymeris* bracelets (MNI = 116). As previously noted, decorative styles included marginal nicking, incised lines, and snake and bird designs. Decorated bracelets were recovered from pit structures and associated intramural features (MNI = 11) and extramural pit Feature 4156 (MNI = 1), all of which were assigned to the Middle Formative A or A/B periods. The absence of decorated bracelets in the shell collections from Loci A and C prevents us from inferring possible evidence of cultural variability in decorative styles among roughly contemporaneous residents in different areas of the site.

Locus F

Only two shell artifacts (MNI), both bracelets, were recovered from Locus F (see Table 117). One is a reworked *Glycymeris gigantea* bracelet with one end ground to a taper and an incomplete perforation. The fragment may have been intended for the manufacture of a needle pendant. The other is a *Glycymeris gigantea* bracelet fragment. Though limited, shell artifact production likely took place in this locus, as evidenced by the reworked shell bracelet fragment.

Use of Shell through Time

Early Formative Period

Overall, only two (MNI) shell artifacts were recovered from Early Formative or possible Middle Formative A period contexts (Table 124). However, this low number may be the result of the less-extensive excavations of these early components rather than less-frequent use of shell artifacts during the early occupational phases. A larger sample of materials from well-dated Early Formative period features will be required to assess this hypothesis.

Both of the artifacts are *Glycymeris gigantea* shell bracelets, suggesting that these may be the earliest shell artifacts produced and used in the area. The earliest shell bracelet in the collection was recovered from a circular pit structure (Feature 4912) in Locus D, which was assigned to the Early Formative period (ca. A.D. 1–750). Another bracelet was recovered from a structure in Locus D (Feature 9729) that was assigned to a transitional Early Formative–Middle Formative A period (ca. A.D. 500–850).

Notably, both shell artifacts from these early contexts were exclusively recovered from within pit structures, indicating a possible emphasis of shell use within intramural contexts rather than in extramural areas. Perhaps shell bracelets were initially used in connection with household-level rituals that occurred within intramural contexts. Later rituals involving shell use might have occurred in both intramural, household-level contexts and in extramural, communal-level contexts (see below). A larger sample of pre–Middle Formative period shell artifacts will be needed to evaluate this hypothesis.

Table 124. Distributions of Shell Artifacts Over Time

Period	Time Range	MNI	% MNI	NISP	% NISP
Early Formative	A.D. 1–750	1	0.4	1	0.3
Early Formative–Middle Formative A	A.D. 500–850[a]	1	0.4	1	0.3
Middle Formative A	A.D. 750–950	86	31.9	101	32.4
Middle Formative A/B	A.D. 800–1050[b]	18	6.7	18	5.8
Middle Formative B	A.D. 950–1150	66	24.4	72	23.1
Middle Formative (indeterminate)	A.D. 750–1150	13	4.8	14	4.5
Late Formative B	A.D. 1300–1450	19	7.0	19	6.1
Indeterminate		66	24.4	86	27.6
Total		270	100.0	312	100.0

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

[a] This date range is based on the inferred age of Feature 9729 in Locus D, which encompasses portions of the Early Formative and Middle Formative A periods.

[b] We developed this period designation to refer to the features that produced AM assays that encompasses the Middle Formative A and B periods. This date range accommodates the beginning and end dates of the inferred date ranges for these features.

Middle Formative A Period

A total of 101 pieces (NISP) representing an estimated 86 specimens (MNI) were recovered from contexts dating to the Middle Formative A period, comprising 32 percent (MNI) of the total analyzed collection (see Table 124). The Middle Formative A period collections contained not only the highest frequency of shell artifacts among the defined temporal components but also the most diverse collection of artifact types.

All of the shell artifacts that were assigned to Middle Formative A period contexts were recovered from Locus D. Additionally, all but 4 were recovered from within pit structures (17 in all), including 62 bracelets, 14 pendants, 7 beads, 10 unworked shell pieces, 3 artifacts in process, and 1 indeterminate worked shell fragment. The extramural contexts from which shell artifacts were recovered included a surface feature (Feature 11342) and a roasting pit (Feature 5612). Both extramural pits each contained 1 *Glycymeris gigantea* bracelet fragment. The roasting pit also yielded 1 unworked *G. gigantea* specimen and 1 *G. gigantea* snake pendant. It may be worth noting that 1 snake pendant was not included among the 14 pendants recovered from structures; these include 7 *cipactli*/coyote pendants, 2 bird pendants, and 5 pendants of indeterminate form. It is possible that the bird and *cipactli*/coyote pendants were related to indoor rituals or other intramural activities; conversely, the snake pendants may be related to extramural activities and communal ritual. However, a considerably larger sample will be needed to corroborate this hypothesis.

In terms of taxa, the shell recovered from Middle Formative A period contexts consisted of mostly *Glycymeris gigantea* (78 percent [MNI]) (Table 125), which largely reflects the abundance of shell bracelets assigned to this period (60 MNI; 70 percent) (see Table 120). In general, the collection was made up of mostly shell ornaments, as well as evidence of limited onsite ornament manufacture (MNI = 3). The latter included two reworked bracelet segments and a bracelet in process, all of which were recovered from pit structures, suggesting likely household-level production. Overall, there appears to have been an increase in the use of shell artifacts during the Middle Formative A period relative to the earlier periods, as noted above. This increase is evidenced by both a higher frequency and a greater variety of shell artifact types. There is also clear evidence for limited shell artifact manufacture at the site by the Middle Formative A period, which is not present in the small pre–Middle Formative period collection.

In Chapter 3 of this volume, Garraty and Heckman defined four groups of Middle Formative A period features within Locus D (all structures) based on spatial proximity and clustering (see Figure 34 for a map of these groups). They defined these feature groups to compare painted pottery ware classes and infer possible differences in nonlocal affiliation or patterns interaction among contemporaneous house or kin groups within the Middle Formative A period

Table 125. Shell Species by Time Period

Shell Type, by Habitat	Scientific Name	Late Archaic/ Early Formative		Early Formative-Middle Formative A		Middle Formative A		Middle Formative A/B		Middle Formative B		Middle Formative (Indeterminate)		Late Formative B		Indeterminate		Total	
		MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP	MNI	NISP
Marine																			
Bivalve	*Glycymeris* sp.	—	—	—	—	—	—	—	—	2	2	1	1	—	—	1	1	4	4
	Glycymeris gigantea	1	1	1	1	67	71	14	14	37	38	10	11	5	5	44	44	179	185
	Argopecten ventricosus	—	—	—	—	—	—	—	—	5	5	—	—	—	—	—	—	5	5
	Nodipecten nodosus	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	2	1	2
	Pecten vogdesi	—	—	—	—	1	1	2	2	6	6	—	—	—	—	2	2	11	11
	Pteria sterna	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	1
	Laevicardium elatum	—	—	—	—	—	—	—	—	5	5	—	—	—	—	4	4	9	9
	Protothaca sp.	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	1
	unidentifiable	—	—	—	—	1	1	—	—	1	5	—	—	1	1	3	8	6	15
Gastropod	*Olivella dama*	—	—	—	—	6	6	—	—	1	1	1	1	1	1	4	4	13	13
	Acanthina sp.	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	1
	Hexaplex nigritus	—	—	—	—	—	—	—	—	1	1	—	—	—	—	—	—	1	1
	Conus sp.	—	—	—	—	—	—	—	—	1	1	—	—	3	3	—	—	4	4
	Vermetus sp.	—	—	—	—	1	1	1	1	—	—	—	—	—	—	—	—	2	2
	unidentifiable (neogastropoda)	—	—	—	—	—	—	—	—	—	—	—	—	—	—	1	1	1	1
	unidentifiable	—	—	—	—	1	1	—	—	1	1	—	—	—	—	—	—	2	2
Unidentifiable	unidentifiable	—	—	—	—	3	12	—	—	1	2	—	—	—	—	—	—	4	14
Freshwater																			
Bivalve	*Anodonta californiensis*	—	—	—	—	6	8	1	1	1	1	1	1	6	6	1	1	16	18
Terrestrial																			
Gastropod	*Succinea* sp.	—	—	—	—	—	—	—	—	—	—	—	—	3	3	4	4	7	7
Unidentifiable																			
Bivalve	unidentifiable	—	—	—	—	—	—	—	—	1	1	—	—	—	—	1	15	2	16
Total		1	1	1	1	86	101	18	18	66	72	13	14	19	19	66	86	270	312

Key: MNI = minimum number of individuals; NISP = number of identified specimens.

settlement. In all, they found substantial differences in painted pottery distributions among the four spatially defined groups. Briefly, Group 1 (3 structures) is characterized by higher-than-average percentages of Phoenix Basin buff wares and San Simon painted wares. Group 2 (1 feature) included a high ratio of Phoenix Basin to Tucson Basin painted wares and a high proportion of Dragoon wares. Both Group 3 (2 features) and Group 4 (4 features) are dominated by Tucson Basin brown wares, with low proportions of Phoenix Basin buff wares. However, Dragoon brown wares are frequent in Group 3, whereas San Simon wares are more frequent in Group 4.

The shell evidence does not reveal patterns of variability among the four feature groups comparable to the painted pottery data. However, the shell artifact collection from Group 4 is distinct from those of the other three groups (Table 126). Groups 1, 2, and 3 all include mostly bracelets, which comprise 100 percent (MNI) of the Group 1 collection, 80 percent (8 of 10 MNI) of the Group 2 collection, and 78 percent (18 of 23 MNI) of the Group 3 collection. These groups include a mix of plain and decorated bracelets, including 2 (MNI) bracelets with carved bird motifs and 1 (MNI) with a carved snake motif. Two (MNI) *Olivella* beads (1 each from Groups 1 and 2) are the only other artifacts in these collections. In contrast, Group 4 includes 5 (MNI) pendants (18 percent of the group collection) and 1 (MNI) *Olivella* bead; the pendants include 3 (MNI) zoomorphic motifs (2 birds and 1 *cipactli*/coyote) and 2 (MNI) indeterminate forms. As in the other groups, bracelets comprise most of the Group 4 collection (18 of 28 MNI; 64 percent), but the proportion of bracelets is lower than in Groups 1, 2, and 3. On the whole, however, these data suggest shared rather than distant use of shell artifacts among the contemporaneous groups within Locus D.

Transitional Middle Formative A/B Period

A total of 18 pieces (NISP) representing an estimated 18 specimens (MNI) were recovered from features assigned to transitional Middle Formative A/B period (ca. A.D. 800–1050) (see Table 124). Chronometric data from these features (all structures) generally produced date ranges that encompass portions of the late Middle Formative A period and early Middle Formative B period, suggesting a transitional period of occupation. Most of the Middle Formative A/B period features were located in Locus D (Features 3545, 4682, and 8655), with the exception of Feature 376 in Locus C. The shell artifacts assigned to this transitional period account for about 7 percent (MNI) of the collection.

As with the Middle Formative A period collection, most of the shell from contexts extending into the Middle Formative A/B period contexts were *Glycymeris gigantea* shell bracelets (61 percent [MNI]) (see Table 120). Additional decorative artifacts include one tubular bead and one carved bird pendant. Also recovered were two artifacts in process (both bracelets), one determinate worked shell artifact, and one unworked *Pecten vogdesi* specimen.

As would be expected, considering the high frequency of bracelets, *G. gigantea* was the most-common shell taxa identified in the collection (MNI = 14). Additional shellfish taxa consist of 2 *P. vogdesi* specimens, 1 *Vermetus* sp. specimen, and 1 freshwater *A. californiensis* specimen (see Table 125). As noted above, the presence of *P. vogdesi* shell could be indicative of high levels of achieved status or an important political office (Bayman 2002).

Middle Formative B Period

The second highest frequency of shell artifacts (MNI = 66; 24 percent) was recovered from contexts dating to the Middle Formative B period. Locus C yielded the highest number of the artifacts (MNI = 39; 59 percent), followed in decreasing frequency by Locus A (MNI = 26; 39 percent) and Locus D (MNI = 1; 1.5 percent). As noted above, Locus D was most-intensively occupied during the Middle Formative A period, which accounts for the low frequency of shell from features assigned to the Middle Formative B period. Also, Locus A has been determined to be a probable single-component occupation during the Middle Formative B period, and thus, we assume that all of the excavated features can be confidently assigned to that period, including those that yielded indeterminate or ambiguous chronological information.

More than 9 out of 10 shell specimens (MNI = 60; 91 percent) were recovered from structures, including intramural features. Extramural features containing shell (MNI = 6; 9 percent), include a fire pit and an *horno* in Locus C (Features 6146 and 7153, respectively), an extramural nonthermal pit in Locus C (Feature 7196), a midden in Locus A (Feature 2143), and the fill of a human inhumation in Locus C (Feature 9410; see above). Overall, these results suggest that, despite this range in feature types, shell use continued to be largely associated with intramural activities, possibly household-level rituals (see Bayman 2002).

As with earlier Middle Formative A and Middle Formative A/B period collections, *Glycymeris gigantea* bracelets is the predominant artifact category (45 percent [MNI]) (see Table 120). However, this percentage suggests a decline from earlier Middle Formative period components, during which bracelets comprise about 60–70 percent (MNI) of the collections. Pendants comprise about 8 percent (MNI = 5) of the Middle Formative B period collection, including one cut oval, one trapezoid, and one sunburst washer designs, a carved bird pendant, and a perforated whole shell. As noted above, the higher prevalence of geometric relative to

Table 126. Comparisons of Shell Artifact Frequencies (MNI) among Feature Groups Based on Spatial Proximity

Artifact Type	Middle Formative A Period				Middle Formative B Period[a]		Late Formative B Period		
	Locus D				Locus A	Locus C	Locus D		
	Group 1 (Phoenix Basin, San Simon painted wares)	Group 2 (Phoenix Basin, Dragoon)	Group 3 (Tucson Basin, Dragoon)	Group 4 (Tucson Basin, San Simon)	Group 1 (Tucson Basin)	Group 2 (Tucson and Phoenix Basins, Dragoon)	Group 1 (Roosevelt Red Ware, Unpainted Red Ware)	Group 2 (Unpainted Red Ware)	Group 3 (Roosevelt Red Ware)
Bead	1	1	—	1	—	1	—	2	—
Tinkler	—	—	—	—	—	—	1	—	1
Pendant (bird)	—	—	—	2	—	1	—	—	—
Pendant (*cipactli*/coyote)	—	—	—	1	—	—	—	—	—
Pendant (geometric)	—	—	—	—	—	3	—	—	—
Pendant (perforated whole shell)	—	—	—	—	—	1	—	—	—
Pendant (indeterminate)	—	—	—	2	—	—	—	—	—
Ring/pendant	—	—	—	—	2	—	—	—	—
Bracelet (plain)	1	2	3	3	9	3	—	—	—
Bracelet (marginal nicking)	—	—	—	1	—	—	—	—	—
Bracelet (carved bird)	1	—	1	—	—	—	—	—	—
Bracelet (carved snake)	1	—	—	—	—	—	—	—	—
Bracelet (indeterminate)	9	6	14	14	7	9	5	—	—
Artifact in process (bracelet)	—	1	1	1	2	5	—	—	—
Worked shell, unknown form	—	—	—	—	2	3	2	—	—
Unworked shell	—	—	4	3	3	7	6	1	1
Total	13	10	23	28	25	33	14	3	2

Note: Feature groups are defined in Chapter 2, this volume.
[a] No shell artifacts were recovered from feature Group 3 (Locus D).

zoomorphic motifs among the Middle Formative B period pendants could reflect a temporal trend. Additional finished artifacts in the Middle Formative B period collection include two beads and two rings/pendants.

The presence of shell artifacts in various stages of manufacture (MNI = 7) as well as manufacturing debris (MNI = 1) indicate limited local artifact production during the latter half of the Middle Formative period. There also appears to be continuity in the types of shell taxa used (see Table 125). *Glycymeris gigantea* continued to be the most frequent shell species (MNI = 37; 56 percent of the Middle Formative B period collection), although this percentage is lower than in the earlier Middle Formative period collections (approximately 78 percent in both the Middle Formative A and A/B collections). Some exceptions, however, include the relatively high frequency of *Pecten vogdesi* (MNI = 6) and *Laevicardium elatum* (MNI = 5) compared to the earlier collections (see Table 125). In addition, the only *Argopecten ventricosus* specimens identified in the collection (MNI = 5) were recovered from a Middle Formative B context, a pit structure with a recessed hearth area and a series of parallel floor grooves (Feature 379) in Locus C that likely served a communal function. Notably, two *Pecten vogdesi* specimens also were recovered from this feature, further underscoring a possible communal functional or association with community-level political office.

Furthermore, Feature 379 contained a somewhat anomalous shell artifact collection consisting of a relatively high frequency (MNI = 22; 33 percent of the Middle Formative B period collection) and a broad variety of finished forms and artifacts in process. The collection included 4 of the 5 pendants, 7 bracelets, 4 artifacts in process (3 bracelets and 1 pendant), 1 worked shell of unknown form, and 5 pieces of unworked shell. The quantity and diversity of shell artifacts in this structure may relate to a community-level usage or, alternatively, to a high status or important leadership role for the individual or lineage that resided in structure Feature 379.

The Middle Formative B period occupation at Mescal Wash was marked by Hohokam-style pit structures, as well as what appeared to be a local architectural style consisting of large pit structures with recessed hearth areas. As explained above for the Middle Formative A period, Garraty and Heckman (see Chapter 3, this volume) identified feature groups based on spatial proximity. They identified three feature groups for the Middle Formative B period—one each in Loci A, C, and D. The painted ceramic collections in Group 1 (Locus A, 7 features) and Group 3 (Locus D, 1 feature) were dominated by Tucson Basin wares, whereas Group 2 (Locus C, 6 features) was distinct, consisting of a more-diverse collection of Hohokam (Tucson and Phoenix Basin painted wares) and Dragoon brown wares.

Shell artifacts were identified in only Groups 1 and 2, which limits the spatial extent of our intrasite comparison (see Table 126). Even so, Loci A and C were the primary loci of settlement during the Middle Formative B period, and thus, this two-way comparison encompasses the major settlement locations for the site at that time. As with the Middle Formative A period, the most-conspicuous difference between Groups 1 and 2 is the differing ratios of bracelets and pendants. In Group 1, bracelets comprise about two-thirds of the shell collection (16 of 25 MNI), and no shell pedants or beads were recovered. Conversely, in Group 2, bracelets comprise only about one-third of the shell artifacts (12 of 33 MNI), and pendants comprise about 15 percent (5 of 33 MNI), including 3 (MNI) geometric pendants, 1 bird pendant, and 1 perforated whole-shell pendant. Group 2 also contains 1 (MNI) *Acanthina* sp. bead, the only one of its kind recovered at the site. Notably, Group 2 includes structure Feature 379, which we describe above as a possible communal structure because of its abundant and diverse shell collection.

Overall, it is unclear whether the slightly different shell collections in Groups 1 and 2 indicate distinct cultural traditions. Rather than cultural variability (e.g., Hohokam vs. Dragoon affiliations), these differences could indicate variability in social status, group or sodality affiliations, ritual practices, or political clout (Bayman 2002).

Indeterminate Middle Formative Period Specimens

This broadly defined group encompasses features that could not be assigned specifically to the Middle Formative A, A/B, or B periods but only generally to the Middle Formative period. A total of 14 pieces (NISP), representing an estimated 13 specimens (MNI), were assigned to this group (see Table 124), including materials recovered from five structures in Locus D, one structure in Locus C, and a borrow pit in Locus D (Feature 3870). As with the other Middle Formative period contexts discussed above, most of the shell artifacts consisted of *Glycymeris gigantea* bracelets (MNI = 9; 69 percent). Also recovered were one whole-shell bead and one ring/pendant (see Table 120). The presence of one indeterminate artifact in process suggests possible shell artifact manufacture. One unworked *Anodonta californiensis* (MNI = 1) specimen also was recovered. This group also includes similar shell taxa to the other Middle Formative period collections, mostly *Glycymeris gigantea* (MNI = 10; see Table 125).

Late Formative B Period

Few features recorded in Mescal Wash were assigned to the early part of the Late Formative period (ca. A.D. 1150–1300; Late Formative A period), and no shell artifacts were recovered from contexts assigned to this time span. However, four adobe structures and an extramural pit in

Locus D were assigned to the Late Formative B period (ca. A.D. 1300–1450). A few families likely resided in a small number of adobe-walled pit structures in Locus D during this time period. Compared to the earlier Middle Formative period components, however, the Late Formative B period is marked by fewer features and probably a considerably smaller population size within the current project area. This difference accounts for the relative decrease in shell artifact frequencies for this time period relative to the Middle Formative period (see Table 124).

A total of 19 (MNI) shell artifacts were recovered from four structures, including *Glycymeris gigantea* bracelets (MNI = 5),an *Olivella dama* bead (MNI = 1), *Conus* sp. tinkler pendants (MNI = 2), and worked *Anodonta californiensis* (MNI = 1) and *Conus* sp. (MNI = 1) artifacts. Notably, this also included an *A. californiensis* cut rectangle bead—the only one of its kind recovered from the site, although in a different feature, a piece of cut *A. californiensis* shell was recovered that may have been intended for bead or ornament manufacture. *Conus* sp. artifacts were recovered from three of the four adobe-walled pit structures, which underscores the importance of this marine species during the Late Formative B. period. Additionally, Late Formative B period contexts yielded unworked *Anodonta californiensis* (MNI = 4) and *Succinea* sp. (MNI = 2) fragments from three of the adobe-walled structures. *Succinea* sp. is a terrestrial snail and likely migrated to the site or was inadvertently transported with the collection of other materials, such as mud or vegetation used for the construction of such structures.

Garraty and Heckman (see Chapter 3, this volume) identified three feature groups for the Late Formative B period based on spatial proximity, each of which exhibit variable proportions of two Late Formative B period ceramic ware classes: elaborately painted Roosevelt Red Ware and unpainted red wares. Group 1 contains roughly equal proportions of Roosevelt Red Ware and unpainted red wares. Group 2 is dominated by unpainted red wares, and Group 3 is dominated by Roosevelt Red Ware sherds. As above, our objective is to determine whether the shell artifact distributions reveal similar differences among the three feature groups.

However, comparison of the shell artifact collections in the three groups is inhibited by the very small number of artifacts in Groups 2 and 3 (MNI = 3 and 2, respectively), which inhibits our ability to detect meaningful variability among them. Despite the small sample sizes, one potentially important difference relates to the distribution of shell beads vs. *Conus* sp. tinklers. Tinklers are present in both Groups 1 and 3, but none was recovered from the feature comprising Group 2. By contrast, Group 2 includes 2 shell beads. Also, bracelets were recovered only in Group 1, but this pattern could be a product of sampling error stemming from the very small shell collections in Groups 2 and 3. Overall, it is plausible that these differences indicate variability in shell artifact use among the residents in these groups of structures, but a much larger sample will be needed to test this hypothesis.

Contemporaneity Studies

Based on archaeomagnetic data, stratigraphic relationships, and temporally sensitive artifacts, Lengyel (see Chapter 2, this volume) identified groups of contemporaneous features during the Middle Formative period on a sitewide scale and within Loci C and D, which she refers to as AM groups. The groups provide a means of analyzing trends in the shell evidence during the Middle Formative period at a far more refined level of detail than is possible using the broader period designations. However, these more-refined AM contemporaneity groups also produce analytical units with small shell collections. Nevertheless, some notable trends can be inferred from these refined chronological groups. Below, we analyze changes in shell use separately in Loci C and D and conclude with a synthetic study of analysis of changes on a sitewide scale.

Locus C AM Contemporaneity Groups

AM Groups 1–4 contained shell artifacts (Table 127); these four groups encompass the Middle Formative A/B and B periods. Garraty and Heckman (see Chapter 3, this volume) make a case that AM Groups 1–3 reflect relatively short-term and successive occupational episodes during the mid to late A.D. 900s. AM Group 4 in Locus C probably reflects a later occupational episode during the A.D. 1000s.

AM Groups 1, 2, and 3 each contain only three (MNI) shell artifacts, which limits their reliability for inferring trends in shell use. The largest sample is from AM Group 4 (MNI = 22), which includes the aforementioned Feature 379, a likely communal “big house” in Locus C. As noted above, this structure generated a larger shell collection than the other structures features in the project area.

Despite the small sample sizes, it is worth noting that AM Groups 1 and 2 include only finished or partially worked artifacts. Artifacts in process are present only in AM Groups 3 and 4. Based on this pattern, we can hypothesize that shell manufacture was not well established prior to that time, although a larger sample will be needed to corroborate this hypothesis. Additionally, shell frequencies markedly increased in the latter portion of the Middle Formative B period (AM Group 4). Concurrent with the increasing frequency is a trend toward a wider variety of artifact types, especially pendants. The validity of these trends is suspect, although all of the shells artifacts in AM Group 4 were recovered from Feature 379, and thus, it is unclear whether these changes represent a temporal trend or if the collection of artifacts was simply unique to that particular feature.

Table 127. Shell Counts (MNI) per AM Contemporaneity Group in Locus C

Artifact Type	Archaeomagnetic Group				Total
	1 (Oldest)	2	3	4 (Youngest)	
Bead	1	1	—	—	2
Pendant (bird)	—	—	—	1	1
Pendant (geometric)	—	1	—	2	3
Pendant (perforated whole shell)	—	—	—	1	1
Bracelet (plain)	1	—	1	2	4
Bracelet (indeterminate)	1	—	1	5	7
Artifact in process	—	—	1	4	5
Worked shell, unknown form	—	1	—	2	3
Unworked shell	—	—	—	5	5
Total	3	3	3	22	31

Note: See Chapter 2, this volume, for a discussion of feature groups.

Locus D AM Contemporaneity Groups

Lengyel (see Chapter 2, this volume) identified seven AM contemporaneity groups in Locus D with date ranges that encompass the Middle Formative A, A/B, and B periods. However, shell artifacts were recovered only in features assigned to AM Groups, 3, 4, and 5 (Table 128). According to Garraty and Heckman (see Chapter 3, this volume), AM Group 3 likely encompasses a date range in the first half of the Middle Formative A period, roughly A.D. 750–850. AM Group 4 is probably associated the latter half of the Middle Formative A period, after about A.D. 850. AM Group 5 likely correlates with transitional period between the Middle Formative A and B periods in the early and mid A.D. 900s. Notably, the latest of these groups in Locus D is probably roughly contemporaneous with the earliest one (AM Group 1) in Locus C.

The largest shell collection among the AM contemporaneity groups in Locus D is from AM Group 3, which encompasses 38 (MNI) shell artifacts. Unfortunately, only 2 (MNI) shell artifacts were recovered from features assigned to AM Group 4, which inhibits out ability to detect diachronic trends in shell use. AM Group 5 includes a somewhat large sample of 13 (MNI) shell artifacts.

Artifact types recovered from the three AM contemporaneity groups varied slightly, and no variability in artifact distribution is conspicuous. The percentage of bracelets varies slightly in AM Groups 3 and 5 (82 and 62 percent (MNI), respectively), but the sample size is too small to confirm this difference as a valid diachronic trend. Overall, these data suggest fairly stable patterns of shell use and use intensity during the Middle Formative A and A/B periods in Locus D. More salient, however, are differences between these groups and the later ones identified in Locus C. Only 1 pendant out of a MNI of 53 artifacts (1.8 percent) was recovered from features assigned to the three AM contemporaneity groups in Locus D, which is well below the MNI of 5 of 31 (16 percent) among the features assigned to the four groups in Locus C. This result complements the abovementioned trend of increasing use of pendants from the Middle Formative A to Middle Formative B period.

Sitewide AM Contemporaneity Groups

For the project area as a whole, Lengyel (see Chapter 2, this volume) identified six AM contemporaneity groups that encompass the entire Middle Formative period (Table 129). However, no shell artifacts were recovered from features assigned to AM Group 4, which is excluded from our analysis. Generally, AM Groups 1 and 2 correspond to the first and second centuries of the Middle Formative A period (A.D. 750–950) and include only features from Locus D. AM Group 3 is associated with the transitional Middle Formative A/B period (ca. mid A.D. 900s) and include features from Loci C and D. AM Groups 5 and 6 also date to the Middle Formative B period (ca. A.D. 950–1100) and encompass features from Loci A, C, and D.

As is the case with the AM contemporaneity groups defined for Loci C and D, the shell counts vary substantially among the sitewide groups. AM Groups 1 and 6 are fairly sizable (MNI = 38 and 30, respectively), but AM Groups 2 and 5 possess very small MNI values of 2 and 8, respectively. A total MNI of 15 shell specimens were recovered from features assigned to AM Group 3.

Table 128. Shell Counts (MNI) per AM Contemporaneity Group in Locus D

Artifact Type	Archaeomagnetic Group			Total
	3 (Oldest)	4	5 (Youngest)	
Bead	2	—	—	2
Pendant (bird)	—	1	—	1
Bracelet (plain)	8	—	1	9
Bracelet (carved bird)	1	—	—	1
Bracelet (indeterminate)	22	—	7	29
Artifact in process	2	—	2	4
Worked shell, unknown form	—	—	3	3
Unworked shell	3	1	—	4
Total	38	2	13	53

Note: See Chapter 2, this volume, for a discussion of feature groups.

Table 129. Shell Counts (MNI) per Sitewide AM Contemporaneity Group for Middle Formative Period Features

Artifact Type	Archaeomagnetic Group					Total
	1 (Oldest)	2	3	5	6 (Youngest)	
Bead	2	—	1	1	—	4
Pendant (bird)	—	1	—	—	1	2
Pendant (geometric)	—	—	—	1	2	3
Pendant (perforated whole shell)	—	—	—	—	1	1
Bracelet (plain)	8	—	1	1	5	15
Bracelet (indeterminate)	22	—	8	—	9	39
Bracelet (carved bird)	1	—	—	—	—	1
Artifact in process	2	—	2	2	5	11
Worked shell, unknown form	—	—	3	1	2	6
Unworked shell	3	1	—	2	5	11
Total	38	2	15	8	30	93

Note: See Chapter 2, this volume, for a discussion of feature groups.

Comparisons of the different groups indicate continuous use of shell throughout the Middle Formative period; the variable frequencies probably stem from the different numbers of features assigned to these groups rather than temporal changes in the intensity of shell use. In other words, these fluctuations are probably tied to changes in village population size and not to substantial shifts in per capita demand for shell artifacts among the site inhabitants. Additional data will be needed to corroborate this conclusion, however.

Of note, bracelets are present throughout the Middle Formative period sequence, as were artifacts in different stages of manufacture. However, the frequencies of bracelets generally decreased over time; excluding the smaller AM Groups 2 and 5 collections, the percentages of bracelet steadily declined from 82 percent of the shell collection in AM Group 1 (31 of 38 MNI) to 60 percent in AM Group 3 (9 of 15 MNI) to a low of 47 percent in AM Group 6 (14 of 30 MNI). As noted, however, this trend coincides with a general increase in pendant frequencies. Among these same groups, pendants are absent in AM Groups 1 and 3 but comprise about 13 percent (4 of 30 MNI) in AM Group 6. However, it is worth noting that 1 (MNI) pendant piece was present in the smaller AM Groups 2 and 5. Overall, the use of shell pendants appears to have peaked during the final centuries of the Middle Formative period in Mescal Wash. No such changes are evident with respect to shell beads.

Comparison of AM Groups 1, 3, and 6 also suggest a possible trend of increasing local production of shell over time. The percentages of artifacts in process increases from 5 percent in AM Group 1 (2 of 38 MNI) to 13 percent in AM Group 3 (2 of 15 MNI) to 17 percent in AM Group 6 (5 of 30 MNI). These suggest a diachronic shift from the primary acquisition shell artifacts as finished goods to a more-frequent acquisition of raw materials for local manufacture of shell artifacts. Additional data will be needed to corroborate this trend, however.

Discussion and Conclusions

The Mescal Wash shell artifact collection consisted of a variety of different types of worked and unworked marine, freshwater, and terrestrial shell artifacts. Shell artifacts were recovered from contexts located across the site within intramural and extramural contexts dating to all time periods identified for the site (Early Formative–Late Formative B period), but the majority were recovered from features assigned to the Middle Formative period. The shell collection provides a glimpse of the aesthetic preferences and manufacturing activities of the site's occupants, who expressed Hohokam (Phoenix and Tucson Basins), and Mogollon (Dragoon and San Simon) cultural affiliations and extralocal connections (Vanderpot and Altschul 2007).

The presence of marine shells indicates that the local population had ties with the Gulf of California and the southern California coast. The Mescal Wash site occupants may have acquired marine shell directly from coastal regions or through exchange (see Bayman 2002). Two major trade routes crossed Arizona at the time Mescal Wash was occupied, connecting local groups with the areas of northwestern Mexico and the greater Southwest. During the Late Archaic and Early and Middle Formative periods, trade corridors extending between the Gulf of California and Arizona passed through the Western Papaguería, following the Gila River floodplain and drainages (Hayden 1972; Howard 1983; Lyon et al. 2008; McGuire and Schiffer 1982:240–252; Teague 1981:12–18). During the Middle Formative B period, trade activities increased along another route, which followed Río del la Concepción and the Santa Cruz River through northern Sonora (R. Nelson 1991; Vokes 2009:396). Considering the long-term occupation at the Mescal Wash site, inhabitants likely obtained marine through direct acquisition or exchanged shell from both routes. Prior to the Middle Formative B period, shell was likely transported by way of the Western Papaguería, and later on, the northern Sonora route was likely more intensively used. Marine shell from the southern California coast likely passed through the Colorado Desert along the Lower Colorado River region and into southeastern Arizona (Koerper 1996).

In addition to marine shell, the site's occupants used freshwater *Anodonta californiensis*, which was locally available in the region. Collected for food, raw material manufacturing sources, or a combination of these, they likely obtained the freshwater shell from nearby Cienega Creek and Mescal Wash. A total of 16 *A. californiensis* shell specimens were recovered in the project area as both worked artifacts (MNI = 4) and unworked pieces (MNI = 12), which could reflect its use as both a food source and as a raw material for making shell jewelry.

A variety of different types of shell were used over time; however, *Glycymeris* spp., *Olivella dama*, and *Anodonta californiensis* appeared to have been used continuously. The greatest shell taxonomic diversity was recorded in contexts assigned to the Middle Formative period, whereas much less variability was present in the Early Formative and Late Formative B periods. Interestingly, most of the *Conus* sp. specimens (3 of 4 MNI) were recovered from Late Formative period contexts in the form of tinklers and worked shell of unknown form. This evidence is consistent with Bayman's (2002:83) observation that the use of *Conus* sp. shell as a raw materials for making shell artifacts peaked during this span (i.e., during the Classic period in the Hohokam sequence).

The greater taxonomic diversity in the Middle Formative period might reflect a larger and more internally diverse shell-using population. Alternatively, exchange patterns or other economic factors could have facilitated access to a greater variety of marine shell species. For example, if Mescal Wash had been incorporated into the extensive Hohokam ballcourt system during the Middle Formative period, the site inhabitants may have had ready access to a wide variety of goods and materials sold during the ballcourt events (e.g., Wilcox and Sternberg 1983). David Abbott (2010) (see also Abbott, Smith, and Gallaga 2007) described the ballcourt networks as a market system, and if so, goods from all over the Hohokam region may have circulated through the ballcourt network. Furthermore, if marine shell was regularly sold during ballcourt events, it stands to reason that a greater diversity of species could have been made available at the "market nodes" located in ballcourt villages throughout the region. Garraty and Heckman (see Chapter 2, this volume) make a similar argument to explain the widespread availability of nonlocal painted pottery types in the Mescal Wash collection.

In general, the occupants of the Mescal Wash site were mainly consumers of shell artifacts, as evidenced by the predominance of finished artifacts in the analyzed shell collection. Finished artifacts consisted of mainly decorative items, with bracelets dominating the analyzed collection. Bracelets were ubiquitous across the site and throughout the occupation sequence from contexts dating from the Early Formative to the Late Formative B period. Finished shell artifacts associated with the earliest period of occupation during the Early Formative period consisted of *Glycymeris gigantea* bracelets and an *Olivella dama* spire-lopped bead.

The range of artifact types increased over time, however, peaking during the Middle Formative period. In particular, the Middle Formative period witnessed an expansion of pendant types that included needles, as well as cut and carved geometric and zoomorphic forms. This increase in pendant frequencies over time has been noted at other Hohokam sites in the Arizona (Vokes 2001, 2009). As pendant frequencies increased, however, the relative popularity of *Glycymeris* bracelets decreased over time throughout the U.S. Southwest, according to Vokes (2009).

The evidence from Mescal Wash corroborates the trend identified by Vokes (2001, 2009). The percentage of bracelets decreased from 70 percent (MNI) in the Middle Formative A period collection to 45 percent (MNI) in the Middle Formative B period collection. For the Late Formative B period, bracelets comprise only 26 percent of the collection. Concurrently, the percentages of shell pendants increased over time in the AM contemporaneity groups, as explained above. This increase in pendant frequencies over time is muted, however, if we consider the more-broadly defined periods (7.0 vs. 7.6 percent [MNI], respectively, for the Middle Formative A and B period collections). From a slightly different perspective, however, the ratio of bracelets to pendants decreases from 10 to 1 (MNI) in the Middle Formative A period to 6 to 1 (MNI) in the Middle Formative B period. For the Late Formative B period, the percentage of pendants increases to about 11 percent (MNI)—a roughly 50 percent increase relative to the percentages in the Middle Formative period collections—and the ratio of bracelets to pendants declines to 2.5 to 1 (MNI). The behavioral implications of this trend are unclear, but it might broadly suggest diachronic changes in ritual practices and/or in media used to express social affiliation and identity.

We also hypothesize a temporal trend related to pendant shapes and forms. The earlier pendants recovered from Middle Formative A period contexts in Locus D were mostly naturalistic and zoomorphic motifs. In contrast, the majority of Middle Formative B period pedants from Loci A and C were fashioned into more abstract geometric shapes. The sample sizes are small, but if valid, this trend could indicate changes over time in the social use and perceptions of shell pendants. One possibility is that the images and concepts depicted in ritual paraphernalia changed from more naturalistic to abstract expressions. These changes also could indicate changes in the social meanings and conceptual depictions. Zoomorphic pendants may have portrayed totemic social affiliations, whereas geometric pendants could have expressed different concepts related to ritual participation or cosmologies.

In addition to finished artifacts, the presence of artifacts in different stages of manufacture as well as manufacturing debris indicates limited local production at the site. The Middle Formative A period marked the first evidence for localized manufacture. Manufacturing materials included bracelets and pendants in different stages of manufacture, as well as shell fragments that were cut, chipped, ground, or a combination of these modifications. Reworked bracelet fragments attested to economical use and reuse of marine shells. The relative frequency of finished artifacts compared to those in process and manufacturing debris indicate that, although limited onsite manufacture occurred, the site occupants likely imported most of their finished shell artifacts from external production sources.

The analysis of the refined chronological evidence (AM contemporaneity groups) presented above indicates a possible trend of increasing local production of shell artifacts over the course of the Middle Formative period. For instance, the percentages of artifacts in process increases nearly threefold from 3.5 percent in features assigned to the Middle Formative A period to 10–11 percent (MNI) in features assigned to the Middle Formative A/B and B periods. Based on this evidence, as we hypothesized above, during the Middle Formative A period, the site inhabitants probably acquired shell artifacts as finished goods. However, over time, they increasingly obtained raw or partially processed shell for the local manufacture of shell artifacts.

For the most part, shell artifacts were mainly associated with structures and intramural contexts. One structure of note was Feature 379, a likely communal pit structure in Locus C assigned to the Middle Formative B period. The shell artifact collection recovered from Feature 379 contrasted markedly with other structures at the site. The feature yielded a relatively high frequency of shell artifacts, as well as a diverse series of artifact types, including bracelets; cut and carved oval, sunburst, and bird pendants; and bracelets and pendants in production. If the structure was in fact communal, then the shell artifact diversity may be attributed to a wider range of people using the structure for a variety of different activities, including, in part, shell artifact manufacture. However, we cannot rule out other explanations for the larger and more-diverse shell collections. One alternative possibility is that the resident of this structure achieved a high social rank or held a high political office in the community. The presence of a *Pecten vogdesi* pendant and unworked shell specimen supports this possibility. Bayman (2002:77) (after R. Nelson 1991:83–84) has argued that *Pecten vogdesi* pendants were widely recognized among Middle Formative period (pre-Classic period) Hohokam peoples as symbols of political office and leadership and, therefore, "were restricted to specific segments of Hohokam society."

Shell artifacts recovered from extramural features were similar to those from intramural contexts and included bracelet fragments and unworked shell, as well as lower frequencies of beads, indeterminate worked shell, and manufacturing materials. Thermal features contained burned as well as unburned shell, indicating that shell was occasionally deposited following thermal activities.

In general, the Mescal Wash site shell collection shared many similarities with those recovered from other sites in southern Arizona. As with such sites as Sunset Mesa Ruin (AZ AA:12:10 [ASM]), Los Morteros (AZ AA:12:57 [ASM]), Julian Wash (AZ BB 13:17 [ASM], Fastimes (AZ AA:12:384 [ASM]), and Garden Canyon (AZ EE:11:13 [ASM]), *Glycymeris* bracelets dominated the Middle Formative period collections (Vokes 1988, 1995, 2009). At the latter two sites, bracelet frequencies decreased over time, coinciding with an increase in popularity of pendants (Vokes 2001), as is the case at Mescal Wash. Geometric and zoomorphic pendants and carved bracelets similar to those recovered in Mescal Wash also have been recovered from other Middle Formative B period contexts, including Julian Wash, Sunset Mesa Ruin, and Shelltown (AZ AA:1:66 [ASM]) (Haury 1937b, 1976; Vokes 1999, 2009). Interestingly, zoomorphic cut pendants and carved bracelets outnumbered geometric forms at Mescal Wash. This pattern was also true for Sunset Mesa Ruin during the Middle Formative B period (Vokes 1999). Similarities in artifact styles found at other sites in southern and central Arizona underscores that the occupants of Mescal Wash likely shared cultural practices and social ties with other communities in the region.

Comparisons of different shell artifact styles and relative frequencies indicate some spatial variability in shell use at Mescal Wash. Loci C and D were more closely aligned in terms of artifact types and relative frequencies, suggesting that they may have in fact participated in a shared cultural tradition of shell use. Comparisons with Garraty and Heckman’s (see Chapter 3, this volume) ceramic feature groups, however, did not reveal distinct shell patterning that could be attributed to cultural variability. Rather, the observed patterns of variability likely reflect temporal changes in shell use during the Middle Formative period. This lack of distinct spatial patterning may have been a function of the relatively small sample recovered from the feature groups, particularly in the case of diagnostic artifacts. Alternatively, it may reflect shared Hohokam and Mogollon cultural traditions, as well as a broader shell tradition encompassing much of the U.S. Southwest.

CHAPTER 7

Bone Artifacts

Janet L. Griffitts

A total of 65 bone artifacts were recovered from the Mescal Wash site. This total includes several broken tools that were refitted and counted as single artifacts, but does not include six additional artifacts found in mortuary contexts. All 65 collected artifacts are summarized in Appendix 8.A. Awls or other pointed tools comprise nearly half of the collection. Next most common are ornamental bones, including tubes, beads, and rings. A few other artifact types and unidentifiable fragmentary artifacts were also recovered. Nearly 90 percent of the artifacts came from Locus D, with only 1 found in Locus A, and 5 in Locus C.

Several overarching research themes were proposed at the beginning of this project (Altschul et al. 2000). Themes best addressed by the present study are those focusing on technology and site function, in particular by looking at craft production, tool use, and raw material selection. Site chronology and cultural affiliation form another theme. Additionally, certain bone objects may provide hints of ritual life and symbolic behavior, thereby addressing the theme of ideology.

Following this introduction is a detailed discussion of the analysis methods, focusing on use-wear analysis. Next, the analysis results are presented, including a summary of the taxa represented, proportions of burned bone, and descriptions of nonutilitarian and utilitarian artifacts. Although not part of the analysis, a brief discussion of six bone artifacts found in burials is also provided. A brief comparison with other sites in the region is followed by the summary and conclusions in the final portion of this chapter.

Methods

Bone artifacts were initially analyzed by Robert Wegener and the data entered during the project's overall faunal bone analysis presented in Chapter 8. Bone and antler artifact taxon, element, and bone condition were identified during the initial faunal analysis, and the artifacts were set aside for additional work. At that time, artifacts were assigned to standard types based on overall shape, such as awl, ring, or tube. Later, more-detailed analysis was conducted by the author, identifying any remaining manufacturing traces and examining tools for use wear using high-power optical microscopy analysis. Ethnographic and ethnohistoric sources were consulted for possible tool uses (Bartlett 1949; Densmore 1979; Fowler 1989; Hayden and Cannon 1984; Hudson and Blackburn 1987; Kluckhohn et al. 1971; Newman 1974; Parsons and Parsons 1990; Rea 1997, 1998; Russell 1908; Webb 1959).

This study employs methods introduced by lithic-use-wear researchers (Keeley 1980; Vaughan 1985). Use-wear analysis was conducted using an Olympus BHM-J metallurgical microscope with incident light at 50×, 100×, 200×, and 400×. A 10× hand lens and the unaided eye were used to identify manufacturing traces and other large patterns. Wear patterns were compared to those found on the surfaces of a comparative collection of 180 replicated bone and antler tools and 7 ethnographic specimens of known use. The tools in this comparative collection were used for a variety of tasks, with many contact materials and motions. High-power optical microwear analysis was employed to identify possible tool uses; because this method is not yet common in bone tool analysis, detailed discussions describe the stages of analysis and appearance of replicated wear. Descriptive information is provided on tool morphology, manufacturing methods, taxon, and skeletal elements. The classification system used in this analysis follows that used in earlier studies on bone artifacts from southern Arizona (Griffitts and Waters 2005). Use-wear analysis was conducted to identify tool uses and to aid in reconstructing human behavior at and around the site.

Use-Wear Analysis

Experimentally Produced Use-Wear Patterns

Use-wear patterns are made up of several kinds of surface modifications, including the presence or degree of rounding or flattening of surfaces, pitting, cracking, polish appearance, overall distribution, directional polish features, and direction of striations. Interpretation relies on the combination of these various traces. Striation orientation shows the direction and kinds of movements employed, and striation size and appearance can provide data on material texture. For example, the striations on tools used to work gritty, dirty hides are heavier and wider than those on tools used to work cleaner skins. Fine-textured plants leave finer striations than those with coarser fibers. The distributions of polish and other features can provide clues to the material contacted, as discussed below.

Manufacturing processes include grinding, cutting, breaking, and deliberate polishing, all of which may leave traces on the bone. These processes can be subdivided further into different types. For example, cutting may be divided into groove-and-snap, shaving or whittling, and sawing. Tools can be made by flaking or by simply taking advantage of a sharp-edged spiral fracture. Manufacturing traces are usually large and can be distinguished from use wear by differences in size. Most manufacturing traces are visible macroscopically or with a 10× hand lens and are too large to be seen with higher magnification (Griffitts 2006). Use traces are usually, though not always, smaller.

Experimental tools were used for a variety of activities involving many soft and hard contact materials and wet and dry substances: basket making, fiber processing, cotton weaving, leather and hide working, wood working, pressure flaking, pottery modeling, and others. Use-wear analysis cannot identify every exact use, but instead diagnoses general contact materials, direction of use, and motions used to interpret probable use. For example, a tool with wear suggesting that it was used with silica-rich plants in twisting motions at the tip is likely to have been employed as a basketry awl, but could have been used for another activity that involved twisting the tip in silica-rich plants.

Details of experimental design and the resulting experimentally produced use-wear patterns on bone are described at length elsewhere (Griffitts 1993, 2001, 2006; Griffitts and Bonsall 2001; Griffitts and Waters 2005; LeMoine 1991); therefore, they will be given only a brief treatment here. A few broad generalizations can be made concerning contact materials. It is important to note that, with a few exceptions, these patterns only become visible at higher magnifications—50× to 400×. Researchers seeking to find similar traces using 10×–25× are likely to be unsuccessful.

Other wear patterns were produced experimentally, but those listed below are the most common and most relevant for the present project. The macroscopic presence of polish alone does not always signify that a bone was used. Many processes can produce polish on bone; carnivore chewing, the effects of wind or water, tool use, or overzealous postexcavation cleaning (Griffitts 1993). Weathering causes bone to exfoliate, and use wear can be altered or lost. Caliche deposited on the surface interferes with the ability to observe use wear, and is very difficult to remove without damaging the wear. Bones can be broken by trampling, dog chewing, and other processes. Unless stated otherwise, the discussions below are drawn from Griffitts (2006).

Use Wear Formed by Contact with Soft Materials

People in the past made a variety of products using leather, hide, and rawhide, including containers, clothing, and shelters. The surfaces of tools used in contact with soft materials such as leather or hide become polished and rounded. Wear patterns follow the contours of the bone surface. Pitting, usually visible at 200×–400×, is often present on tools used to work leather or hide, but surface cracking is rarely seen. Wear formed during fresh or wet hide processing tends to be more widespread than wear developed through dry hide or leather working, but these differences are subtle and are here considered together.

Hand wear is found on some experimental, ethnographic, and archaeological tools. This takes the form of polish and rounding. The wear produced by contact with human hands during the course of a tool's use life is similar overall to that produced by leather and hide working, but the striations are less common, more widely spaced, and less patterned than those found on the working ends of tools used to work leather or hide. Hand wear is very slow to develop on experimental tools, and a tool handle with heavy hand wear probably received heavy use.

Experimental tools used to weave or crochet homespun or commercially processed cotton develop rounded and very brightly polished surfaces, but they are less likely to be pitted than leather-working tools. Instead, the surfaces develop very fine surface cracking. Cracking is found only rarely on experimental leather or hide working tools, and is usually only visible at higher magnifications, such as 200×–400×.

Use Wear Formed by Contact with Silica Rich Plants

Bone tools are used to process silica-rich plants or to make other artifacts in a variety of ways. Examples abound in the ethnographic literature. People used tools to interact with silica-rich plants in many ways, including the making of baskets, mats, and nets; preparation of basket-making materials (Bartlett 1949; Newman 1974); weaving; and the processing of plants for fiber (Gustafson 1980:73; Russell 1908). Hopi basketmakers split yucca leaves into strips using an awl tip (Bartlett 1949). The Pima scraped fibers from roasted agave (*Agave* sp.) leaves using the edges of deer scapulae (Russell 1908:142), fished the Gila River using fiber nets (Castetter and Bell 1942:72), slept on woven yucca-leaf mats (Webb 1959:16), and added black color to their baskets using wefts wrapped in strips of devil's claw pods (*Martynia fragrans*). Pima women soaked or buried these pods in moist sand until the black outer covering was soft enough to be stripped away with the point of an awl (Newman 1974). In the historical period, the Pima used stone scrapers or pointed tools made from creosote-bush wood (*Larrea tridentata*) to shell dried maize (Castetter and Bell 1942:182), but bone and antler shelling and husking tools are documented in other regions (Hayden and Canon 1984).

As with tools used for soft materials, the surfaces of plant-working tools become polished, but the polish often has a different appearance under magnification, possibly because silica residues have adhered to the tool surface (d'Errico et al. 1995). The silica particles in plants such as grass, corn husks, tree bark, yucca, and agave are hard and abrasive (LeMoine 1991), and the wear produced by silica-rich plants is found on the high points of the bone surface and does not extend deeply into the lower areas of the bone surface. Consequently, the surfaces become flattened rather than rounded, and in very heavily worn tools, the high points are sheared off. Surface cracking is often seen at 400×, and pitting may or may not be present. Grit particles in dirty materials produce large, sharp, nonparallel striations that are often isolated rather than grouped as the striations left by parallel-fibered plants are.

Experimental tools used to split leaves or strip the fibers from fibrous plants develop parallel striations in a flattened surface. The striations usually lead from one edge. The wear traces left by plant splitting resemble those left by plant fiber stripping, and both are similar to those produced by corn husking. A person making wicker baskets uses both the tip and the shaft of an awl. She or he employs the tip to open spaces between the warps (producing longitudinal and diagonal striations on the tip), and the edge of the shaft to press down wefts between warps. This last motion can cause groups of striations to form on the edges of tool shafts. These wear patters are similar, but not identical, and there are some differences that may be visible with better preserved tool surfaces. Striations from wicker work, for example, generally occur in parallel-fibered groups that are confined within a short area, while corn husking produces striations that are more widespread and less parallel than those produced while making baskets.

Use Wear Formed by Pressure Flaking

Wear traces on flint knapping tools are among the few that are visible macroscopically or at low magnifications. Ends are battered, with deep, wide, sharp-edged striations and a patchy polish. Tiny stone flakes are sometimes left embedded in tips of experimental tools (Griffitts 1993; Olsen 1989).

Use Wear Formed by Wood Working

Wood is neither as soft as leather or hide, nor as abrasive as the hard particles and fibers contained within silica-rich plants, and the resulting wear patterns usually fall between the two. Different hardnesses of wood leave different patterns. These are described in more detail elsewhere (Griffitts 2006), as no wear suggesting woodworking was observed in the present collection, no further discussion is warranted.

Effects of Burning on Microwear

Experiments show that some formation processes can change the appearance of use wear on bone (Griffitts 2006). For example, when tools are used and then burned until blackened, the surfaces grow shinier and appear macroscopically to be more heavily polished. This bright polish is, in fact, caused by burning, rather than by use. The surfaces of blackened bones become smoother and more rounded; experimentally produced wear formed by contact with harder materials, such as silica-rich plants, becomes more like wear created by contact with soft materials after burning. Therefore, caution must be used when interpreting wear patterns and intensity of polish on burned bones. As bones are heated, the surfaces eventually melt and bubble, and wear patterns are lost; but some large manufacturing traces may still be seen. At this point, the bone is still black and can be very shiny. When bone is heated further, it becomes calcined. The color changes to gray or white, and when observed under high magnifications, the outermost bone surfaces of experimentally heated replicated bone tools often appear to have peeled away, and the bubbly surface is no longer present. The surface also becomes less reflective, and it is difficult to discern details of the tool surface under optical magnification. Some manufacturing traces may remain on calcined bone, but microscopic use-wear traces are usually no longer visible.

Analysis Results

Taxa and Elements Represented

All artifacts were made from mammalian taxa, with the possible exception of a single bone that could not be identified to any taxon. Altogether, slightly more than 70 percent of the modified bone was assigned to deer, pronghorn, artiodactyl, and indeterminate deer-sized and deer- to bison-sized taxa. The remainder was mostly assigned to cottontails, jackrabbits, leporids, and rabbit-sized taxa, with one specimen identified as coyote-to-deer-sized and one listed as entirely unknown. Most are made from long bones, and a few of these long bones could be identified further as metapodials or other elements.

Proportion of Burned Bone

Many of the bone artifacts in the Mescal Wash collection were burned at some point in their life histories. Burning can come about through a variety of processes. Objects may be burned as part of discard processes. Burial goods may be cremated along with the person they accompany, or, more prosaically, people may simply discard their tools in a nearby fire. Tools can also be accidentally burned; for example, if the structure in which they are stored catches fire. Altogether, approximately 50 percent of the bone artifacts from Mescal Wash were burned. Unfortunately, in addition to causing bones to become fragmented and hard to identify, as noted above, these high rates of burning interfere with use-wear analysis. Since burning can alter wear and cause surfaces to appear as if they contacted soft materials, rounding on burned surfaces should not be taken to indicate leather working or other similar activity unless other traces also support this interpretation. Since woodworking produces wear patterns that lie in between the rounding formed by leather working and the flattening characteristic of silica-rich-plant processing, use wear suggestive of wood working is also suspect when a tool surface is burned. Therefore, when high proportions of bone are burned, leather and hide working and wood working may be underrepresented compared to activities that involve contact with harder materials. Because nearly equal proportions of burned and unburned artifacts were found, it is likely that the proportions of tools interpreted as plant processing tools and those used for softer materials are biased in favor of plant processing tools. The surfaces of several tools from this project are black and bubbly and appear melted under high magnification. Presumably, these fragile-looking bubbles would be damaged by the working of abrasive materials such as silica-rich plants, and charred, completely blackened bone tools would be likely to leave black residues on hands and worked materials, and this would be a consideration when working fine hides or baskets. Burning on these tools therefore is likely to have occurred during or after discard.

Types of Bone Artifacts

This study uses a multistage typology. First, objects are divided into two very general categories: utilitarian and nonutilitarian bone. This division is not as simple and straightforward as it may seem. Some objects look decorative, such as large beads or tubes, but may in fact be utilitarian tool hafts. Conversely, some objects that we see as purely utilitarian may in fact have had a symbolic function for the tool's owner. Nonetheless, the two-part division provides a convenient starting point for discussions of bone artifacts and their uses.

Nonutilitarian Bone

Tubes, beads, and rings form just over 20 percent of the collection (Tables 130 and 131). Of these, tubes were most numerous, followed by beads and a few rings. Tubes and tubular beads were cut from long bones. Several large tubes were cut from the bones of artiodactyls or similar-sized taxa; smaller tubes and beads were made from bones of smaller taxa (see Table 131). Beads and tubes appear to be minimally decorated aside from polishing or were decorated using perishable materials. Artifact makers cut and beveled the ends of two tubes and incised each with a single transverse cut. On one tube from the Middle Formative (PD 9635) (Figure 135a) the cut is in the center, extending most of the width of one side. On the other (PD 7403, from the Middle Formative B), the groove runs parallel to the end about 2 mm from the edge. Beads and tubes can have ornamental uses, for example as hair ornaments (Di Peso 1956; Rohn 1971) or as tinklers (Olsen 1980). Some could have more ritual functions. Bone tubes found in Finch Camp (AZ U:11:7 (ASM) were found associated with pipe bowls, and in one case, the end was placed in an individual's mouth (Griffitts 2010). Although tubes are discussed here as ornamental, or nonutilitarian objects, researchers suggest a number of functions for cylindrical bones in the Southwest (see Ferg 1998 for an extensive review of bone tubes in the Southwest and their many possible uses), and the utilitarian/nonutilitarian division used here may ignore some of the varied uses. When strung together to function as wrist guards (Hodge 1920) they could have both an ornamental and utilitarian function. It is also possible that some large tubes might have served as tool handles. Antler pieces with hollowed-out ends were recovered from Late Archaic/Early Agricultural contexts at Los Pozos, Stone Pipe, and Santa Cruz Bend and interpreted as socket handles (Griffitts and Waters 2005). Two awls from Ventana Cave (Haury 1950) were first encased in pitch and then wrapped in bark, and a similar effect could have been accomplished by affixing a tube onto a narrower tool to form a larger haft. Farther from our project area, a bone awl with a tubular point protector was found in a Tsegi Basketmaker III site (Guernsey 1931:84).

Several pieces from Mescal Wash could be either fragments of large tubes or handles of other artifacts. They are listed in Table 131 with other tubes, but could as easily be

Table 130. Bone Artifacts from Mescal Wash, by Type and Time

Time	Awl		Flaker		Awl or Spatulate Tool		Shaft		Handle		Ring		Bead		Tube		Tube or Handle		Unknown		Total	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Undated	1	33	—	—	—	—	1	33	—	—	—	—	—	—	1	33	—	—	—	—	3	5
Archaic	1	50	—	—	—	—	—	—	1	50	—	—	—	—	—	—	—	—	—	—	2	3
Early/Middle Formative	1	50	—	—	—	—	—	—	1	50	—	—	—	—	—	—	—	—	—	—	2	3
Middle Formative	9	53	—	—	—	—	1	6	—	—	—	—	2	12	4	24	—	—	1	6	17	27
Middle Formative A	9	47	1	5	1	5	2	11	1	5	1	5	—	—	2	11	1	5	2	11	20	30
Middle Formative B	3	38	—	—	—	—	—	—	1	13	1	13	1	13	1	13	1	13	—	—	8	13
Late Formative B	8	89	1	11	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	9	14
Post-A.D. 500	2	67	—	—	1	33	—	—	—	—	—	—	—	—	—	—	—	—	—	—	3	5
Pre-A.D. 840	—	—	—	—	—	—	—	—	—	—	—	—	1	100	—	—	—	—	—	—	1	2
Total	34	53	2	3	2	3	4	6	4	6	2	3	4	6	8	13	2	3	3	5	65	100

Note: Percentages are rounded to the nearest whole number.

Table 131. Nonutilitarian Bone Artifacts and Possible Bone Artifact from the Mescal Wash Site, by Time Period and Context

Time		Location							Measurements			Taxon and Element				
Period	Date Range	Feature No.	Feature Type	Subfeature	Prov	Locus	Level	Strat	Length	Width	Thickness	Common Name	Element	Burning	Artifact Type	Comments
N/A	N/A	SU 5188			7001	C	1	mixed	33	12	6	deer-sized mammal	long bone	unburned	tube	Heavy tube fragment, root etched, bevelled end.
Middle Formative	A.D. 700–1040	6129	structure		7369	C	1	fill	50.8	25.6	19.6	medium artiodactyl	proximal humerus	unburned	tube or haft/ handle	Large tube or handle fragment, cut at one end, possible carnivore gnawing on proximal end.
Middle Formative	A.D. 735–865	438	structure		5105	D	2	fill	36.2	11.8	4.4	deer	metapodial condyle	unburned	bead	Metapodial condyle, drilled through center from one side, polished all over. Bead, pendent, or tool fragment?
Middle Formative	A.D. 735–865	438	structure		5210	D	2	fill	73	22	4	deer-sized mammal	long bone	black	tube	Both ends cut, broken into 7+ fragments. About a third of the tube is present. Longitudinal striations on high points of cancellous side.
Middle Formative	A.D. 735–865	825	multiple features		8628	D	2	floor fill	20	9	3	rabbit-sized mammal	long bone	unburned	tube	Cut-and-snapped bone tube, edge was ground to a bevel.
Middle Formative	A.D. 860–1015	3545	structure		2429	D	2	fill	21	9	8	rabbit-sized mammal	possible femur shaft	unburned	bead	Complete, ends cut, surface polished, very thin walled.
Middle Formative	A.D. 825–1090	8655	structure		9635	D	3	structural debris	43.2	16.8	3.3	deer-sized mammal	long bone	unburned	tube or haft/ handle	Grooved and snapped, bevelled edges, longitudinal striations on inside, rounded, pitted as though either polished with or strung on leather. Transverse cut on the center of bone.
Middle Formative A	A.D. 650–950	5994	structure		7944	D	4	structural debris	39.4	26.8	18.2	deer-sized mammal	long bone	black	tube	Large tube burned, cut on both ends via groove and snap. Striations on the cancellous side, possible string wear.
Middle Formative A	A.D. 685–915	834	structure		8853	D	3	floor	60.6	18.3	3.7	deer-sized mammal	long bone	unburned	tube or tool fragment	One end cut via groove and snap, bevelled, maybe tool handle, maybe tube fragment. Very weathered.

Time		Location							Measurements			Taxon and Element				
Period	Date Range	Feature No.	Feature Type	Subfeature	Prov	Locus	Level	Strat	Length	Width	Thickness	Common Name	Element	Burning	Artifact Type	Comments
Middle Formative A	A.D. 650–950	3595	multiple features		5756	D	1	fill	20.7	7.6	3.2	deer-sized mammal	long bone	unburned	tube	10 fragments of a heavy large tube. most of tube is present. maybe humerus.
Middle Formative A	A.D. 650–950	3595	multiple features		5756	D	1	fill	7	20	3	deer-sized mammal	long bone	unburned	ring	Cut via groove and snap.
Middle Formative B	A.D. 700–1150	2192	structure		8161	A	1	structural debris	6	12	10	deer-sized mammal	proximal humerus?	unburned	ring	Root etched, rounded on inside, for small fingers but not child sized, polished on ends, root etched on exterior, 10 mm inside diameter.
Middle Formative B	A.D. 1010–1015	379	structure		7077	C	2	floor fill	25	12	4	deer-sized	long bone	unburned	tube or tool fragment	Fragment, cut/bevelled at one end, use unknown, root etched but possibly polished.
Middle Formative B	A.D. 935–1015	6098	structure	2	7403	C	1	structural debris	32.8	12.5	10.4	deer-sized mammal	long bone	black	tube	Large tube. Grooved near the end. Longitudinal striations on the inside.
Middle Formative B	A.D. 1010–1090	4768	structure	1	8929	D	2	fill	6.1	5.8	3.6	unidentifiable	indeterminate	unburned	bead	Small bead, unburned or slightly heated, light grey. Cut both sides, polished.
Pre-840 A.D.	pre-840 A.D.	4105	pit		2484	D	1	fill	N/A	N/A	N/A	rabbit-size	long bone	black	bead	Very small bead, highly fragmented and unmeasurable.

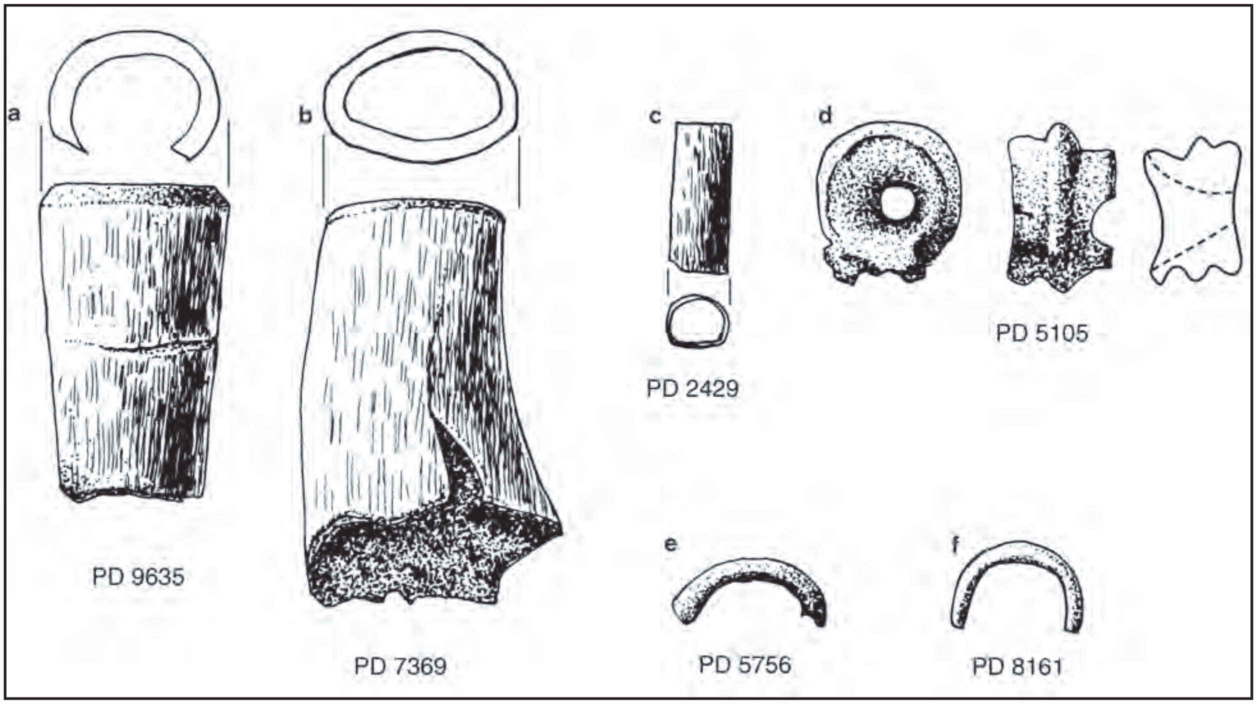


Figure 135. Examples of ornaments or possible ornaments: (*a*) tube or handle, PD 9635; (*b*) tube or handle, PD 7369; (*c*) tubular bead, PD 2429; (*d*) drilled metapodial condyle, PD 5105; (*e*) ring, PD 5756; (*f*) ring, PD 8161.

included in Table 132 with tool shafts, handles, and awls. These pieces were cut from long bones. Today they are broken on one end and both sides but retain cutmarks on the remaining, unbroken side. The diameters of two large Middle Formative tubes or possible handles (PDs 9635 and 7369; see Figure 135b; see Figure 135a) expand from one end to the other. Similar objects found in the Gleeson site were identified as hafts (Fulton and Tuthill 1940), and a large tube of the same general size and shape was also found in Los Pozos.

Most of the beads were tubular in form (e.g., PD 2429; see Figure 135c), but a single cut bead (PD 8929) was found in Middle Formative B deposits. One unusual object is an artiodactyl metapodial condyle (PD 5105) (see Figure 135d) that was detached and drilled medial-laterally through the center, largely from one side. The resulting hole is large, measuring 4.8 mm across, and the piece, though root-etched now, was probably polished all over. Patches of polish are found in all areas not covered by root etching. This piece could have been a bead or a pendant or could have had a more utilitarian function but is listed among the beads.

Two rings were found, one from the Middle Formative A (PD 5756, Figure 135e) and one from the Middle Formative B (PD 8161, see Figure 135f). These objects closely resemble one another in overall form. Each was cut from long bones of deer-sized mammals using the groove-and-snap method. One may be a humerus shaft, but this is not certain; one is rounded on the inside, but root-etching on the outer surface makes it difficult to tell whether it was originally polished; both are broken. The Middle Formative B ring is small but not child-sized; the diameter is slightly smaller than that of a metal ring that fits the author’s smallest fingers. The other ring is larger and so would have fitted larger fingers.

Utilitarian Bone

The utilitarian bone from Mescal Wash is composed of awls; fragments of tips, shafts, and handles; flaking tools; and two fragments that could be either wide awls or narrow spatulate tools (see Tables 130 and 131). A few fragments of unidentified but worked bone were also recovered. Only part of the life history of a bone artifact is represented here. No bones were positively identified as manufacturing debris, though some unidentified worked fragments could represent broken waste left over from tool making. This is somewhat surprising given the number of bone artifacts recovered. Perhaps bone tools and ornaments were imported, or bone manufacture was consistently conducted off site through time. If artiodactyls were scarce and raw material hard to come by, then people may have resharpened and reworked their old tools rather than making new ones, and

Table 132. Awls, Flakers, Handles, and Fragments from Mescal Wash, by Time Period and Context (not including burials)

Time		Feature Number and Type			Location				Measurements			Taxon and Element				
Period	Date Range	No.	Type	Sub-feature	PD	Locus	Level	Strat	Length	Width	Thickness	Common Name	Element	Burning	Tool Type	Use Summary
N/A	N/A	437	multiple features		1913	D	1	fill	19	6	3	leporid	radius shaft	unburned	unknown, possible tool shaft	Use is unclear, a lot of wear is present, longitudinal and transverse striations but fragment is too small to identify wear.
N/A	N/A	3544	multiple features		1921	D	1	fill	88	12	4	medium artiodactyl	metapodial shaft	unburned	awl	Burnishing/side to side sort of motion at tip on one face. Burned, so material is unknown.
Late Archaic	1110–900 B.C.	5505	pit		11339	D	1	fill	10	12	7	deer-sized	long bone	calcined	handle/ shaft	No wear.
Late Archaic	1110–900 B.C.	5505	pit		11339	D	1	fill	21.8	7	4.5	deer-size	long bone	calcined	awl tip	2 fragments, inserting and twisting in unknown material, snapped at area of twisting.
Early/Middle Formative	A.D. 500–915	4642	structure		5971	D	1	fill	181.1	12.7	2.2	deer-size	long bone	unburned	awl	Complete, probably plant processing, but with fibers that were not held parallel, transverse motions leading from one edge. Resharpened. Root etched.
Early/Middle Formative	A.D. 500–915	4642	structure		5971	D	1	fill	78.4	11.1	4.6	deer	metapodial	black	handle and/or shaft	Used in inserting and twisting motions with a hard material (possibly plants?) near the break.
Middle Formative	A.D. 700–1150	784	multiple features	1	5834	D	1	fill	71.4	8.3	2.2	deer-size	long bone	black	awl	Resharpened, wear between resharpening marks contacted fine textured material complex motions in silica-rich plants.
Middle Formative	A.D. 700–950	3681	structure		3304	D	1	fill	126	15	12	black-tailed jackrabbit	proximal tibia	unburned	awl	Nearly complete, covered with consolidant so use-wear analysis is not possible.
Middle Formative	A.D. 735–865	825	multiple features		8789	D	3	floor	47	12	5	deer-size	long bone	black	awl	Awl tip, used in primarily inserting motions, burned, so rounded surface is unreliable.
Middle Formative	A.D. 735–865	438	structure		2901	D	1	fill	107	19	11	black-tailed jackrabbit	tibia	unburned	awl	Inserted and only slightly twisted into fine textured, parallel fibered, hard materials probabably plants. Fragmentary, length measurement approximate.
Middle Formative	A.D. 735–865	438	structure		5210	D	2	fill	27	5	4	deer-size	long bone	calcined	awl	Inserting in unknown material without much twisting.
Middle Formative	A.D. 735–865	438	structure		5210	D	2	fill	40	8	4	deer-size	long bone	calcined	shaft	Tool midsection, wear unidentifiable. This piece is similar size to above but probably not of the same awl.
Middle Formative	A.D. 700–1015	3817	structure	40	2408	D	3	fill	23.4	3.8	3.4	deer-size	long bone	unburned	awl tip	Inserting a short distance and twisting in soft material (likely leather or hide, but lacks diagnostic characteristics).
Middle Formative	A.D. 825–1015	4682	structure		5543	D	1	fill	20.1	4.9	2.9	rabbit-size	long bone	calcined	awl	Tapered awl tip/midsection.extreme tip is missing. No wear present.
Middle Formative	A.D. 825–1090	8655	structure		9643	D	2	structural debris	18.8	8.8	4.6	deer-size	long bone	calcined	awl	Use unknown.
Middle Formative	A.D. 825–1090	8655	structure	2	9653	D	1	fill	125.5	145.2	3.2	deer	distal metapodial	unburned	awl	Multi use awl, striations in several sizes, textures, depths, complete awl, carnivore chewed. root etched.
Middle Formative	A.D. 860–1015	3545	structure		2429	D	2	fill	70	9	7	black-tailed jackrabbit	tibia	unburned	possible tool	Broken to a rough point, could be carnivore-chewed, shaft polished.
Middle Formative A	A.D. 650–950	5612	pit		5878	D	4	fill	24.6	12.5	3.7	deer-size	antler tine	black	flaker	Possible antler tine pressure flaker.
Middle Formative A	A.D. 650–950	5612	pit		7511	D	5	fill	64.7	7.7	2.4	deer-size	long bone	unburned	awl tip and shaft	Awl, light use in inserting and twisting motions and unknown material.
Middle Formative A	A.D. 685–915	834	structure		7547	D	1	fill	117.2	26.4	1.8	deer	metapodial	unburned	awl	Complete awl root etched, not enough surface left for analyses.
Middle Formative A	A.D. 685–915	834	structure		8802	D	1	fill	59	10.3	3.2	deer-size	long bone	partial	awl	At least two sequential uses, one involving longitudinal/ inserting motions, followed by one twisting. Wear is blurred, patches of rounding in between burned spots suggest possible contact with soft materials.
Middle Formative A	A.D. 685–915	834	structure		8853	D	3	floor	60.6	18.3	3.7	deer-size	long bone	unburned	handle	Handle? Very weathered.
Middle Formative A	A.D. 865–915	3710	structure		2675	D	1	floor fill	13.2	7.8	4.4	deer-size	long bone	calcined	shaft	No wear remains.
Middle Formative A	A.D. 685–915	8644	structure		8536	D	3	fill	70.3	7	2.6	deer-size	long bone	black	awl or spatulate tool	Long, longitudinal motions, inserting without much twisting. Surface is rounded but is burned.
Middle Formative A	A.D. 685–915	8644	structure		8536	D	3	fill	30	10.4	5.2	deer-size	long bone	unburned	awl	Unknown.
Middle Formative A	A.D. 685–915	8644	structure		8539	D	2	fill	30.5	7.8	2.3	deer-size	long bone	burned	awl tip	Wear is blurry, use unknown.
Middle Formative A	A.D. 700–950	3681	structure		3039	D	2	fill	40.6	9.2	4.2	deer-size	long bone	calcined	awl tip	Unknown.
Middle Formative A	A.D. 700–950	3681	structure		3039	D	2	fill	32.8	17.7	5.5	deer-size	long bone	unburned	unknown	Cut near end, transverse, broken near cut.

Time		Feature Number and Type			Location				Measurements			Taxon and Element		Burning	Tool Type	Use Summary
Period	Date Range	No.	Type	Sub-feature	PD	Locus	Level	Strat	Length	Width	Thickness	Common Name	Element			
Middle Formative A	A.D. 700–950	3879	structure		2373	D	1	fill	148.8	13	4.2	deer-size	metapodial	unburned	awl	2 pieces. Coarse parallel fibers, probably plant fibers, leading from one edge, similar to plant processing/ splitting/stripping.
Middle Formative A	A.D. 700–950	3879	structure		2373	D	1	fill	23	14	7	deer-size	metapodial?	calcined	shaft	Unknown. May be part of the same awl as above (considered to be part of the same awl in other tables).
Middle Formative A	A.D. 700–950	3879	structure		2480	D	2	floor	124.4	14.9	4.4	deer-size	long bone	unburned	awl tip and shaft	3 conjoining fragments, no wear, very deteriorated.
Middle Formative A	A.D. 835–865	3679	structure		1929	D	1	fill	65	14.7	6.1	deer-size	long bone	calcined	awl midsection	2 tool midsection fragments, multiple textures, leading from edge of shaft (like plant processing but materials are unclear).
Middle Formative A	A.D. 835–865	3679	structure	17	3158	D	3	floor	20	12	2.5	coyote-to-deer-size	long bone	unbuned	unknown	Cut and snapped long bone, one edge ground.
Middle Formative B	A.D. 935–1015	6098	structure	2	7403	C	1	structural debris	32.8	12.5	10.4	deer	antler	black	handle	Two conjoining fragments.
Middle Formative B	A.D. 935–1100	995	structure		9386	C	2	structural debris	49.5	12.7	3.3	deer-size	long bone	partial	awl	Complex or multiple use including fine textured plant fibers, some parallel grouped striations, some are individual. Resharpened.
Middle Formative B	A.D. 660–940	5781	structure		5782	D	1	floor fill	37.2	9.9	6.3	deer-size	long bone	black	awl	Use unknown, maybe light use.
Middle Formative B	A.D. 1010–1090	4768	structure		7506	D	1	fill	55.8	5	4	deer-size	long bone	black	awl	Melted looking, surface cracked, probably resharpened, clear manufacturing marks but no use-wear remains.
Late Formative B	A.D. 1340–1390	4729	structure		7042	D	2	structural debris	22	7	5	deer-sized	long bone	partial	awl	Inserting into plant without much twisting.
Late Formative B	A.D. 1340–1391	4729	structure		5176	D	2		21.4	6.9	5.1	deer-sized	long bone	black	awl	Longitudinal, very sharp edged individual striations. manufacture?
Late Formative B	A.D. 1340–1392	4729	structure		5135	D	1	floor fill	32.9	9	5.4	deer-size	long bone	black	awl	2 conjoining pieces. Heavily used with indeterminate hard materials in longitudinal motions near the smaller broken end, the rest of the tool is very smooth and consistant with wear on shafts of heavily used tools.
Late Formative B	A.D. 1310–1690	4684	structure		5236	D	2	structural debris	14	4	4	deer-size	long bone	unburned	awl tip and shaft	Contacted grouped parallel plant fibers in diagonal motions. Groups of striations overlap onto one another (similar to fiber stripping, leaf splitting). Root etched.
Late Formative B	A.D. 1310–1691	4684	structure		5326	D	2	structural debris	100	12	7	deer-to-bison-size	long bone	unclear	awl	Twisting in plant.
Late Formative B	A.D. 1310–1692	4684	structure		5101	D	3	structural debris	36.2	11.8	4.4	deer	antler tine	partial	flaker/awl	Tip used with at least two textures, one creating large longitudinal gouges possibly pressure flaking, the other very fine textured parallel fibers in diagonal motions. Rodent gnawed.
Late Formative B	A.D. 1310–1693	1575	structure		1726	D	3	structural debris	45.2	5.6	5.3	deer-size	long bone	black	awl	4 pieces, join to form short complete awl. Inserting and twisting fairly deeply into an unknown material, snapped at area twisted. If tool wasn't burned the wear would suggest contact with soft material.
Late Formative B	A.D. 1310–1694	4683	structure		6820	D	5	structural debris	22	7	6	deer-size	long bone	black	awl	Surface is melted, transverse and diagonal striations are barely visible.
Late Formative B	A.D. 1310–1695	4683	structure		6868	D	3	floor	150	16.3	5	pronghorn antelope	metapodial, shaft and condyle fragments	black	awl shaft, tip missing	11 fragments. Possible contact with fine texture material.
Post A.D. 500	post A.D. 500	723	nonthermal pit		817	D	1	N/A	21	8	5	deer-size	long bone	black	wide blunt pointed awl or narrow spatulate tool	Twisting in plants.
Post A.D. 500	post A.D. 500	4733	structure	1	8900	D	2	fill	43.8	7.3	3	deer-size	long bone	unburned	awl	Two motions—transverse with unknown material at tip and near break, also longitudinal with a fine textured hard material. Resharpened, possibly multiuse. Broke in area where twisted.
Post A.D. 500	post A.D. 500	4733	structure		9589	D	1	floor fill	89.7	7.6	5.8	deer-size	long bone	unburned	awl	Awl tip (measured) and many fragments. Tip fragment has very faint longitudinal striations but remaining surface is too discontinous to interpret.

some scraps of leftover bone may have been ingested by dogs or other carnivores, but it is curious that no manufacturing waste was found over such a long time period.

Awls or probable awls make up just over half of the total collection (56 percent), and an additional 7 percent are broken handles and shafts, some of which are likely awls as well. Two blunt-pointed tools were likely flakers.

Awls and Other Pointed Tools

Most of the identifiable bone artifacts from Mescal Wash were pointed tools; in fact, just over half of all bone artifacts were awls or other pointed tools. In this analysis, I initially grouped all pointed tools together into a single category to avoid inconsistently applied use designations, such as punches, reamers, bodkins, pins, clothing pins, uneyed needles, daggers, stilettos, and dirks. The term "awl" is used by many researchers as an overall category to describe pointed tools of unknown function (James 1993), and I follow this precedent. A few tool handles and midsections were also recovered. Many of these, too, are likely to have once been awls. A few pieces of indeterminate bone were also found. These pieces displayed cutmarks or other such traces and had obviously been modified by humans, but their original form and use could not be identified. Two flakers were identified. These were both large, blunt-pointed objects. Both were fragmentary.

Artifact Types and Frequencies over Time

The following describes the uses of many of the more interesting tools in detail, by time period. All tools are included in the accompanying tables. Bone artifacts were found in several contexts, but far more were found within structures than in extramural pits. Most of the artifacts from intramural contexts were recovered from structure fill (see Tables 130 and 131), suggesting that they were discarded after the structures were abandoned. A few (13) were found in structural debris; even fewer were found on structure floors (5) or in floor fill (6). The kinds or uses of artifacts found on floor, floor fill, and fill exhibited no strong patterns. Artifacts were primarily recovered from contexts in Loci C and D. For date ranges of the individual time periods, a summary of the various feature types, and an explanation of the recovery contexts, see Chapter 1.

Archaic Period

Only two artifacts were found in Archaic period contexts. Both were recovered in the fill of Feature 5505, a bell-shaped nonthermal pit in Locus D. Both are calcined and made from long bones of deer-sized mammals. One is a short section of an awl tip, broken on both ends and with the point missing. Striations suggest that it was inserted and twisted in some unknown material, and that the tip broke near the area where it contacted the material during twisting. It could have been used for a variety of tasks; unfortunately, the tasks cannot be narrowed down by contact material because the surface is calcined. The second Archaic-aged tool is likely a handle or shaft fragment.

Early/Middle Formative

Two bone artifacts date to the Early/Middle Formative period. One is a long, fairly robust awl (PD 5971 Figure 136a) and the other a tool handle and/or shaft. Both were recovered in structure fill (Feature 4642). The bright polish and flattened surface on the awl suggests that it was used on silica-rich plants. The use wear includes overlapping, individual, nonparallel striations leading from one edge in longitudinal and transverse directions. Such one-way striations are formed when using a tool to split tough yucca and agave leaves into strips, as well as by stripping the soft pulp from yucca or agave leaves to produce fiber. One-way striations are also formed during corn husking. In addition, this tool was probably resharpened.

The second tool is a handle and shaft made from a split metapodial that contacted hard materials in diagonal, possibly twisting motions near the shaft. These hard materials were likely plants, but lack diagnostic characteristics. This tool could have been used for basketmaking or for another activities involving inserting the tool and twisting it in plants or materials of similar texture. Both tools have wear suggesting plant use, but may have been used for different activities, or different stages of a single task. For example, a person could have used the first tool to process leaves into strips or fibers and the second tool to weave baskets or other containers from those fibers.

Middle Formative

The vast majority of artifacts were found in Middle Formative contexts, including the Middle Formative A and B and a general Middle Formative period. Six ornaments and eleven utilitarian or indeterminate tools were found in the general Middle Formative contexts, including awls, beads, tubes, and indeterminate shaped bone. All but one of the artifacts from the general Middle Formative were recovered in Locus D. Most were found in structures.

The sole bone artifact from the Middle Formative in Locus C consists of the proximal humerus of an artiodactyl (PD 7369, Feature 6129) (see Figure 135b). Both ends were removed using the groove and snap technique and then were ground, producing a hollow, roughly tubular object, wider on one end than the other. It is heavily root

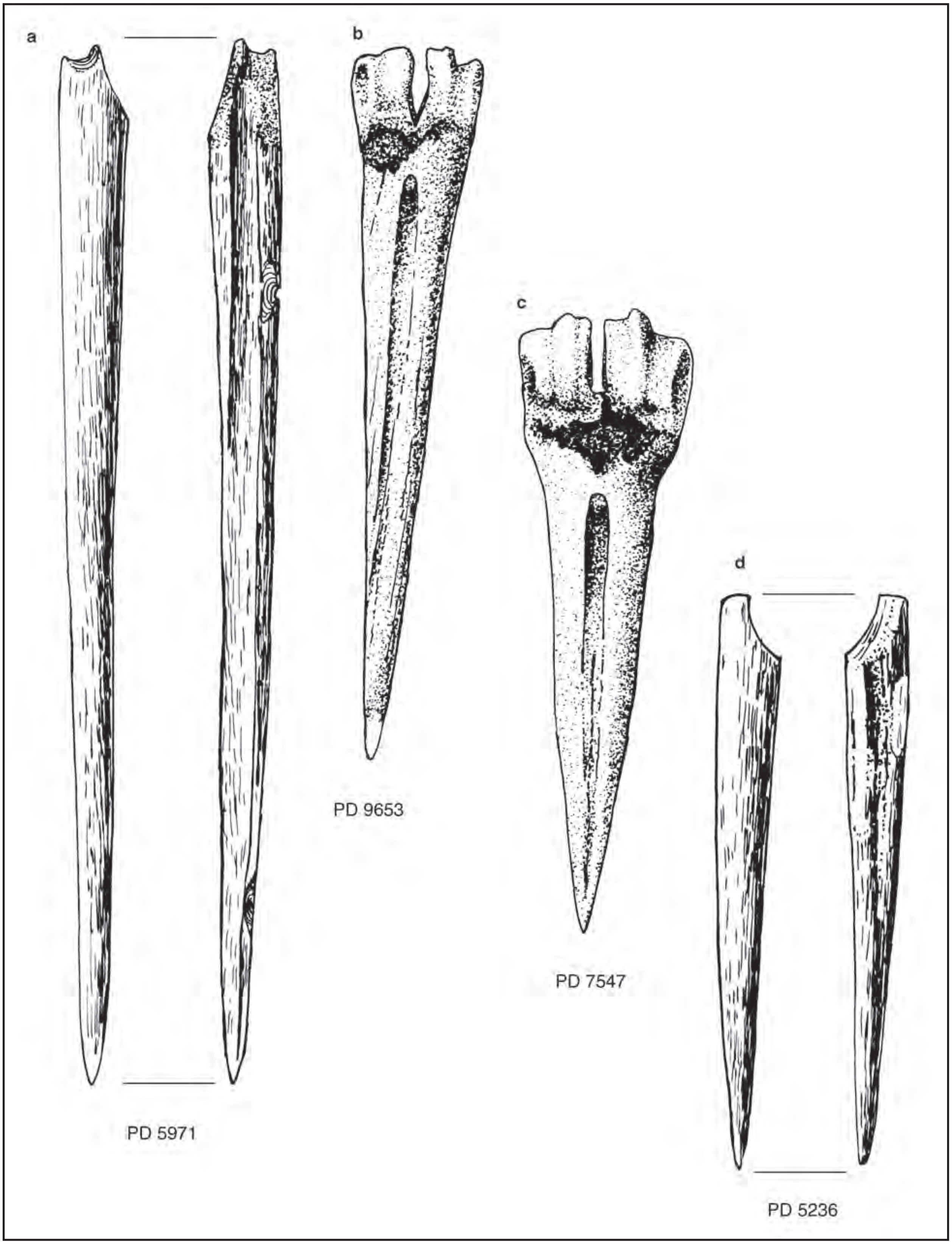


Figure 136. Examples of awls: (*a*) long awl, PD 5971; (*b*) complete awl, PD 9653; (*c*) complete awl, PD 7547; (*d*) awl midsection and tip, PD 5236.

etched, with possible carnivore gnawing on the wider end. This object could be the handle of a multicomponent tool, but could also be a tube.

A bead, a tube, and two awls were found in the fill of a single structure, Feature 438. All but one of these artifacts were recovered in Level 2—one of the awls was found in Level 1. Both awls were used in longitudinal motions, inserting and only slightly twisting, as when it is necessary to only pierce a small hole, but not to open up a wider space by twisting. One tool contacted a fine textured, parallel-fibered, hard material; the material contacted by the other tool is unknown.

Two awls and a tube were found in different levels of another Middle Formative structure, Feature 8655. Heavy root etching obscures part of the surface of PD 9653 (see Figure 136b), but the remaining surface is crossed by striations of several sizes and depths, indicating multiple textures running transversely, longitudinally, and diagonally, indicating multiple directions. A few patches of rounded wear suggest that at least one of the uses may possibly have involved a soft material. The inside of the tube is polished with fine longitudinal striations, with wear similar to that formed through contact with leather or hide in a longitudinal motion. This could come about by deliberate polish using leather or possibly if the tube moved back and forth on a leather thong.

Two bone artifacts were found in Feature 825, an awl from the floor and a tube from the floor fill. A very thin-walled, polished tubular bead with cut ends was recovered in the fill of Feature 3545 along with a broken, polished jackrabbit tibia (both PD 2429). The tibia is broken to a rough point at one end and polished on the shaft—it could be an expedient awl. The high points of the broken end are polished but the striations within the polish are unpatterned. This piece is identified as an ornament but could conceivably be a broken tool shaft that has undergone some other formation processes resulting in the polish. The remaining features contained only one bone artifact each, including tools likely used in contact with fine textured silica-rich plants, hard materials, possibly soft materials

Middle Formative A

More bone artifacts were recovered from Middle Formative A deposits than from any other time period. The 20 artifacts from the Middle Formative A were primarily found in structures, and all in Locus D. Artifacts from this time were generally found in clusters of two or more per feature. For example, two tools, an awl and an antler-tine flaker, were found in the fill of Feature 5612 (a pit structure). More artifacts were found in the fill of another structure, Feature 8644: two awls and a wide awl or narrow spatulate tool. All three were found in the fill. Two bone artifacts were found in the fill of another structure (Feature 3681), the uses of both are unknown. Feature 3879, another structure, contained two fragmentary tools, each broken into three pieces. One from the fill has wear similar to that produced experimentally splitting or stripping coarse-fibered plants. Coarse parallel fibers left striations leading from one edge of the tip, a similar pattern to that found on tools used to split fibrous leaves for fibers or strips for mat or basketmaking. The other tool was found on the floor and is very deteriorated. A handle or tube fragment and a possible tool handle were found on the floor of another structure (Feature 834), and two awls were found in the fill of the same structure, one of which appears to have had at least two sequential uses, with striations going in several directions and textures, apparently laid down through sequential uses. But this tool is burned, and the material types are entirely unknown. A second multiple use tool was recovered from Feature 3679. This tool consists of a midsection that contacted more than one texture, including both coarse and fine textured fibers drawn across one edge (PD 1929). The type of material is unknown, but the striation pattern is similar to those found on tools used for plant-fiber stripping or splitting. A piece of bone, cut and snapped on one side, was also found. This piece could be a tool or ornament fragment or may represent one of the few possible pieces of manufacturing debris recovered at this site. Two pieces were found in Feature 5612 (a pit) including an antler tine that may have been used as a pressure flaker and an awl that received only light use in longitudinal and transverse motions. The wear on an awl from PD 8536 suggests it was used in long, longitudinal motions on an unknown material. The uses of the remaining awls are entirely unknown (for example, PD 7547, see Figure 136c). Fewer pieces of nonutilitarian bone were recovered from this time than were assigned to the indeterminate Middle Formative. In addition to the handle or tube fragment from Feature 834, two ornaments, a tube and a ring, were found in the fill of Feature 3595, and a tube was recovered in Feature 5994. Although beads were recovered in general Middle Formative contexts and in Middle Formative B, none were identified in the earlier Middle Formative A.

Middle Formative B

Eight bone artifacts dating to Middle Formative B were found in structures in Loci A, C, and D. A solitary ring fragment was found in the structural debris of Feature 2192 in Locus A. Three different recessed-hearth style houses in Locus C yielded four bone artifacts: a calcined tube and an antler-tool handle in the structural debris of Feature 6098; a possible tube from the floor fill of Feature 379; and an awl in structural debris of Feature 995. Locus D structures included an awl in the floor fill of Feature 5781 and a bead and an awl in the fill of Feature 4768. Use-wear analysis was productive on only two of the eight artifacts recovered from six features in Middle Formative B contexts. The calcined tube, PD 7403, found in Feature 6098 (Locus C), was ground flat on each end, and decorated with a groove cut a few millimeters from one end parallel to the end. The tube is split longitudinally and there are longitudinal striations on the high points inside.

Use wear on the awl (tip and shaft) from Feature 995 (PD 9386) suggests that it may have received multiple uses, including on silica-rich plants. Striations run in all directions, indicating complex motions; it was probably resharpened. Wear was not well preserved on the other tools from this time period.

Late Formative B

Nine artifacts were found in Late Formative B contexts, all from four adobe structures (Features 1575, 4683, 4684, 4729) in Locus D, and all are awls or other pointed tools. In Feature 1575, four pieces join to form a single short, complete or nearly complete tool. This awl shows only light use, and bears wear traces similar to those produced by leather or hide working, but the tool is burned and this interpretation is therefore tentative. The tool tip is missing, but wear just above the break shows that it was inserted into some material and twisted, and snapped at the area where it was twisted against the material. This pattern of breakage has occurred during the author's own experimental hide processing and leather work. Although leather or animal hide are soft materials, they are also stretchy and tough, fresh hides especially, and considerable force must sometimes be used while inserting and twisting.

Three tools were found in the structural debris of Feature 4684. Two may have been used for different stages of basket, mat, or other textile production. The wear on PD 5236 (see Figure 136d) indicates that the tool likely contacted grouped, parallel plant fibers in diagonal motions, creating a pattern similar to those produced experimentally by splitting yucca leaves or processing yucca or agave into fibers. This by no means indicates that the tool was used with these specific plants, but it does suggest the processing of fairly coarse plant fibers. The second tool (PD 5326) has wear suggesting that it was twisted in silica-rich plants and thus could have been used to make baskets, mats, or other plant-fiber-based objects. A blunt-pointed antler tine was found in the same feature. This tool seems to have been most recently used as a pressure flaker, but a few patches of diagonally-running very fine textured parallel striations can be seen in areas between the larger gouged striations, and these suggest use with another, finer-textured but unknown material prior to its final use as a pressure flaker.

Two tools were found in Feature 4683 but were both too burnt to identify contact materials. The surface of one (PD 6868) is covered with very fine but indistinct striations. Some run longitudinally, but the direction of others is unclear. The most that can be interpreted about this tool use is that it was likely used on a fine textured material. The surface of the other (PD 6820) was heated to the point of melting, and glossy melted patches are present in some areas, other patches retain faint diagonal and transverse striations.

Three burned and fragmentary awls were recovered from Feature 4729. One, recovered from the floor fill, was broken on both ends (PD 5135) and very heavily used, but the uses are unknown. Two more were found in structural debris, including an awl tip (PD 7042) that appears to have been inserted into plants without much twisting, suggesting that the spaces that it opened did not need to be large. The striations are very close together, indicating that the fibers contacted by the tip were also very closely spaced. The third tool (PD 5176) has large, sharp-edged striations that may result from manufacturing processes. If this is so, it was either discarded or lost soon after it was made or resharpened or was only used on materials that did not leave many use traces.

Undated/Mixed Contexts

Three objects were found in mixed or undated contexts. An awl and a possible tool shaft were recovered from Features 3544 and 437, respectively (both Locus D). These two features are conglomerates, composed of multiple structures and pits. Striations on the awl indicate that one face of the tip was used in a side-to-side motion on an unknown material, perhaps burnishing or another, similar activity. The third artifact is a fragment of a large, heavy tube that was recovered as a grab sample during stripping in Locus C.

A few more tools were recovered from contexts with extremely broad dates. Two awls and a narrow spatulate tool were recovered from contexts dating to after A.D. 500. The use of one awl is unknown (PD 9589). The second awl (PD 8900) has wear suggesting it was used in longitudinal motions on fine textured material, perhaps plants, and was resharpened. The blunt point the spatulate tool (PD 817) seems to have been used in twisting motions with silica-rich plants. A possible bead made from a leporid radius was found in a context dating prior to A.D. 840. It is blackened, one end is cut, the other is broken and a bit chipped, and it is impossible to tell whether it was cut on both ends.

Bone Artifacts from Mortuary Features

Artifacts from the Mescal Wash burials were repatriated immediately after excavation, thus the information in this section comes from the burial forms. None of the individuals found in the Mescal Wash burials was adorned with bone beads, rings, or other ornaments, but six bone awls were recovered from five mortuary features in Locus D (Table 133). Three of these awls accompanied cremations. One, from Feature 4069 (dating from after 200 B.C.), was interred with an adult of indeterminate age and gender. This calcined tool was found along with a bowl or jar and a large, ochre-covered carved stone censer. One adult, aged 30–40 years (Feature 10674, undated), was interred with an awl in a secondary pit cremation in an extramural pit. Another awl tip may have been included in the burial of another adult, but was found in the upper fill of a primary cremation (Feature 4221, undated), as were sherds and flaked stone. The remaining three tools were found in inhumations. Two awls were found in or next to the right hand of an adult male aged at least 45 years (Feature 4886, undated). No other artifacts were found with these individuals. The third was recovered from Feature 5512, an inhumation dating from after A.D. 735. This piece was a long awl made from a split artiodactyl metapodial retaining part of the proximal epiphysis on the handle end. It was found below or beneath the left foot of an adult male and is the only artifact directly associated with this burial, though other material, including a few lithics and sherds, a worked sherd and a *Glycymeris* bracelet were found in the fill. Interestingly, in spite of the ethnographic and ethnohistoric association of awls with women's work, such as basket making (James 1972; Newman 1974; Tanner 1983), in cases where gender could be assigned, all awls were found with males. But, long, thin pointed tools are useful, if not essential, for many tasks performed by both men and women and cannot be assumed to indicate only basketry, or only leatherworking. Moreover, gendered tool use may have changed over time.

Comparisons with Other Sites

WestLand's 2009 excavations at Loci A and G of the Mescal Wash site recovered a small number of bone artifacts, and the types found were similar to those found in the SRI excavations. Of 12 bone artifacts, 8 were identified as awls or awl/hairpins. Two rings, an antler tine, and a single piece of manufacturing debris were also found (Deaver et al 2010:4–63). Two awls were surface finds and thus undated. All bone artifacts from dated contexts were assigned to the Middle Formative period (Rincon phase or Tres Alamos phase). Awls from the WestLand excavations were made from elements and taxa similar to those seen in the SRI excavations. No beads or tubes were identified, but an incised humerus shaft may represent ring or tube manufacture (Buckles, Adams, et al. 2010). No bone artifacts were recovered that were clearly associated with human burials, but an awl was found in the fill of a pit that had been reused for an inhumation of an adult woman (Deaver et al. 2010:4–63, Appendix C).

Sixteen bone artifacts were recovered during the 1983 excavations at the nearby Donaldson site (Huckell 1995). Of these, twelve were awls or awl fragments, and one of the remaining pieces was also a pointed tool. Earlier excavations at that site also produced bone objects, including an awl and awl fragments, antler knapping tools, a tube, and a bone cylinder (Huckell 1995).

Only one bone artifact was recovered during recent SRI excavations at Christiansen Border Village (Griffitts 2009); previous excavations at the site reported none (Kurdeka 1985). The sole bone artifact from Christiansen Border Village was a tool midsection, probably an awl. Only a few bone artifacts were recovered from the El Macayo site, similarly located near the U.S.-Mexican border in southern Arizona (Rockman and Shelly 2001) and dating to about A.D. 550–1150. Quantities of stone (argillite) and shell beads were found in El Macayo (Della Croce 2001; Urban 2001), but no bone beads were found at that site. As is common, the bone artifacts consisted mostly of pointed tools, including three awl tips, one antler tine, and one worked bird bone suggested by the authors to be a possible awl.

Researchers at Garden Canyon on Fort Huachuca near the middle San Pedro River noted that the overall numbers of bone artifacts recovered at that site were lower than expected (Jones and Shelley 1996). Two excavations at the Garden Canyon site recovered different proportions of artifacts. The earlier (1964) excavations produced seven awls, two notched deer scapulae, and an unidentified number of miscellaneous objects. Later excavations (1991–1992) recovered an also small (only 11 objects) but more diverse collection, including three awls, a decorated hairpin, an incised fragment, a tubular bead, a spherical bead, two incised fragments of a jackrabbit-sized long bone, and a distal metapodial drilled between the two condyles.

Only six bone tools were found at the Reeve Ruin, and all were awls (Di Peso 1958), but the bone artifact collection from the Babocomari site (located at the confluence of the Babocomari and San Pedro Rivers) was larger and more diverse, including beads, awls, antler tine tools, two spatulae, a shaft wrench, whistles, and notched long bones, ribs, and scapulae (Di Peso 1951). A more diverse collection was also recovered at Tumacacori along the Santa Cruz River (Di Peso 1956), again including many pointed tools (identified as awls and hairpins) and a bone scraper, as well as notched scapulae and other tools. The bone artifact collection from the Tres Alamos site (Tuthill 1947) at the San Pedro River was dominated by awls, though a few other objects were present, including a needle, three bone tubes, an antler flaker, a shaft wrench, and at least two bone rings.

Excavators at the Hodges site in the Tucson Basin recovered 22 bone artifacts in 1985, 21 of which were awls (Beckwith 1986), but larger numbers and more diverse

Table 133. Bone Artifacts from Mortuary Features

Locus	Date	Feature	Feature Type	PD	Count	Tool Type	Burning	Individual Age	Individual Sex	Measurements (cm) [a]			Comments
										Length	Width	Thickness	
D	post 200 B.C.	4069	primary cremation		1	awl	calcined	2 individuals, 1 adult, 1 child/adolescent or young adult	indeterminate	8	1		Slender awl tip, found in three fragments. A bowl or jar and an ochre-stained carved stone censer were also found.
D	pre A.D. 585–1015	4221	primary pit cremation	2510	1	awl tip	burned	indeterminate	indeterminate	2.5			Very thin tip, found in cremation fill, also biface, flaked stone, sherds.
D	none	4886	inhumation	7507	1	awl	unburned	adult (aged 45+)	male				Found in or near right hand.
D	none	4886	inhumation	7508	1	awl	unburned	adult (aged 45+)	male				Found in or near right hand.
D	post A.D. 735	5512	inhumation	6819	1	awl	unburned	adult (aged 35–45)	male	20.8	2.4	1.1–0.4	Made from proximal left artiodactyl metatarsal, found below or beneath left foot of individual. Lithics, sherds, a worked sherd, and a *Glycymeris* bracelet were also present.
D	none	10674	secondary pit cremation		1	awl	burned	adult (aged 30–40)	indeterminate	3.5			

[a] Where measurements are lacking, the artifact was too fragmentary to allow meaningful measurement.

artifacts were found in earlier excavations (Kelly 1978). The earlier excavations at Hodges also produced more pointed tools (n = 66) than other artifacts, but also included 7 spatulate tools, 4 antler flakers, 28 tubes, and 4 beads.

Bone artifacts from Las Colinas, a Hohokam community in the Salt River Valley, were, as usual, dominated by awls or other pointed tools. Altogether 155 awls or awl/hairpins were found at that site. Other artifacts made up a much smaller proportion—two tubes, two ring fragments (one from Sacaton contexts and one undated), and 54 indeterminate pieces (Szuter 1988). What makes this site especially relevant to the collection at hand is that among the indeterminate pieces are two drilled metapodial condyles from Middle and Late Sacaton contexts. These pieces were not illustrated but appear to be similar to PD 5105, found in the fill of a Middle Formative structure (see Figure 135d). These drilled condyles seem to be uncommon; however, unusual bone artifacts, or artifacts that do not fit an obvious typological category, are often not described and simply lumped into a larger category of unknown artifacts. It is therefore difficult to determine if these drilled condyles are as unique as they seem, or if they are simply unreported. The drilled distal metapodial noted at Garden Canyon (Jones and Shelley 1996) may cast a new light on the drilled condyle. It may be that the modified condyles are not beads at all, but could represent the ends of longer tools that were drilled at the end for ease of storage or transport.

The rings recovered by SRI and Westland at Mescal Wash represent less common objects, but they are not unique. A few were found at Tres Alamos (Tuthill 1947), but they were absent from Tumacacori and from Babocomari (Di Peso 1951), but *Conus* sp. shell were cut into somewhat similar-appearing rings at Tumacacori (Di Peso 1956). At least five bone rings were recovered from the Gleeson site in Cochise County (Fulton and Tuthill 1940), where 34 awls and at least 2 tubes were also found. A single ring fragment was found at Snaketown (Haury 1976:305), and to the north, one ring fragment was found in the Siphon Draw site (Szuter 1983).

Bone from midden deposits at Ventana Cave include 9 tubes, 111 awls, and a variety of other objects, making up a total of 151 artifacts (Haury 1950). Haury (1976) considered decorated and undecorated bone tubes to be a hallmark of the Hohokam and noted a ratio of 19 tubes to 36 awls at Snaketown. Bone beads, tubes, and tubes/hafts together make up 18 percent (n = 12, not including 2 pieces that could be either broken tubes or fragments of other artifacts) of the bone artifacts from Mescal Wash, while awls constitute 53 percent (n = 34) (see Table 130). As seen in the discussion above, the proportions of beads/tubes to awls varies considerably from site to site, as does the overall diversity of artifact collections in Southern Arizona. Bone artifacts from Mescal Wash are dominated by awls, with tubular beads and tubes making a distant second, a pattern seen frequently throughout southern Arizona. Small bone tool collections across southern Arizona most commonly contain awls, or awls and tubes, and occasionally also have spatulate tools and a few badly deteriorated pieces of antler. Such collections are seen in early sites such as Coffee Camp (James 1993:365), El Taller (Dean 2007a), Las Capas and Los Pozos (Griffitts and Waters 2005), and the Early Agricultural component of V:13:201 (Glass 2000:6-4) and in later Hohokam sites (Wegener 2008). Even in larger collections, the primary artifacts are usually awls, tubes, and beads.

The bone artifact collection from Mescal Wash is interesting for some of the absences. As noted above, little or no manufacturing debris was recovered. There are no unequivocal spatulate or chisel-ended tools, and none of the notched rib or scapulae that appear in Archaic and Basketmaker times across the arid west (Ferg 1998). Spatulate tools or fragments of possible spatulate tools were found in Los Pozos and Las Capas (Griffitts and Waters 2005), in Red Mountain and Cienega contexts at Finch Camp, and in Red Mountain contexts at Bighorn Wash (Griffitts 2010). Similar tools were also identified in Ventana Cave (Haury 1950) and Babocomari (identified there as a scraper) (Di Peso 1951). Use wear on the tools from Los Pozos suggests that these tools were used for a variety of tasks, including wood working. Use-wear analysis on one notched tool from Santa Cruz Bend (Griffitts and Waters 2005) and on a sample of Basketmaker scapulae and ribs indicates that at least some of these tools were used to process fibrous plants, as do dried yucca residues preserved on some Basketmaker tools (Mobley-Tanaka and Griffitts 1997). Notched scapulae, ribs, and long bones were found at Babocomari (Di Peso 1951), and notched scapulae were found at Tumacacori (Di Peso 1956). The Babocomari and Tumacacori tools were all identified as rasps, but photographs show that at least some of the tools from Babocomari had sharp incised notches, while those illustrated at Tumacacori were heavily worn and appear more like the Santa Cruz Bend and the Basketmaker fiber-processing tools. Notched scapulae were also found in early excavations at Garden Canyon, where they were identified as rasps (Jones and Shelley 1996). Use-wear analysis of the tools from Mescal Wash suggests that fibrous plant processing likely took place at several features and times in this project, but for some reason, the large deer scapula and rib tools either were not employed, or were not discarded onsite. No bone gaming pieces were found, nor were there drilled teeth or claws, flat disc beads, or drilled and cut pendants. Perforated carnivore mandibles or imitation mandibles, as found at Snaketown, are absent (Haury 1976). Although edge-used scraping or cutting tools and flaked bone tools are found occasionally in southern Arizona sites (Griffitts and Waters 2005; Griffitts 2010), none was seen here. No constricted-tip awls, such as found in Basketmaker and Anasazi sites, were recovered, nor were the notched awls often seen in Mogollon collections. The latter tools are occasionally found outside the Mogollon area; for example, a few were found in Snaketown (Haury 1976) and in the Tucson phase of the Tres Alamos Site (Tuthill 1947) and, interestingly, in Late Archaic/Early Agricultural contexts at Los Pozos (Griffitts and Waters 2005). Identification of these tools, though, could be limited by the fragmentary condition of the collection. Few complete tools were found at Mescal Wash, and the distinctive notching manufacturing technique is invisible if the tool handle and upper shaft are missing.

Summary and Conclusions: Addressing the Research Themes

How have the results of this study helped further our understanding of past human behavior? At the beginning of this chapter, we outlined a few research themes that could potentially be addressed using data drawn from modified bones. In this last part of the chapter, the analysis results are summarized in view of the research questions.

Time and Cultural Affiliation

It was not possible to identify clear temporal patterns. Awls—metapodial awls in particular—are widespread and consequently of little use for identifying cultural affiliation or time period. Tubular beads are also very common in Southwestern sites and cannot be used as chronological indicators. Bone rings are less common, though not unique, and it is possible that future study may show some patterning of these objects. The artifacts recovered here, therefore, provide little new information concerning regional styles or cultural affiliation.

Ritual or Symbolic Behavior

Iconography on the analyzed bone artifacts provided no evidence for use in rituals. Additionally, none of the individuals was buried adorned with bone rings, beads, tubes, hairpins, or other decorative bones. Instead, the people were interred with seemingly everyday utilitarian objects. All six of the artifacts recorded with burials were awls, and, interestingly, three of those awls were found with adult males, suggesting they were craftsmen. Cut and tubular beads and rings were found in non-mortuary settings in low numbers through time. People chose to adorn themselves with bone, but other materials may have been preferred for burials.

Raw Material Use

Not surprisingly, the people of Mescal Wash clearly preferred to use bone tools made from artiodactyls and similar-sized taxa. The faunal collection, of both unmodified and modified bone, includes a total of nearly 8,000 bones of leporids and rabbit-sized and squirrel-to-rabbit-sized mammals, compared to more than 2,000 artiodactyls and coyote-to-deer sized mammals (see Chapter 8). Artifacts follow the reverse pattern: nearly three times as many artifacts were made from deer-sized taxa than were made from bone of rabbit-sized taxa. Szuter (1984:598–599) noted that artifacts are most commonly made from artiodactyl bone or bone from deer-sized taxa, and nothing in the present study contradicts her observations. Awls or other tools can be made from smaller taxa. For example, archaeologists do occasionally recover carnivore ulna awls and tools made from smaller taxa. Indeed, one jackrabbit tibia awl and one possible modified tibia were found in Mescal Wash contexts. But in spite of the ubiquity of leporids and the scarcity of artiodactyls, residents of southern Arizona overwhelmingly preferred the bigger bones of larger animals. A deer metapodial or other long bone provides much more raw material than any rabbit element it is thicker and heavier and therefore has greater flexibility in terms of the final tool shape. Small items like beads, though, were easier to make from smaller, thinner bones of leporids or birds, and the beads and a few of the tubes found in Mescal Wash were made from these smaller bones.

Other researchers have noted that bone artifacts are less common in the Hohokam region than in other areas and have suggested that Hohokam may have used desert hardwoods rather than bone because of the scarcity of suitable-sized taxa (Haury 1976:302). The importance of bone technology at a particular settlement or time seems to vary widely within southern Arizona, based on bone artifacts found discarded or lost. But if large mammals were uncommon, then people may have chosen to curate their tools longer than those living in areas where suitable raw materials were more common. Thus it is possible that we may find fewer tools discarded in temporary sites.

Tool Use, Site Function, and Craft Production

The people of Mescal Wash used bone in a variety of day-to-day activities, both ornamental and utilitarian. Small beads were likely worn as ornaments, stitched to clothing, strung as necklaces or bracelets, or worn in the hair. A few decorated themselves with rings, but no bone ornaments were found in burials. Larger tubes could have been worn as ornaments as well, as discussed above, or they could have had either utilitarian or other uses.

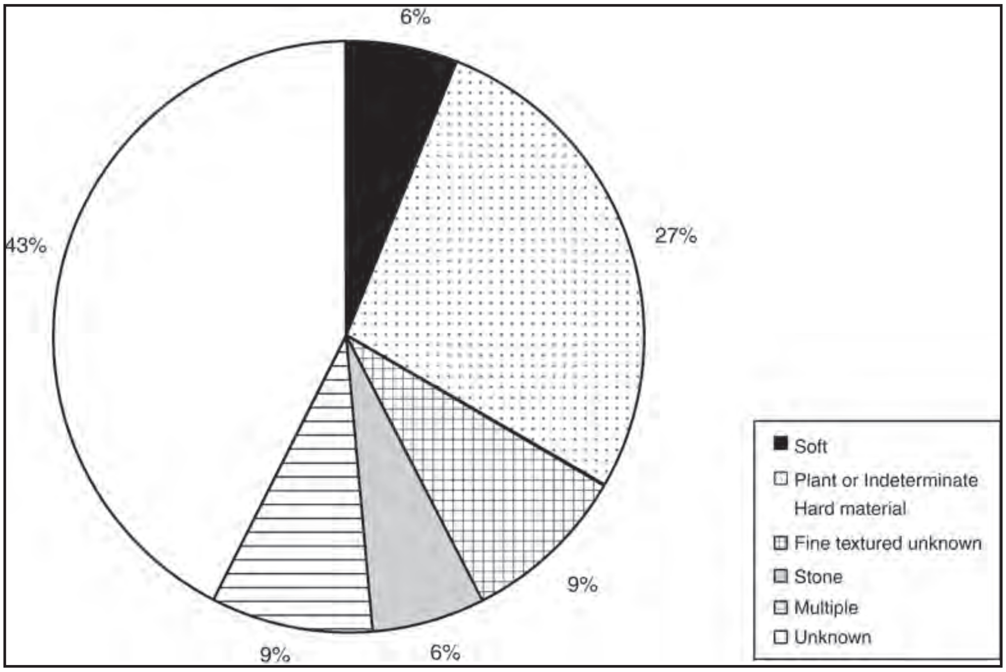


Figure 137. Proportions of materials contacted by pointed tools.

In summary, the primary trend seen in the Mescal Wash bone technology is one of consistency, with people relying on pointed tools for a variety of tasks involving plant-processing or basketry/textile manufacture (Figure 137). Tools were used for other tasks as well, but silica-rich plants were clearly very important. Several tools have wear suggesting use in basket-making. Tools that appear to have been inserted into plants with little twisting and those that were inserted and twisted could easily have been used to make different kinds of baskets or mats, or for different stages of basket-making and were recovered in undated contexts, as well as contexts dating to the Early/Middle Formative. Tools contacted both coarse and fine textured plants. Two tools found in the structural debris of Feature 4684 appear to show different stages of textile production. One has wear similar to that found on experimental fiber processing; the wear on the other suggests it was inserted and twisted in silica-rich plants.

Evidence of plant processing—perhaps stripping fiber or splitting fibrous leaves for mats or baskets—was found on tools from undated and Middle Formative A contexts. Another wear pattern suggesting plant processing was found on a tool from Early/Middle Formative contexts. In this case, though, striations appear individually, rather than in large bundles, suggesting that if this tool was indeed used to process plants, they were likely smaller than those that some other tools contacted. A few other tools also appear to have contacted silica-rich plants, or in some cases, indeterminate fine-textured hard materials that may well have been fine-textured plants but lack diagnostic features. In sum, although the condition of the tools prohibits identifying some uses—leather, hide and wood working, in particular—we can nonetheless identify plant uses and that the people using these tools exploited a variety of plants, both coarse and fine textured, in different activities (Table 134). Several multiple-use tools were seen, and a few tools were resharpened. A few tools could be identified as having contacted softer materials (see Table 134). Even when the exact contact material could not be determined, it was still sometimes possible to learn a little about prehistoric activities. Minimally, we can see that all of the tools were not used alike. Some appear to have been used in twisting motions, others were used in more longitudinal motions (see Table 134). Tools of unknown use with transverse striations on the shaft similar to those found on some plant processing tools, for example, may well have also been used to split or strip plant fibers. Tools used in primarily inserting or inserting and twisting motions may have had a variety of uses.

Use-wear analysis provides a snapshot of certain aspects of everyday life, showing the importance of plant processing through time. The inhabitants of the project area relied on large mammalian taxa for many of their bone artifacts—in particular on artiodactyl or deer-sized bone. Even given

Table 134. Tool Uses as Interpreted by Microwear Analysis

Motions Used	Contact Material						Total
	Soft	Plant or Indeterminate Hard Material	Fine-Textured Unknown	Stone	Multiple	Unknown	
Longitudinal/inserting	—	1	2	—	2	5	10
Transverse	—	2	—	—	—	3	5
Twisting	1	4	—	—	—	2	7
Longitudinal and transverse	—	—	—	—	—	1	1
Diagonal and transverse	—	1	—	—	—	2	3
Longitudinal and diagonal	—	—	—	1	—	—	—
Complex motions or multi use	1	1	1	1	1	1	6
Total	2	9	3	2	3	14	32

Note: Includes 4733 and 5101 twice each. Use wear suggests that both tools had multple sequential uses.

the disappointing proportion of burned tools, this analysis clearly shows that people living at Mescal Wash were making, using, resharpening, and repairing tools needed for processing fibers and making other products from plants, as well as from leather or hide. Some people wore bone beads, and some also used larger tubes, either decoratively or in some other fashion. They buried their dead with a few bone tools, but without bone ornaments.

The people of Mescal Wash lived in an ecotone between the Sonoran and Chihuahan Deserts with access to resources in a variety of environmental and topographic zones. The nearby cienegas also had much to offer. Although the riparian animals seem to have been largely ignored as food sources (see Chapter 8), people could have found reeds or other useful fiber or food plants growing near the water. The importance of plants indicated by the use-wear analysis dovetails with the botanical analysis, including evidence of reed matting and other use of plant fibers (see Chapter 9), all of which typically involved the use of awls and other bone tools.

CHAPTER 8

Faunal Bone

Justin Lev-Tov and Robert Wegener

This chapter presents the results of a study of the vertebrate faunal remains recovered during SRI's investigations of the Mescal Wash site. The site is located in southeastern Arizona, immediately above the confluence of Cienega Creek, an intermittently perennial stream, and Mescal Wash, an ephemeral drainage (Altschul et al. 2000:5). The creek usually contains slow-moving, pooled waters that encourage dense stands of vegetation in marshy environments. The site is located in a transition zone between the Sonoran Desert to the west and Chihuahuan Desert grasslands to the east. It is the desert grasslands signature that prevails in the immediate site area. Oak and coniferous woodland is nearby at higher elevations.

Native Fauna

The site's location near several different vegetation and topographic zones would have provided access to a wide variety of fauna, including, principally, small mammalian species at home in grassland/desert scrub and higher-elevation environments. These taxa include several *Peromyscus* mouse species, some at home in wooded areas, and others more common on rocky slopes. Alongside these can be found pocket mice, kangaroo rats, and, in many Arizona ecological zones, pocket gophers. To these latter species should be added both wood rats and pack rats. The wood rat and pack rat may not normally appear in this environment, but they tend to be commensal in nature and are attracted to human settlements and/or surrounding agricultural fields. The hispid cotton rat is also noteworthy in that it frequents areas with dense vegetation as well as near water. One can well imagine, therefore, that the cotton rat would have been attracted to the area around Mescal Wash. Ground squirrels are also likely to be found in the site area. These are classified into two genera, *Spermophilus* and *Ammospermophilus*. Ground squirrels are burrowing animals, and some are omnivorous, eating a wide variety of fruits, buds, green plants, or even small mice (Hoffmeister 1986:172). Although the animals were hunted in historical times by the Pima (Rea 1998; Russell 1908), it is also possible that as burrowers attracted to gardens, their bones may not always represent the detritus of human meals.

Riparian-oriented small mammals, which may well have inhabited the area prehistorically, can still be found in many parts of Arizona today, including beavers, raccoons, weasels, and muskrats. Mammals of similar size, but not necessarily riparian in adaptation, include ringtails, skunks, and badgers. Bones of these animals appear in the region's prehistoric faunal assemblages, although they are seldom common finds.

Jackrabbits and cottontails make up the other category of small mammals that frequent the Mescal Wash area and formed an important component of native human diets. The cottontails that dwell in the Arizona desert are considerably smaller (ca. 0.5–1 kg) than jackrabbits (2–4 kg), and the two types of leporids inhabit different niches. Cottontails are most often found in areas with brushy cover, for example, hills and canyons. By contrast, jackrabbits prefer open areas without extensive vegetation. Despite preferring different niches, the ranges of jackrabbits and cottontails overlap. Both the large and small leporids were hunted—either individually with projectile weapons or communally by trapping them along fences or driving them with fire (Rea 1998).

Among the most economically important large mammals of the area were mule deer and pronghorn. The latter, as with jackrabbits, are found mainly in open grassland, areas where they can outrun pursuers. The animals also can be found in higher elevations, within the piñon-juniper vegetation zone. Mule deer also migrate seasonally between high and low environmental zones, but they generally prefer a greater amount of cover than do pronghorns. Both species, at home in the Arizona desert, tend to be tolerant of arid environments.

A number of avian species might have been attracted to the dense vegetation that grew along the edges of the creek and wash, in addition to a variety of dry grassland–adapted taxa. In fact, the number of individual species that might have either lived in the area permanently, or seasonally migrated through it, is too long to discuss. Instead, it is worth mentioning that waterfowl of many types, including ducks, geese, herons, egrets, cranes as well as plovers, and sandpipers might have frequented the area, at least seasonally. Most waterfowl come to Arizona's Sonoran Desert area during the winter months (Peterson 1990).

Other, nonaquatic or partially aquatic bird groups such as birds of prey, rails, gallinaceous species, and passerine or near-passerine taxa inhabit the area surrounding the Mescal Wash site, whether bottomlands or grasslands, on a year-round basis. Most of these species were not economically important components of prehistoric Native American diets, but some, such as the Marsh hawk, held symbolic significance (Rea 2007). On the other hand, rails and gallinaceous birds might regularly have been hunted by the peoples of the area. The faunal collection from this site contains bones from Gambel's quail and a single turkey element.

Finally, the watercourses themselves may have provided living areas for fish, freshwater shellfish, toads, and aquatic turtles. The area is a good environment for both mud and musk turtles, most likely food sources during the hot months when the reptiles would not have been in hibernation. The toads of the area, the Sonoran Desert toad and the Sonoran green toad, might also be found at Mescal Wash, as well as in variety of grassland and woodland niches.

Fish would most often be encountered in the Gila River system, of which Cienega Creek is a part. It is not clear if there would have been enough water flow in the creek to support Gila River species such as the bonytail chub (*Gila elegans*) and the Colorado pikeminnow (*Ptychocheilus lucius*) during the era in which Mescal Wash was occupied. Buckles, Adams, et al. (2010) have reconstructed Cienega Creek at Mescal Wash to have been a swampy area with a high water table that led to ponded waters; the faunal remains from this study contained no fish bones. By contrast, a faunal collection from Pueblo Grande, a site near the Salt River (in present-day Phoenix), contained bones from at least nine species of freshwater fish (James 1994). The only mollusk species native to inland areas that appeared in the faunal collection were terrestrial snails belonging to the genus *Succinea*, and the freshwater bivalve *Anodonta californiensis*, the California floater.

This faunal survey, as well as the faunal collection itself, suggests that aquatic species would not have been abundant even if Cienega Creek's flow had been greater and more consistent in the past than it is today, which is probably the case. Clearly, desert, grassland, and montane species that migrate to lower elevations would have been those most available. Still, a number of riparian taxa—those attracted to but not living in aquatic environments such as birds and turtles—might nonetheless be expected to have formed a significant portion of prehistoric diets at this site.

Research Questions and Chapter Organization

This chapter is divided into several sections that each address different research questions. First, the bone collection is described, in terms of its size, major temporal components, and general species content. Species presence is briefly discussed with reference to other sites in southern Arizona as well as to the desert environment in which the site is located. Next, we present an overview of field collection and laboratory analysis methods. Here, we also discuss our decisions concerning the quantification methods employed as well as how best to place the site in a regional context in order to construct meaningful comparisons to other published faunal collections.

The three major sections that follow these introductory sections are divided into an analysis of the taphonomic history of the collection, an intrasite comparison of faunal remains from features, and an intersite comparison with other sites, in particular Hohokam sites. The taphonomic analysis focused on how bone destruction and differences in fragmentation patterns across the site and certain types of features within it, may shed light on activities carried out there. These research questions concerned the relative sizes of bone fragments in different types of features; the extent and intensity of bone burning; and how such patterning may relate to either archaeological recovery techniques, prehistoric activities such as carcass processing and refuse disposal, or some combination of these causes. On a larger scale, we sought to find out if the taphonomic patterning could shed light on abandonment processes at the site. Abandonment processes are particularly interesting in light of the site's characterization as a persistent place. It implies that human occupation was never, or seldom, completely and abruptly discontinued, but rather that settlers repeatedly came back to the site over time, even if the settlement did not always have the same function or size.

Following this, readers are introduced to an examination of the collection on an intrasite basis, how each time period's collection differs from others, as well as on the basis of the contemporaneity groups that Lengyel (Chapter 2) constructed. The intrasite comparison is therefore structured along the fine-scale line of attempting to differentiate food preferences and perhaps status between households, as well as the ways in which the diets of inhabitants of various loci across the site differed from or were similar to one another. Variation is also assessed over time, comparing successive periods' collections with one another in an effort to pick out trends relating to, possibly, environmental change or stability, site function, population size, and community organization.

Following the intrasite section is a comparison with Hohokam sites in the Tucson Basin, using diversity analysis as the primary tool with which to detect variation over time. This comparison is modeled on the previous work of Dean (2007b, 2007c), who constructed extensive comparisons through several cultural phases and used a large number of published faunal collections to demonstrate temporal patterning. Although this study somewhat artificially integrates Mescal Wash with the Hohokam heartland settlements, it does provide a comparative context for the collection reported on here. One major point of divergence between Dean's (2007c) assembled data and that from Mescal Wash, for instance, is the relative abundance of artiodactyls during the Late Archaic. The nature of this difference and its implications are discussed in detail within that section.

This chapter's conclusions focus on the concordance of this collection with expectations drawn from comparisons with Dean's (2007b, 2007c) work, the contents of the faunal collection vs. what might be expected in this ecological zone, and to what extent the remains support the idea of Mescal Wash as a persistent place. All the insights drawn from the collection are interesting and of use, but what makes the conclusions both possible and significant is the unusually large number of bones recovered from the excavations, in addition to the consistency with which they were collected.

The Collection

The excavations at the Mescal Wash site produced a faunal collection numbering 10,385 pieces of bone, quantified as the number of identified specimens (NISP [Table 135]). Please note that in this chapter's summary tables, the NISP includes the bone artifacts which are discussed in the previous chapter. Also, in these tables jackrabbit bones were assigned to *Lepus californicus* unless they could be positively identified as belonging to *Lepus alleni*. Species diversity (measured as a simple count of taxa) within the collection was low, with at least 26 identified taxa. Most of the identified animals were represented only by a small number of fragments, 20 bones or less per species, with the notable and expected exceptions of leporids and deer, which numbered into the thousands when generic, family-level, or size/taxon-specific categories were included.

In Phase 1, the site was divided into eight separate loci (A–H) based on surface indications of feature concentrations. Loci A–F were investigated by mechanical trenching and stripping, as well as hand excavation of test units (Vanderpot and Altschul 2000). Phase 2 investigations focused on three loci (A, C, and D), with minimal excavation done in Locus B (Vanderpot 2001). Most of the features, and therefore most of the faunal sample, were discovered within Locus D (Table 136), although substantial collections derived from Loci A (Table 137) and C (Table 138) as well. Although artifacts, including animal bones, were collected from Loci B, E, and F (Table 139), most of the remains collected from these areas were not dated. Thus, for our purposes the most useful portion of the faunal data set—the collection from the three more intensively investigated and better-dated loci—was slightly less than the total given above. The total from Loci A, C, and D was 10,331 specimens, representing 99.7 percent of the collection.

The faunal remains recovered represent the entire span of the site's occupation. Most of the animal bones were collected from Locus D, largely from contexts dated to the Middle Formative (A.D. ca. 750–1150) or Early/Middle Formative periods (A.D. 1–1150). The samples from contexts dated earlier than that were quite small, especially from purely Early Formative (A.D. 1–750) features, which returned only seven bones. The Late Archaic period (ca. 1500 B.C.–A.D. 1) sample was also small, numbering only 173 specimens. After the Middle Formative and its subdivisions (Middle Formative A [ca. A.D. 750–950] and Middle Formative B [ca. A.D. 950–1150]), the Late Formative period (A.D. 1150–1450) was best represented within the faunal collection, a collection containing 569 pieces of bone.

Only a narrow range of species are present, and nearly all of these are mammals. Several of the taxa may be commensal: animals not hunted or trapped, but rather individuals attracted to food supplies in the settlement, or burrowing animals that died at the site after it or parts of it were abandoned. Those taxa include two species of toads, a fence lizard, rattlesnakes, and perhaps small mice and rats (but see Szuter 1989). Some rodents and other small taxa may have been consumed, others may have been intrusive (Szuter 1989). Birds of prey and songbirds may have been consumed or hunted for their feathers or for ritual use, but they are unlikely to have contributed a substantial portion of the human diet compared to the more common leporids and artiodactyls. The list of identified species (see Table 136) is striking for its near lack of aquatic fauna, even for the arid Southwest. The only aquatic or semiaquatic fauna at Mescal Wash were toads and mud turtles; there were no aquatic birds, mammals, or fish. This lack of aquatic fauna was particularly striking because the site is located next to Cienega Creek, a body of water which even today supports native species of small fish, including the Gila topminnow (Bodner et al. 2007). Other sites in Arizona located on larger bodies of

Table 135. Species List for the Mescal Wash Site (All Periods)

Taxon	Common Name	NISP	Percent per Class	Percent of Collection
	Amphibia			
Bufo alvarius	Sonoran Desert toad	1	25.0	<0.1
Bufo retiformis	Sonoran green toad	3	75.0	<0.1
Subtotal		4		<0.1
	Reptilia			
Testudinata	turtles	15	22.7	0.1
Kinosternon sp.	musk and mud turtles	8	12.1	0.1
Gopherus agassizii	desert tortoise	18	27.3	0.2
Scleporus sp.	spiny lizard	1	1.5	<0.1
Serpentes	snakes	2	3.0	<0.1
Crotalus sp.	rattlesnake	22	33.3	0.2
Subtotal		66		0.6
	Aves			
Meleagris gallopavo	turkey	1	2.9	<0.1
Callipepla gambelii	Gambel's quail	20	57.1	0.2
Accipitridae	hawks, eagles, and relatives	2	5.7	<0.1
Picidae	woodpeckers	1	2.9	<0.1
Passeriformes (large)	perching bird, robin-sized	3	8.6	<0.1
Aves (eggshell)		8	22.9	0.1
Subtotal		35		0.3
	Mammalia			
Carnivora	carnivore	1	<0.1	<0.1
Canis familiaris/*latrans*	domestic dog/coyote	15	0.2	0.1
Urocyon cinereoargenteus	gray fox	1	<0.1	<0.1
Leporidae	rabbits and hares	449	4.5	4.3
Lepus alleni	antelope jackrabbit	5	0.1	<0.1
Lepus californicus	black-tailed jackrabbit	1,190	12.0	11.5
Sylvilagus sp.	cottontail	567	5.7	5.5
	rabbit-sized mammal	4,920	49.6	47.4
	squirrel-to-rabbit-sized mammal	591	6.0	5.7
Rodentia	rodents	5	0.1	<0.1
Sciuridae	tree and ground squirrels	19	0.2	0.2
Ammospermophilus sp.	antelope ground squirrel	17	0.2	0.2
Spermophilus sp.	ground squirrel	15	0.2	0.1
Spermophilus variegatus	rock squirrel	1	<0.1	<0.1
	squirrel-sized mammal	3	<0.1	<0.1
Thomomys sp.	pocket gopher	10	0.1	0.1
Perognathus sp.	pocket mouse	4	<0.1	<0.1
Cricetidae	New World mice, rats, lemmings and voles	32	0.3	0.3

Taxon	Common Name	NISP	Percent per Class	Percent of Collection
Peromyscus sp.	white-footed or deer mouse	1	<0.1	<0.1
Neotoma sp.	wood rat	7	0.1	0.1
Sigmodon hispidus	hispid cotton rat	1	<0.1	<0.1
	mouse-sized mammal	5	0.1	<0.1
	coyote-to-deer-sized mammal	156	1.6	1.5
Artiodactyla (medium)	even-toed hoofed mammal	1,696	17.1	16.3
Odocoileus sp.	mule or white-tailed deer	174	1.8	1.7
Cf. *Odocoileus* sp.	possible deer	1	<0.1	<0.1
Antilocapra americana	pronghorn	12	0.1	0.1
Odocoileus/*Ovis* sp.	deer/bighorn sheep	13	0.1	0.1
Ovis canadensis	bighorn sheep	2	<0.1	<0.1
Subtotal		9,913		95.5
	Unknown			
	unidentifiable	367		3.5
Subtotal		367		
Total		10,385		3.5
Large-game index		0.21		
Lagomorph index		0.32		

Key: NISP = number of identified specimens.

Table 136. Faunal Content of Locus D at the Mescal Wash Site by Time Period

Taxon	Common Name	NISP	Percent per Period
	Late Archaic		
Accipitridae	hawks, eagles, and relatives	1	0.6
	coyote-to-deer-size mammals	9	5.2
Leporidae	rabbbits and hares	5	2.9
Lepus californicus	black-tailed jackrabbit	6	3.5
	rabbit-sized mammal	64	37.0
Artiodactyla (medium)	even-toed hoofed mammal	1	0.6
Odocoileus sp.	mule or white-tailed deer	8	4.6
	deer-sized mammal	78	45.1
Odocoileus/*Ovis*	deer/bighorn sheep	1	0.6
Subtotal		173	1.8
	Early Formative		
	squirrel-to-rabbit-sized mammal	1	14.3
Sylvilagus sp.	cottontail	1	14.3
Lepus californicus	black-tailed jackrabbit	1	14.3
	rabbit-sized mammal	2	28.6
	deer-sized mammal	2	28.6
Subtotal		7	0.1
	Early-Middle Formative		
Testudinata	turtles and tortoises	4	0.4
Gopherus agassazii	desert tortoise	1	0.1

continued on next page

Taxon	Common Name	NISP	Percent per Period
Canis familiaris/latrans	dog/coyote	3	0.3
	coyote-to-deer-sized mammal	34	3.3
Neotoma sp.	wood rat	1	0.1
	squirrel-to-rabbit sized mammal	21	2.0
Leporidae	rabbits and hares	5	0.5
Lepus californicus	black-tailed jackrabbit	5	0.5
Sylvilagus sp.	cottontail	3	0.3
	rabbit-sized mammal	35	3.4
Odocoileus sp.	mule or white-tailed deer	52	5.1
	deer-sized mammal	729	71.0
Antilocapra americana	pronghorn	9	0.9
Artiodactyla (medium)	even-toed hoofed mammal	22	2.1
	unidentifiable	103	10.0
Subtotal		1,027	10.9
	Formative		
	deer-sized mammal	1	100.0
Subtotal		1	<0.1
	Middle Formative		
Bufo alvarius	Sonoran Desert toad	1	0.2
Gopherus agassazii	desert tortoise	3	0.5
Meleagris gallopavo	domestic turkey	1	0.2
	coyote-to-deer-sized mammal	9	1.6
Ammospermophilus sp.	antelope ground squirrel	5	0.9
Cricetidae	New World mice, rats, lemmings and voles	1	0.2
	squirrel-to-rabbit-sized mammal	5	0.9
Leporidae	rabbits and hares	31	5.5
Sylvilagus sp.	cottontail	20	3.5
Lepus californicus	black-tailed jackrabbit	124	21.9
	rabbit-sized mammal	285	50.4
Artiodactyla (medium)	even-toed hoofed mammal	6	1.1
Odocoileus sp.	mule or white-tailed deer	11	1.9
	deer-sized mammal	55	9.7
Antilocapra americana	pronghorn	1	0.2
	unidentifiable	8	1.4
Subtotal		566	6.0
	Middle Formative A		
Bufo alvarius	Sonoran Desert toad	1	0.0
Testudinata	turtles and tortoises	7	0.1
Kinosternon sp.	musk and mud turtles	5	0.1
Gopherus agassazii	desert tortoise	10	0.2
Scleroporus sp.	fence lizard	2	0.0
Crotalus sp.	rattlesnake	5	0.1
Callipepla gambelii	Gambel's quail	14	0.2
Passeriformes	robin-sized perching bird	2	0.0
Aves	indeterminate bird	1	0.0
Aves (eggshell)	indeterminate bird eggshell	8	0.1
Carnivora	carnivore	1	0.0

Taxon	Common Name	NISP	Percent per Period
Canis familiaris/latrans	dog/coyote	4	0.1
	coyote-to-deer-sized mammal	21	0.3
Urocyon cinereoargenteus	gray fox	1	0.0
Rodentia	rodent	5	0.1
Thomomys sp.	pocket gopher	7	0.1
Sciuridae	squirrels	11	0.2
Spermophilus sp.	ground squirrel	9	0.1
Ammospermophilus sp.	antelope ground squirrel	7	0.1
	squirrel-sized mammal	3	0.0
	squirrel-to-rabbit-sized mammal	320	5.3
Cricetidae	New World mice, rats, lemmings and voles	20	0.3
Perognathus sp.	pocket mouse	4	0.1
Sigmodon hispidus	hispid cotton rat	1	0.0
Peromyscus sp.	white-footed or deer mouse	1	0.0
Neotoma sp.	wood rat	6	0.1
	mouse-sized-mammal	4	0.1
Leporidae	rabbits and hares	310	5.1
Sylvilagus sp.	cottontail	397	6.5
Lepus alleni	antelope jackrabbit	3	0.0
Lepus californicus	black-tailed jackrabbit	777	12.8
	rabbit-sized mammal	3,665	60.2
Artiodactyla (medium)	even-toed hoofed mammal	27	0.4
Odocoileus sp.	mule or white-tailed deer	55	0.9
Odocoileus/*Ovis*	deer/bighorn sheep	4	0.1
	deer-sized mammal	177	2.9
Antilocapra americana	pronghorn	1	0.0
	unidentifiable	189	3.1
Subtotal		6,085	64.4
	Middle Formative B		
	squirrel-to-rabbit-sized mammal	5	15.2
Leporidae	rabbits and hares	2	6.1
Lepus californicus	black-tailed jackrabbit	5	15.2
	rabbit-sized mammal	17	51.5
	deer-sized mammal	2	6.1
Artiodactyla (medium)	even-toed hoofed mammal	1	3.0
	unidentifiable	1	3.0
Subtotal		33	0.3
	Late Formative B		
Testudinata	turtles and tortoises	1	0.2
Kinosternon sp.	musk and mud turtles	3	0.5
Gopherus agassazii	desert tortoise	1	0.2
Thamnophis sp.	garter snake	2	0.4
Callipepla gambelii	Gambel’s quail	5	0.9
Accipitridae	hawks, eagles, and relatives	1	0.2
Picidae	woodpeckers and flickers	1	0.2

continued on next page

Taxon	Common Name	NISP	Percent per Period
Canis familiaris/*latrans*	coyote, dog, or wolf	5	0.9
	coyote-to-deer-sized mammal	24	4.2
Thomomys sp.	pocket gopher	3	0.5
Sciuridae	squirrels	4	0.7
Spermophilus sp.	ground squirrel	3	0.5
	squirrel-to-rabbit-sized mammal	8	1.4
Cricetidae	New World mice, rats, lemmings and voles	5	0.9
Leporidae	rabbits and hares	12	2.1
Sylvilagus sp.	cottontail	59	10.4
Lepus alleni	antelope jackrabbit	1	0.2
Lepus californicus	black-tailed jackrabbit	39	6.9
	rabbit-sized mammal	189	33.2
Artiodactyla (medium)	even-toed hoofed mammal	24	4.2
Odocoileus sp.	mule or white-tailed deer	25	4.4
Odocoileus/*Ovis*	deer/bighorn sheep	3	0.5
	deer-sized mammal	136	23.9
Antilocapra americana	pronghorn	1	0.2
	unidentifiable	14	2.5
Subtotal		569	6.0
	Middle-Late Formative		
Lepus californicus	black-tailed jackrabbit	1	11.1
	rabbit-sized mammal	7	77.8
	coyote-to-deer sized mamal	1	11.1
Subtotal		9	0.1
	Early Formative-Late Formative		
Crotalus sp.	rattlesnake	14	9.9
Sciuridae	squirrels	1	0.7
Ammospermophilus sp.	antelope ground squirrel	1	0.7
Spermophilus sp.	ground squirrel	1	0.7
	squirrel-to-rabbit-sized mammal	1	0.7
Cricetidae	New World mice, rats, lemmings and voles	2	1.4
Leporidae	rabbits and hares	14	9.9
Sylvilagus sp.	cottontail	13	9.2
Lepus californicus	black-tailed jackrabbit	14	9.9
	rabbits-sized mammal	62	44.0
Artiodactyla (medium)	even-toed hoofed mammal	1	0.7
Odocoileus sp.	mule or white-tailed deer	3	2.1
	deer-sized mammal	13	9.2
Ovis canadensis	bighorn sheep	1	0.7
Subtotal		141	1.5
	Middle Formative		
Bufo alvarius	Sonoran Desert toad	2	0.7
Testudinata	turtles and tortoises	1	0.4
Callipepla gambelii	Gambel’s quail	1	0.4
	coyote-to-deer-sized mammal	2	0.7

Taxon	Common Name	NISP	Percent per Period
Leporidae	rabbits and hares	10	3.5
Sylvilagus sp.	cottontail	10	3.5
Lepus californicus	black-tailed jackrabbit	14	4.9
	rabbit-sized mammal	108	38.0
Odocoileus sp.	mule or white-tailed deer	2	0.7
	deer-sized mammal	121	42.6
	unidentifiable	13	4.6
Subtotal		284	3.0
	Late Archaic-Middle Formative		
	rabbit-sized mammal	1	11.1
Artiodactyla (medium)	even-toed hoofed mammal	1	11.1
	deer-sized mammal	7	77.8
Subtotal		9	0.1
	Late Archaic-Late Formative		
Leporidae	rabbits and hares	1	4.8
Sylvilagus sp.	cottontail	6	28.6
Lepus californicus	black-tailed jackrabbit	6	28.6
	rabbit-sized mammal	8	38.1
Subtotal		21	0.2
	Undated		
Crotalus sp.	rattlesnake	2	0.4
Canis familiaris/latrans	dog/coyote	1	0.2
	coyote-to-deer-sized mammal	32	6.1
Sciuridae	squirrels	2	0.4
Spermophilus sp.	ground squirrel	1	0.2
Ammospermophilus sp.	antelope ground squirrel	1	0.2
	squirrel-to-rabbit-sized mammal	50	9.5
Cricetidae	New World mice, rats, lemmings and voles	1	0.2
Leporidae	rabbits and hares	17	3.2
Sylvilagus sp.	cottontail	27	5.2
Lepus californicus	black-tailed jackrabbit	74	14.1
	rabbit-sized mammal	154	29.4
Artiodactyla (medium)	even-toed hoofed mammal	11	2.1
Odocoileus sp.	mule or white-tailed deer	10	1.9
	deer-sized mammal	142	27.1
Ovis canadensis	bighorn sheep	1	0.2
	unidentifiable	2	0.4
Subtotal		528	5.6
Total		9,453	

Key: NISP = number of identified specimens.

Table 137. Faunal Content of Locus A at the Mescal Wash Site by Time Period

Taxon	Common Name	NISP	Percent per Period
	Middle Formative B		
Serpentes	snakes	2	0.7
Thamnophis sp.	garter snake	3	1.1
	coyote-to-deer-sized mammal	4	1.4
Leporidae	rabbits and hares	10	3.5
Spermophilus sp.	ground squirrel	1	0.4
	rabbit-sized mammal	89	31.3
	squirrel-to-rabbit-sized mammal	125	44.0
Cricetidae	New World mice, rats, lemmings and voles	2	0.7
Lepus californicus	black-tailed jackrabbit	22	7.7
Sylvilagus sp.	cottontail	6	2.1
	deer-size mammal	13	4.6
Artiodactyla (medium)	even-toed hoofed mammal	3	1.1
	unidentifiable	4	1.4
Subtotal		284	91.3
	Middle Formative		
	squirrel-to-rabbit-sized mammal	1	0.3
	Undated		
Cricetidae	New World mice, rats, lemmings and voles	1	3.8
	deer-sized mammal	1	3.8
	squirrel-to-rabbit-sized mammal	24	92.3
Subtotal		26	8.4
Total		311	

Key: NISP = number of identified specimens.

Table 138. Faunal Content of Locus C at Mescal Wash by Time Period

Taxon	Common Name	NISP	Percent per Period
	Middle Formative		
Leporidae	rabbits and hares	2	5.3
Sylvilagus sp.	cottontail	6	15.8
Lepus californicus	black-tailed jackrabbit	2	5.3
	squirrel-to-rabbit-sized mammal	8	21.1
	rabbit-sized mammal	18	47.4
Artiodactyla (medium)	even-toed hoofed mammal	1	2.6
Odocoileus/*Ovis*	deer/bighorn sheep	1	2.6
Subtotal		38	7.0
	Middle/Late Formative A		
Lepus californicus	black-tailed jackrabbit	1	0.2
	Middle Formative A		
Lepus californicus	black-tailed jackrabbit	1	50.0
Artiodactyla (medium)	even-toed hoofed mammal	1	50.0

Taxon	Common Name	NISP	Percent per Period
Subtotal		2	0.4
	Middle Formative B		
Crotalus sp.	rattlesnake	1	0.2
Canis familiaris/*latrans*	dog/coyote	1	0.2
	coyote-to-deer-size	16	3.6
	mouse-sized mammal	1	0.2
Sciuridae	squirrels	1	0.2
Ammospermophilus sp.	antelope ground squirrel	3	0.7
	squirrel-to-rabbit-sized mammal	17	3.8
Leporidae	rabbits and hares	19	4.3
Sylvilagus sp.	cottontail	13	2.9
Lepus californicus	black-tailed jackrabbit	65	14.7
	rabbit-sized mammal	175	39.6
Artiodactyla (medium)	even-toed hoofed mammal	15	3.4
Odocoileus sp.	mule or white-tailed deer	8	1.8
Odocoileus/*Ovis*	deer/bighorn sheep	4	0.9
	deer-sized mammal	79	17.9
	unidentifiable	24	5.4
Subtotal		442	81.7
	Early Formative–Late Formative		
Testudinata	turtles and tortoises	1	5.0
Leporidae	rabbits and hares	3	15.0
Sylvilagus sp.	cotttontail	1	5.0
Lepus alleni	antelope jackrabbit	1	5.0
Lepus californicus	black-tailed jackrabbit	3	15.0
	rabbit-sized mammal	11	55.0
Subtotal		20	3.7
	Middle Formative–Late Formative		
Spermophilus sp.	ground squirrel	1	8.3
Lepus californicus	black-tailed jackrabbit	5	41.7
Sylvilagus sp.	cottontail	2	16.7
Leporidae	rabbits and hares	2	16.7
Artiodactyla (medium)	even-toed hoofed mammal	1	8.3
	rabbit-sized mammal	1	8.3
Subtotal		12	2.2
	Middle Formative B–Late Formative		
Testudinata	turtles and tortoises	1	14.3
Leporidae	rabbits and hares	1	14.3
Sylvilagus sp.	cottontail	1	14.3
Lepus californicus	black-tailed jackrabbit	1	14.3
	deer-sized mammal	3	42.9
Subtotal		7	1.3
	Undated		
Sylvilagus sp.	cottontail	1	2.2

continued on next pge

Taxon	Common Name	NISP	Percent per Period
Gopherus agassizii	desert tortoise	3	6.7
Artiodactyla (medium)	even-toed hoofed mammal	1	2.2
Lepus californicus	black-tailed jackrabbit	5	11.1
	coyote-to-deer-sized mammal	2	4.4
Canis familiaris	dog	1[a]	2.2
	rabbit-sized mammal	16	35.6
	deer-sized mammal	10	22.2
	unidentifiable	6	13.3
Subtotal		45	8.3
Total		567	

Key: NISP = number of identified specimens.

[a] Entire dog burial is counted as NISP 1

Table 139. Faunal Content of Loci B, E, and F at the Mescal Wash Site by Time Period

Locus	Taxon	Common Name	NISP
		Undated	
None		deer-sized mammal	1
B		deer-sized mammal	1
B		rabbit-sized mammal	1
E	*Odocoileus* sp.	mule or white-tailed deer	1
E		deer-sized mammal	1
E	Leporidae	rabbits and hares	1
E		rabbit-sized mammal	4
E		squirrel-to-rabbit-sized mammal	5
F		coyote-to-deer-sized mammal	1
F		deer-sized mammal	6
F	Leporidae	rabbits and hares	1
F		rabbit-sized mammal	5
F		unidentifiable	3
		Early Formative-Late Formative	
F	Leporidae	rabbits and hares	1
F	*Lepus californicus*	black-tailed jackrabbit	1
F		rabbit-sized mammal	1
Total			34

Key: NISP = number of identified specimens.

water, e.g., Pueblo Grande (James 1994), have produced bones from a variety of small fish species. Within early historical times, at least the larger rivers, particularly the Gila and its tributaries, supported an abundance and variety of edible fish (Carmony and Brown 1982:191–193). Even if the fish were too small to interest the Native Americans, the riparian setting may have been attractive for waterfowl which, according to historical accounts, were formerly very abundant (Carmony and Brown 1982:189).

The people who lived here oriented their hunting and trapping almost entirely toward terrestrial fauna; they did not draw upon aquatic areas as a significant secondary habitat from which to collect animal products. Unsurprisingly, most of the terrestrial species consumed were leporids, both cottontails and jackrabbits (mainly the black-tailed jackrabbit). The other critically important source of meat for the population was artiodactyls, including a few bighorn sheep, pronghorns, and deer in large numbers, either mule deer or white-tailed deer, or both. The large-game species were most abundant in contexts dated to the Early/Middle Formative and Middle Formative B periods, and they were relatively scarce in both earlier and later features. In addition to these species, there were two different squirrel taxa as well as a gopher species at the site. One dog burial was recovered in Locus C (Feature 7330, post–A.D. 935) and is discussed in greater detail elsewhere (Volume 1, Chapter 6). Please note that this individual is counted as a single specimen in the following tables. To the large number of mammal bones can be added a few bird bones, from both Gambel's quail and a domestic turkey (represented by a single bone), and a number of desert tortoise elements.

All of the likely food species in the collection were, naturally, desert adapted. All but one of these species, moreover, are commonly found in the kinds of Chihuahuan grasslands and desert scrub (Brown 1994:169–179) that cover the desert lowlands in this area of Arizona, although some of these species spend at least part of their time in wash burrows or in wooded areas along watercourses. To successfully hunt bighorn sheep may have required more of a hunting effort because these would have only been found only on mountain slopes and crags; but the collection contained few bones from that species. In sum, the species list makes it apparent that those who lived at Mescal Wash did not necessarily need to go on long-distance hunting journeys, but instead provided themselves mainly with locally available fauna. The methods by which the animals, especially leporids and deer, were hunted varied by species, and in that respect, the relative frequency of common species through time may provide insight into the communities' organizational shifts in hunting practices.

Analytical Approach

Following the methodology and taphonomy discussions below, we used a variety of approaches on the faunal collection in order assess the ancient character of the site. We addressed site-formation processes in terms of both sample taphonomy and intrasite patterning in the distribution of faunal remains within variously located and various types of features. Clearly, it is incumbent upon archaeologists, perhaps especially zooarchaeologists, to take into consideration how animal bones were deposited and were affected by both predepositional and postdepositional processes in order to draw reliable conclusions about the cultural processes that played roles in forming the excavated bone collection.

We next considered, in turn, each temporally distinct faunal collection—its taxonomic content and the relative abundance of species. Here, special attention was paid to the lagomorph and large-game indexes (see below), how they varied with respect to each other within any single period, as well as through time. The delineated trends are summarized through time, and the variation of the game indexes is evaluated with respect to their implications for changes in settlement history, in other words, the possible impacts of population size variation and impact of agriculture on hunting.

Dietary variation through time is examined in another way as well. Lengyel (Chapter 2) conducted a contemporaneity study for a number of features excavated in Loci A, C, and D, and dated these mainly on the basis of archaeomagnetic studies whose chronology was refined through use of stratigraphy, ceramics, projectile points, and other absolute-dating techniques. For both Locus C and Locus D, Lengyel detected a number of contemporaneous feature groups whose faunal content could be compared with one another. The features of Locus A were, however, not pooled into such groups, and the faunal remains from this area of the site could not be compared in the same way. For faunal remains from within Locus C and Locus D, we examined the feature groupings not only in terms of temporal differences, but also in terms of skeletal part representation, in other words, how carcasses were either brought back from kill sites or divided among households, or both. Finally, we also considered the question of spatial differentiation within each locus, whether we could detect differences in a group of features related to one structure vs. a group of features associated with a different structure.

Lengyel, as well as delineating contemporaneity groups for each locus by itself, also constructed synthetic groupings, making use of features from both Loci C and D. This comparison was designed to detect both intrasite differences (or similarities) across space and time, primarily in terms of the variety of species present and the relative abundance of body areas (i.e., front limbs, rear limbs, head, axial skeleton, etc.). The latter analysis serves as a proxy for discussion of hunters' decisions regarding strategies for transporting carcasses and/or meat-sharing.

The understanding of a site's habitation history must, of course, be understood not only via an intrasite analysis, but also by examining a settlement within its regional context. In this latter effort, we were limited by both the number and kinds of sites within the general vicinity of Mescal Wash. Although several sites have been reported on from this area of southeastern Arizona, in most instances, the published faunal collections were very small, or else dated to periods for which we had only small samples of bones, too sparse for useful comparison. Sites in the area which have produced rather small faunal collections include Garden Canyon (Jones and Shelley 1996) and El Macayo

(Rockman and Shelley 2001), and those with large collections but which dated primarily to sparsely represented periods at Mescal Wash include Houghton Road (Cairns and Ciolek-Torrello 1998) and Christiansen Border Village (Griffitts 2009). Huckell's (1995) report on faunal remains from excavations at several sites close to Mescal Wash along Cienega Creek cannot easily be compared to the present collection because of both of these reasons.

To get around the above problems, we constructed a comparison between Mescal Wash's faunal collection and that from the collection of Hohokam sites compiled by Dean (2007b, 2007c). The method used for that comparison, following Dean (2007c), was a diversity analysis of identified species grouped into a few classes of organisms according to general adaptation. The diversity statistics from Mescal Wash were compared with those from Dean's study for each of several cultural periods, in order to delineate similarities and differences. Dean's (2007c) data came exclusively from relatively low-elevation Hohokam sites, which may provide some of the reasons for the observed differences between that data set and trends evident from Mescal Wash. The setting and type of use at Mescal Wash may be the reason for the differences detectable between this faunal collection and the collection of Hohokam sites compiled by Dean (2007c), especially given that these latter sites were all located in the Sonoran Desert, and Mescal Wash lies primarily within the Chihuahua Desert grasslands, even though the Sonoran Desert is nearby to the west.

The key features of Mescal Wash—its upland and riparian settings—may have made it attractive for a variety of cultures and adaptations, and Vanderpot and Altschul (2007) have argued that it was a "persistent place" (Schlanger 1992). What kind of faunal assemblage might we expect the site's population to have left behind, given a long-term place of settlement defined as a persistent place? Schlanger (1992:97) defines a persistent place as a site whose cultural features attract and orient reoccupation. It is not easy to translate Schlanger's (1992) ideas of variance in intensity and duration of occupation, and swings between isolation and incorporation, into expectations for the characteristics of a given faunal collection. Larger faunal assemblages might result from more-intense occupations, that is, more people living at a place and carrying out all domestic activities there for at least a short time, whereas small assemblages might result from the opposite situation. But these are very general expectations and certainly not exclusive to a persistent-place conception of settlement history. At the end of this chapter, we return to this subject and evaluate the zooarchaeological evidence to decide how it may reflect the sporadic but long-term history of settlement that characterizes persistent places.

Analysis Methodology

The faunal remains recovered from Mescal Wash were identified by Wegener, using SRI's comparative collections and those of the Arizona State Museum at the University of Arizona. All bones were first identified to the lowest possible taxonomic grouping. The element, bone portion, area of the body, side of the body, age (juvenile or adult), sex, and any visible modifications were also recorded. The recorded modifications consisted of fragmentation type (erratic, fresh, spiral, oblique, or longitudinal); whether the bone was burned or calcined; and the specimen's weathering stage (following Behrensmeyer [1978] for medium and large mammals and Andrews [1990] for small mammals).

Bones were quantified only according to the number of identified specimens (NISP) method; they were not weighed. The minimum number of individuals (MNI) statistic was not calculated, as this was not called for in the treatment plan for the excavated bones. MNI would have been difficult to usefully apply, given that the site was composed of multiple loci, overlapping temporal phases, and myriad features, with frequent episodes of disturbance and intrusive feature formation. Each comparison, temporal, spatial, or between features or groups of features, would have required laborious recalculations of MNI, performed on smaller and smaller subsets of data. Finally, bone modifications related to their manufacture or use as tools were also noted. The bone tools found during the excavations were analyzed separately and are reported in Chapter 8.

In addition to basic identifications and quantification of relative abundance based on NISP, we also calculated versions of both the large-game index and the lagomorph index, both of which have, in a variety of forms, become standard ways of presenting summary data in the Southwest. Bayham and Hatch (1985) have argued that cottontails do not occupy precisely the same habitats as do jackrabbits. The former prefer brushy areas, so as to be better able to hide, as well as better-watered niches, whereas jackrabbits frequent open and flat landscapes, presumably for visibility and to be able to escape predators by running. Szuter (1989:271–272) added to that argument, suggesting that cultural factors such as duration and intensity of an area's human occupation impacted the distribution and population density of cottontails more so than jackrabbits. Thus, the longer a site was occupied, and by larger populations, the more cottontail populations would have declined in the area immediately surrounding the site. That should be reflected in faunal collections, where multiperiod village/settlement sites ought to demonstrate decreasing numbers of cottontails relative to jackrabbits.

Leporids and artiodactyls were the major groups of species hunted in the prehistoric Southwest. Therefore, their omnipresent remains in faunal collections tempt zooarchaeologists to find new ways of manipulating those portions of the data set. Bayham (1982) and Szuter and Bayham (1989) developed various versions of the lagomorph and artiodactyl indexes, allowing for a direct comparison of cottontail abundance vs. other rabbit species, and of artiodactyls vs. artiodactyls and leporids. The lagomorph index is calculated by dividing the cottontail NISP (S) by the sum of cottontails and jackrabbits (S + L). For the artiodactyls, the usual formula is A/(A + L), with A standing for artiodactyls, and L for Leporidae. Both these indexes have changed over time through use by different researchers, and other indexes have been added to the original two. The indexes may be calculated using either MNI or NISP; the latter measure was used here. One of the variations on these is a large-game index, which measures all large game, whether identified specifically as artiodactyls, or only generally as large mammals (or even carnivores), and then divided by that total plus leporids (Bayham 1982). This measure was used here in place of the artiodactyl index, so as to be able to include a larger proportion of the collection. That formula can be expressed as LG/(LG + L), where LG is large game (including bones identified as Artiodactyla, deer, pronghorn, deer-sized, coyote-to-deer-sized mammal, etc.) and L, stands for Leporidae.

Sample Taphonomy

The faunal collection originated from a variety of differentially classified features, including structures, intramural hearths, postholes, and various types of extramural pits and middens. A variety of recovery methods was used during the excavation. The fill from some features was collected as flotation samples in its entirety, whereas the fill from other features was screened using either 1/8- or 1/4-inch mesh, and other remains from other contexts were not screened at all. In the latter instances, the context may have been a grab sample from a mechanically excavated trench or stripping unit, or a point-provenienced piece. In order to usefully compare faunal samples from these different contexts, we decided it was necessary to first evaluate (1) the effect of recovery method on the frequency of bone fragment size, and (2) whether faunal remains were differentially preserved in the various types of features, as measured by significantly divergent numbers of specimens in different fragment-size categories. These analyses were made possible by the decision made during the analysis phase to roughly sort all fragments by size categories, as measured by the specimen's longest axis, and using the following size ranges in millimeters: less than 5, 5–15, 15–25, 25–35, 35–50, 50–100, and greater than 100.

Effects of Recovery Methods on the Faunal Collection

The analysis results demonstrated both expected and unexpected trends. The sample contained largely what one would expect in terms of percentages of recovered fragments per size category (Table 140). Both flotation and 1/8-inch sieving methods captured greater numbers of bones less than 25 mm in their longest dimension than did either 1/4-inch screening or the various methods of hand-picking employed. More specifically, 81 percent of the fragments collected in flotation samples were less than 15 mm in size, and the use of 1/8-inch screens captured 48 percent of specimens less than 15 mm long. Conversely, neither of these two methods contained more than 1 percent of bones greater than 50 mm in size. By way of contrast, the 1/4-inch screens captured a large number of bone fragments 15–25 mm long or smaller (80 percent). Most of the bones collected by hand, 77 percent, were from grab-sampled contexts.

The effect of screen size on faunal collections has been well documented (e.g., Shaffer 1992; Shaffer and Sanchez 1994), and specifically so for southern Arizona (James 1997): smaller screen sizes recover greater diversity of small species and skeletal elements. However, the situation at Mescal Wash was somewhat different. The general trend holds true, but nonetheless, the bulk of all recovered specimens, regardless of screen size, fell between 5 and 25 mm. Thus, 90 percent of bone fragments from flotation samples were between 5 and 25 mm in size, and 76 percent of 1/8-inch screened samples fell within the same size range. The latter figure was nearly identical to the 77 percent observed for fragments of those size classes recovered from 1/4-inch screens. Among the grab-sampled specimens, 50 percent of the recovered fragments fell into those size classes. Within each of the screen sizes, the highest percentage of faunal remains fell into the expected size categories. In other words, higher frequencies of fragments less than 5 mm were recovered from flotation samples, whereas the 1/8-inch screens captured higher amounts of fragments within the 5–15-mm size range, and so on. What remains unexplained in these statistics, however, was the near-lack of large (50–100 mm) and very large (greater than 100 mm) bone fragments within the flotation samples. This is curious because the flotation samples were brought as whole-feature deposits and not as soil samples presorted in the field.

One possible explanation is that the various types of features contained differently preserved (sized) faunal remains, and the flotation samples missed these because whole-feature deposits were not taken from all features or all feature types. Twenty different types of features were recognized during excavations, of which 8 were sampled via flotation as well as other methods. The most common type of sieving, performed on samples from 18 different feature types, was through 1/4-inch screens. Nine feature types were sampled via hand collection and 8 were sampled with fine sieves. Therefore, 1/4-inch sieving results per feature type provided the best data set by which to gauge bone preservation across the site. Across all feature types, most of the bones were in the 5–15-mm or 15–25-mm size ranges, disregarding a single bone from a recessed hearth area which was in the 25–35-mm category (Table 141). Functionally indeterminate pit features contained the greatest range of bone fragment sizes. The greatest differences, however, were between features that contained relatively large numbers of bones and those that contained only one or a few bones. At first glance, there appears to have been a significant contrast among these features. In fact, the disparity was caused by differences in sample size. Regardless

Table 140. Effect of Recovery Method on Frequency of Size-Classed Bone Fragments

Fragment-Size Range (in mm)	Flotation		1/8 inch		1/4 inch		Not Screened	
	NISP	Percent	NISP	Percent	NISP	Percent	NISP	Percent
<5	19	8.0	3	0.2	307	3.0	9	1.0
5–15	176	73.0	95	46.0	2,986	33.0	162	22.0
15–25	42	17.0	62	30.0	3,993	44.0	202	28.0
25–35	3	1.0	26	1.3	1,154	13.0	125	17.0
35–50	—	0.0	18	9.0	532	6.0	110	15.0
50–100	1	<0.1	2	1.0	170	2.0	95	13.0
>100	—	0.0	—	0.0	38	<0.1	28	4.0
Total	241		206		9,180		731	

Key: NISP = number of identified specimens.

of feature type, however, Table 141 clearly indicates that, once a certain sample-size threshold was reached, on the order of a few dozen bones, a clear pattern emerged: the size categories 5–15 mm and 15–25 mm consistently contained the most bones.

That pattern indicates several things about excavation techniques and formation processes across the site. First, it was not the decisions made by excavators that affected the relative abundance of bone fragments in the various size categories, because even bones collected as flotation samples fell mainly into the 5–25-mm size range. Secondly, although there is no doubt that the wide variety of different features were used for different purposes, the bone samples excavated from most of the features and feature types were derived from secondary trash deposits—they were not from primary deposits representing discrete processing activities that reduced bones to different extents (but see below). In fact, the small size of most of the bones—only 268 fragments from all recovery methods measured greater than 50 mm—indicates that many of the bones were broken, either from rendering bone grease, processing meat, manufacturing bone tools, or other forces such as trampling. If this faunal collection was primarily a series of secondary and tertiary trash deposits (Schiffer 1987), then it makes it difficult to understand the spatial distribution of species and elements across the site, across loci, and between structures.

People may have made an effort to either regularly dump refuse only within certain areas or clear away accumulated refuse scattered across the site. Alternatively, it could have been the case that people took a least-effort approach and carried refuse no farther than they had to in order to dispose of it. If the latter was the case, then animal bones in most cases were deposited not far from where animals were butchered, meals were cooked, or meat was eaten. The point is that we cannot assume which of these scenarios, or combination thereof, occurred most of the time, and the small size of most of the fragments makes it almost impossible to resolve the depositional history of the site, for instance, by means of refit studies.

There were certain prominent exceptions, however, to the observation that, according to fragment size grading, most of the features contained secondary deposits. Those exceptions were the feature types labeled as hearths, recessed hearths, and features of unknown purpose; the latter were indeterminate, nonthermal extramural pits. These three types of features all contained, on average, relatively high percentages of burned and/or calcined bones, greater than one-third of all bones found within those types of features (Table 142). Given the clear contrast in the proportions of burned bones between these and other types of features, we assume that at least these three feature types contained significant proportions of in situ, or primary, deposits.

By way of contrast, it is interesting to note that almost none of the bone sample taken from ash-filled pits was burned. The sample is very small, but may suggest that such pits were used for dumping debris from hearths as well as other activity areas, but they were not themselves areas where animal bones were processed except to dispose of them. Modern experiments on burning bone under a variety of conditions have demonstrated that bones within a soil matrix do burn when fires burn above and near to them (De Graaff 1961; Stiner et al. 1995), not only when they are within the hearth itself. Although other experimentation shows that this is dependent in part on duration of fire and sediment type (Bennett 1999), all these experiments conclude that bone in and near thermal features burns via direct or indirect contact with the fire, so long as it is of sufficient intensity and duration. More recently, Koon et al. (2003) have experimented with distinguishing fire-altered, “cooked,” bone—bone exposed to heat via boiling or roasting while still covered with flesh but with no visible traces of burning—from bone unaffected by heat. This appears possible, but it requires the use of transmission electron microscopy to examine the structure of bone collagen. This procedure, not performed on the Mescal Wash collection, would be the only way to understand the function, as well as the depositional history, of the fire-associated features. Were cooked as well as burned bones found, we could

Table 141. Percentage of Bones Recovered from Feature Types, by Fragment-Size Class

Feature Type	Quarter-Inch Sieve-Recovered Bone Fragments (in mm)														Total
	<5		5-15		15-25		25-35		35-50		50-100		>100		
	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	NISP	%	
Animal burial	—	0.0	—	0.0	—	0.0	—	0.0	—	0.0	—	0.0	1[a]	100.0	1
Ash-filled pit	—	0.0	—	0.0	1	100.0	—	0.0	—	0.0	—	0.0	—	0.0	1
Borrow pit	17	10.6	29	18.1	111	69.4	20	12.5	9	5.6	3	1.9	—	0.0	189
Entry	8	12.7	20	31.7	22	34.9	6	9.5	4	6.3	3	4.8	—	0.0	63
Floor groove	11	7.6	66	45.8	50	34.7	30	20.8	9	6.3	6	4.2	—	0.0	172
Hearth	—	0.0	2	100.0	—	0.0	—	0.0	—	0.0	—	0.0	—	0.0	2
Midden	—	0.0	—	0.0	2	50.0	—	0.0	—	0.0	2	50.0	—	0.0	4
Multiple features	—	0.0	49	38.9	59	46.8	9	7.1	5	4.0	4	3.2	—	0.0	126
Nonfeature	24	3.1	306	39.3	322	41.4	86	11.1	34	4.4	11	1.4	2	0.0	785
Pit (nonthermal)	90	4.6	737	38.0	790	40.6	204	10.5	89	4.6	21	1.0	14	0.7	1,945
Posthole	14	4.4	53	16.6	144	45.0	53	16.6	42	13.1	11	3.4	3	0.9	320
Recessed hearth area (in structure)	—	0.0	2	7.7	17	65.4	1	3.8	5	19.2	1	3.8	—	0.0	26
Roasting pit	56	4.2	478	35.6	552	41.1	158	11.8	69	5.1	31	2.3	—	0.0	1,344
Structure	87	3.8	1,244	54.6	587	25.8	266	11.7	78	3.4	15	0.7	—	0.0	2,277
Total	307	4.3	2,986	41.5	2,657	36.9	833	11.6	344	4.8	108	1.5	20	0.3	7,255

Key: NISP = number of identified specimens.

[a] Entire burial is counted as NISP 1.

Table 142. Amount of Burned Bones by Feature Type

Feature Type	Number of Burned Bones	Percent Burned by Feature Type
Not known	838	8.1
Animal burial[a]	1	0.0
Ash-filled pit	5	<0.1
Borrow pit	194	1.9
Entry	63	0.6
Floor groove	172	1.7
Hearth	39	0.4
Midden	3	<0.1
Multiple features	289	2.8
Nonfeature	8	0.1
Pit (nonthermal)	2,319	20.8
Posthole	321	3.1
Recessed hearth	43	0.4
Roasting pit	1,407	13.5
Rock cluster/hearth	1	<0.1
Rock pile	2	<0.1
Structure	4,686	45.1
Total	10,391	

[a] Entire burial is counted as NISP 1.

surmise that a feature was a thermal feature into which bones were tossed and, each time a fire was lit, burned. The low percentage of burned bones from these fire-associated features suggests one of three things: fires were not of long duration; bones that were cooked but not directly exposed to fire were discarded in the features, where subsequent fires burned them; or that these were not thermal features at all, but instead were merely trash pits that contained burned materials, including bones, from hearths.

Intramural vs. Extramural Features and Bone Fragmentation

Another way to explore the origins of the faunal collection, its characteristics, and the function(s) of various features was to examine the size of bone fragments in extramural and intramural features. We explored these data only with the faunal collection from Middle Formative–dated features from Locus D, the largest collection of animal bones from the site. Although Lengyel (Chapter 2) identified seven successive temporal groups of features dating to the Middle Formative A and located within Locus D, it is defensible to group all the house pits and their subfeatures and contrast them with the extramural pits because we are trying to determine functional differences. From an analytical perspective, examining all Middle Formative A features together, rather than by contemporaneity groups, also makes sense because this gave us a much larger faunal collection to analyze. When the faunal collection was divided into groups of apparently contemporary features, the number of bones involved became much smaller and led to problems of small sample size. In addition, study of the taxonomic content of faunal collections produced in each of these feature groups (discussed below) demonstrated little differentiation through that time span.

We conducted four separate comparisons on the Middle Formative A faunal remains originating from inside and outside structures at Locus D: frequencies of bone-fragment sizes; amount and kind of burning visible on recovered elements; frequencies of skeletal regions (i.e., head, neck, extremities, etc.); and species identified/numbers of bones per species. A priori, we thought that animal processing may have taken place in different ways at different places within the settlement, thus resulting in a different level or range of bone fragmentation in intramural vs. extramural contexts. However, with respect to average fragment size per context, there was no apparent difference in the patterning. In fact, both collections took on the shape of the normal distribution, with the less frequently represented tails representing the smaller and larger fragment sizes, and the middle of the distribution, commonly present, being fragments in the 5–15-mm and 15–25-mm categories (Table 143). A two-sample *t*-test demonstrated no significant differences at the $p = .05$ level ($p = .52$).

It is also possible that not only were roasting pits located extramurally, but so too were the principal trash pits, where bones that were burned in fires were eventually tossed. Therefore, our working hypothesis was that there would be a greater degree of burning visible on bones from extramural features, or at least a greater proportion of burned bones from such contexts. It does appear that a much greater proportion of bones from extramural features were burned (51 percent) vs. bones recovered within structures (9 percent) Table 144). However, the actual degree of burning, as measured by percentage of calcined bones, was similar in extramural and intramural features. Overall, the pattern, if not the amount, of burned bones in both extramural and intramural contexts was evidently very similar, given that the *t*-test returned the result of $p = .72$. The test result apparently stems from the fact that in both extramural pits and intramural contexts unburned bones far outnumbered burned ones, and that calcined bones were relatively rare in both contexts. The much greater amount of blackened bones in extramural features was overshadowed by those commonalities. The fact that there was a high ratio of burned bones in the extramural features is hardly surprising, given that some of these were characterized by excavators as roasting pits or similar features, and once out of use, some were natural receptacles for trash, including burned bones.

Table 143. Comparison of Bone-Fragment Sizes in Locus D Middle Formative A Features

	Within Structures		Within Extramual Pits	
Specimen Size (in mm)	**NISP**	**Percent**	**NISP**	**Percent**
<5	44	1.8	78	4.8
5–15	787	31.6	640	39.4
15–25	1,025	41.2	622	38.3
25–35	372	14.9	168	10.3
35–50	184	7.4	96	5.9
50–100	70	2.8	7	0.4
>100	7	0.3	14	0.9
Total	2,489		1,625	

Key: NISP = number of identified specimens.

Table 144. Comparison of Burning Intensity and Frequency on Bones from Locus D Middle Formative A Features

	Within Structures		Within Extramual Pits	
Burn Category	**NISP**	**Percent**	**NISP**	**Percent**
Blackened	138	5.5	744	45.8
Calcined	95	3.8	88	5.4
Unburned	2,256	90.6	793	48.8
Total	2,489		1,625	

Key: NISP = number of identified specimens.

The third comparison, based on skeletal regions, produced similar results to the foregoing two studies (Table 145). Cranial bones and teeth were assigned to the head region, the neck consists of the cervical vertebrae, and the axial region includes remaining vertebrae, as well as the innominate and sacrum. The upper thoracic limb includes the scapula and humerus; the lower thoracic includes the radius, ulna, metacarpals, and carpals. The upper pelvic region includes only the femur; the lower pelvic includes tibia, patella, tarsals, and metatarsals. Appendicular indeterminate fragments of long bones cannot be identified to the exact element. Extremities consist of the phalanges. Within both extramural pits and intramural contexts, the vast majority of recovered elements could be classified as appendicular bones. Axial bones and those of the extremities were the next most frequent element categories in both contexts, although the two were reversed in relative abundance between the two feature sets. In general, the percentages for the skeletal regions were quite similar in both extramural and intramural contexts, suggesting that the two collections were indistinguishable. A *t*-test result (*p* = .65) supports this. The great degree of similarity in the distribution of skeletal parts between intramural and extramural features may indicate similar animal processing in both outside and inside contexts, especially when taken together with the evidence from fragment-size distributions.

Finally, comparing species composition and relative abundance produced the same results as the other axes of comparison, that is, no significant differences (*p* = .64) were discerned. In comparing the faunal remains from different areas of the site, different periods, and contemporary feature groups, the overwhelming characteristic was similarity rather than difference. This was the case despite the fact that the structures contained a greater range of species than did the extramural features (Table 146). This finding probably reflects the fact that the structures contained approximately twice as many bones. In essence, then, we can summarize this portion of the study by stating that few differences were discernible between faunal remains recovered from extramural and intramural contexts. One distinction, already commented upon, was the amount of burned bones outside the structures (more) as opposed to those found within them (less). Another difference was

Table 145. Comparison of Relative Frequencies of Skeletal Regions (all taxa) for Locus D Middle Formative A Features

	Within Structures		Within Extramural Pits	
Skeletal Regions	**NISP**	**Percent**	**NISP**	**Percent**
Head	115	4.6	42	2.6
Neck	76	3.0	1	0.1
Axial	155	6.2	106	6.5
Upper thoracic limb	123	4.9	27	1.7
Lower thoracic limb	7	0.3	29	1.8
Upper pelvic limb	122	4.9	38	2.3
Appendicular indeterminate	1,555	62.5	1,220	75.1
Extremities	293	11.8	85	5.2
Indeterminate	43	1.7	77	4.7
Total	2,489		1,625	

Key: NISP = number of identified specimens.

Table 146. Comparison of Taxonomic Content and Frequencies from Locus D Middle Formative A Features

	Structures		Extramural Pits	
Identified Taxa	**NISP**	**Percent**	**NISP**	**Percent**
Turtles and tortoises	3	0.1	—	<0.1
Desert tortoise	5	0.2	—	<0.1
Spiny lizard	—	<0.1	1	0.1
Rattlesnakes	5	0.2	—	<0.1
Gambel’s quail	8	0.3	—	<0.1
Robin-sized perching bird	1	<0.1	—	<0.1
Carnivore	—	<0.1	1	0.1
Dog/coyote	3	0.1	—	<0.1
Coyote-to-deer-sized mammal	13	0.5	1	0.1
Rodent	5	0.2	—	<0.1
Pocket gopher	3	0.1	3	0.2
Squirrels	5	0.2	4	0.2
Ground squirrel	1	<0.1	1	0.1
Antelope ground squirrel	6	0.2	—	<0.1
Squirrel-to-rabbit-sized mammal	95	3.8	70	4.3
Pocket mouse	2	0.1	—	<0.1
Rats, mice, and voles	4	0.2	10	0.6
Cotton rat	1	<0.1	—	<0.1
Wood rat	4	0.2	1	0.1
Mouse-sized mammal	—	<0.1	1	0.1
Rabbits and hares	152	6.1	58	3.6
Cottontail	242	9.7	31	1.9
Antelope jackrabbit	2	0.1	1	0.1
Black-tailed jackrabbit	385	15.5	149	9.2
Rabbit-sized mammal	1,379	55.4	1,134	69.8

	Structures		Extramural Pits	
Identified Taxa	NISP	Percent	NISP	Percent
Mule or white-tailed deer	17	0.7	35	2.2
Deer/bighorn sheep	1	<0.1	12	0.7
Deer-sized mammal	89	3.6	29	1.8
Pronghorn	1	<0.1	—	<0.1
Even-toed grazing mammal	13	0.5	6	0.4
Unidentifiable	44	1.8	77	4.7
Total	2,489		1,625	

Key: NISP = number of identified specimens.

more basic in nature, namely that excavation of the structures produced greater than twice as many bones than the pits outside them. This was despite the fact that the extramural pits were much more numerous than structures, although most were not as large. Nonetheless, the imbalance in faunal remains is interesting and probably reflects the fact that as structures were abandoned, the one after the other, they were used as convenient receptacles for trash, as were the various extramural pits. Therefore, we should not be surprised at the similarity between the two contexts, and indeed we could only realistically expect significant differences if the entire settlement had been abandoned at once. But the general character at Mescal Wash was that a favorite, repeated small-scale settlement comparable to a "persistent place" as defined by Schlanger (1992). That characterization of the site militates against the explanation that intrasite faunal patterning among features can be explained by sudden abandonment of the entire site.

Dietary Change and Continuity through Time

Late Archaic

The relatively small sample from this period consisted almost entirely of leporid and artiodactyl bones; only one bone was clearly not from such animals but rather was from a bird of prey (Table 147). Leporids and artiodactyls were present in nearly equal numbers, each ca. 50 percent of the Late Archaic collection if the less-specific categories (e.g., rabbit-sized mammal or deer-sized mammal) are included. Deer may have been much more important than leporids despite the equivalence in number of specimens because they are much larger. It is not possible to calculate a lagomorph index for this period because no cottontail bones were identified in features dated to this period. Given the site's location, just above a perennial creek with wooded areas following its course, the lack of any definitively identified cottontails was surprising. Their absence was all the more remarkable in that Szuter's (1989) model of leporid exploitation predicts that cottontails should be most abundant in periods and places lacking in intensive habitations. Only a small portion of the Late Archaic component of Mescal Wash was excavated (Vanderpot and Altschul 2007:55–56) so it is difficult to judge how extensive and intensive this period's occupation was.

Compared to leporids in general, artiodactyls were unusually abundant in this period; normally, there are fewer of these animals' bones and significantly more from leporids in the region's faunal collections. This may have to do with the sample's small size. If not an effect of sample size, then this collection had somewhat of a "big-game hunter" profile. Perhaps, rather than logistical long-range, large-game hunting, the population found it relatively easy to hunt deer and possibly antelope in the settlement's upland and riverine setting. The site's elevated setting within the Chihuahuan Desert grasslands (Brown 1994) along marshland, surrounded by mountains would have put residents within reach of both pronghorn and deer habitats.

Early Formative and Early/Middle Formative

Only 7 bones were assigned to the Early Formative period (Table 148), emanating from two extramural pits. This sample was too small to form a reliable base for any discussion. On the other hand, animal bones from mixed Early and Middle Formative contexts provided a sample of 1,028 specimens. This portion of the Mescal Wash faunal collection was employed here to substitute for the scant Early Formative component. The Early/Middle Formative collection contained a slightly more diverse array of identified species, including a few tortoise elements, cottontail, canid, wood rat, and pronghorn bones (Table 149). The inclusion of pronghorn bones was particularly interesting, in that the 9 bones recognized in this temporal context was the highest number for any single occupational phase

Table 147. Species List for Late Archaic Contexts at Mescal Wash

Taxon	Common Name	NISP	Percent
Accipitridae	hawks, eagles, and relatives	1	0.6
Leporidae	rabbits and hares	5	2.9
Lepus californicus	black-tailed jackrabbit	6	3.5
Rabbit-size	rabbit-sized mammal	64	37.0
	coyote-to-deer-sized mammal	9	5.2
Odocoileus/*Ovis* sp.	deer/bighorn sheep	1	0.6
Odocoileus sp.	mule or white-tailed deer	8	4.6
	deer-sized mammal	78	45.1
Artiodactyla (medium)	even-toed hoofed mammal	1	0.6
Total		173	
Large-game index		0.56	
Lagomorph index			

Key: NISP = number of identified specimens.

Table 148. Species List for Early Formative Contexts at Mescal Wash

Taxon	Common Name	NISP
	squirrel-to-rabbit-sized mammal	1
	rabbit-sized mammal	2
Sylvilagus sp.	cottontail	1
Lepus californicus	black-tailed jackrabbit	1
	deer-sized mammal	2
Total		7

Key: NISP = number of identified specimens.

at the site. All were recovered from Feature 10,507, a bell- shaped roasting pit in Locus D. The nine bones consisted exclusively of lower limb and hoof bones; a right navicular, radius, a left ulna, a tarsal, first phalanx, second phalanx, and three third phalanges. All could easily belong to a single individual, as could an additional right astragalus that was recovered from Feature 5994, a structure dating to Early Formative to Middle Formative A. Another right astragalus was found in a Middle Formative A structure (Feature 5994), and this bone shows that at least two pronghorns, or portions thereof, must have been present at the site between the Early and Middle Formative. It is tempting to interpret the leg and hoof bones from Feature 10,507 as less meaty pieces that were discarded, but the same feature includes more-meaty elements identified as deer bone, as well as indeterminate deer-sized artiodactyl bone, and deer-sized mammal bone. The ease of identifiability has likely influenced the body-part representation seen here. Rib, vertebra, and long-bone fragments were present but could not be identified either to deer or to pronghorn. Artiodactyl and probable artiodactyl bone made up the bulk of the bone from the feature, but a few cottontail and indeterminate leporid bones were recovered, as well as desert tortoise and unidentified turtle/tortoise bone, rabbit-sized, squirrel-to-rabbit-sized and coyote-to-deer-sized-mammals bone, and unidentifiable bone fragments. The only other pronghorn bone was a metatarsal awl found in an adobe-walled structure (Feature 4683) dating to the Late Formative B period. The presence of pronghorn bones suggests that hunters made occasional use of the local Chihuahuan Desert scrub to pursue game, which was relatively easy to do in the gently rolling grassland. The large-game index calculated for this phase returned a high quotient, 0.92, higher than the figure calculated for the Late Archaic, 0.56. Clearly, large-game hunting figured

Table 149. Species List for Early/Middle Formative Contexts[a] at Mescal Wash

Taxon	Common Name	NISP	Percent
Testudinata	turtles and tortoises	4	0.4
Gopherus agassizi	desert tortoise	1	0.1
Canis familiaris/*latrans*	dog/coyote	3	0.3
	coyote-to-deer-sized mammal	34	3.3
Neotoma sp.	wood rat	1	0.1
	squirrel-to-rabbit-sized mammal	21	2.0
Leporidae	rabbits and hares	5	0.5
Sylvilagus sp.	cottontail	3	0.3
Lepus californicus	black-tailed jackrabbit	5	0.5
	rabbit-sized mammal	35	3.4
Odocoileus sp.	mule or white-tailed deer	53	5.2
	deer-sized mammal	729	70.9
Antilocapra americana	pronghorn	9	0.9
Artiodactyla (medium)	even-toed hoofed mammal	22	2.1
	unidentifiable	103	10.0
Total		1,028	
Large-game index		0.92	
Lagomorph index		0.37	

Key: NISP = number of identified specimens.

[a] These are features with dates spanning these periods but with no further subdivision possible.

prominently in the diet of the population well into the Middle Formative A period, and indeed, some 75 percent of the bones from this period came from large animals the size of deer or other artiodactyl species.

After artiodactyls, the other major dietary contributors were Leporidae (rabbit or hare) species. Most of these bones were unidentifiable, simply classed as rabbit-sized mammal elements. Some additional elements were classifiable only as squirrel-to-rabbit-sized mammal such that we could not say with plausible certainty that these were in fact leporids. Nonetheless, whether or not those bones were included in an estimate of relative abundance of leporids made little difference. Even assuming that all squirrel-to-rabbit-sized bones were from leporids, the animals contributed no more than 7 percent of the bones in the faunal collection and 5 percent if the bones so classified were not included in the count. The small contribution of leporids to this period's collection was an anomaly compared to both earlier and later phases at the site and perhaps should be attributed to sampling error.

Middle Formative

Features dated to the general Middle Formative period contained a relatively small number of bones, totaling approximately 600 (Table 150). The collection contained the usual array of artiodactyls and leporid species (more on these below) but in addition contained several other taxa. These other taxa, represented by one or only a few bones each, included amphibians, reptiles, birds, and other mammals. The mammalian fauna, aside from leporids and artiodactyls, included a number of antelope ground squirrel bones as well as bones in the size range of canids. These latter elements were not well enough preserved, however, to further classify. The amphibian bone was Sonoran Desert toad, and the reptile bone was desert tortoise.

The sole avian species recovered was a turkey, represented by a proximal humerus. This specimen was found in Feature 3545, a Middle Formative A period structure, and was the only turkey bone found in the entire site (Figure 138). Turkeys rarely are found in the faunal

Table 150. Species List for Middle Formative Contexts[a] at Mescal Wash

Taxon	Common Name	NISP	Percent
Bufo retiformis	Sonoran green toad	1	0.2
Gopherus agassizi	desert tortoise	3	0.5
Meleagris gallopavo	domestic turkey	1	0.2
	coyote-to-deer-sized mammal	9	1.5
Ammospermophilus sp.	antelope ground squirrel	5	0.8
Cricetidae	New World mice, rats, lemmings, and voles	1	0.2
	squirrel-to-rabbit-sized mammal	13	2.1
Leporidae	rabbits and hares	33	5.4
Sylvilagus sp.	cottontail	26	4.2
Lepus californicus	black-tailed jackrabbit	125	20.4
	rabbit-sized mammal	313	51.1
Odocoileus sp.	mule or white-tailed deer	11	1.8
	deer-sized mammal	55	9.0
Odocoileus/*Ovis* sp.	deer/bighorn sheep	1	0.2
Antilocapra americana	pronghorn	1	0.2
Artiodactyla (medium)	even-toed hoofed mammal	7	1.1
	unidentifiable	8	1.3
Total		613	
Large-game index		0.14	
Lagomorph index		0.17	

Key: NISP = number of identified specimens.

[a] These are features with dates spanning this period but with no further subdivision possible.

assemblages of southern Arizona. No specimens have been reported from sites such as El Macayo (Rockman and Shelley 2001), the Garden Canyon site (Jones and Shelley 1996), Los Morteros (Gillespie 1995), Shelltown (Marmaduke and Strand 1993), Sunset Mesa Ruin (Cairns and Huber 1999), the Tucson Aqueduct Project (Gillespie 1989), Ventana Cave (Bayham 1982), the Hohokam sites reported on by Dean (2003), or the Tucson Basin and Chihuahua, Mexico, faunal collections studied by Schmidt (2008). Szuter (1989) reported, without further elaborating, that turkeys were rare finds in south-central Arizona sites, based on more than 50 faunal collections she either studied or reported on in her dissertation.

We do not know whether this sole turkey specimen came from a wild or domestic bird, as there is no consistent criteria for differentiating between wild and domestic turkey elements other than, possibly, the greatest length of the tarsometatarsus (Breitburg 1988; McKusick 1986). Indeed, both Munro (1994) and Breitburg (1988) have questioned the validity of many traits argued by McKusick (1986) to be useful in distinguishing between wild and domestic or different breeds of ancient turkeys. The grassland ecotone immediately surrounding the Mescal Wash site was probably not suitable habitat for wild turkeys, but a wild bird could have been hunted elsewhere, for example, to the north in the nearby woodlands of the Rincon Mountains. Recent genetic work on the origins of southwestern turkeys indicates that some of the tested prehistoric specimens were from wild birds, indicating that there were wild turkeys in the prehistoric Southwest. Other tested bones were possibly hybrids of local wild birds and imported domesticated birds, from the East or Midwest of North America (Speller et al. 2010). It is intriguing that only a single turkey element was identified. As archaeological literature from surrounding Arizona sites suggests, turkeys seem to have been rare in this region, a statistic which may have bearing on the domestic vs. wild question.

The percentage of leporids vs. artiodactyls was quite interesting, in that it was a completely different pattern from that seen in earlier periods at the site—a complete reversal of the trends in the Early/Middle Formative collection. In the Middle Formative, rabbits and hares far outnumbered deer and other artiodactyls, by as much as 82 to 11 percent, depending upon whether one includes percentages based

Figure 138. Proximal left humerus of a turkey (*Meleagris gallopavo*) found in a Middle Formative structure (Feature 3545, Locus D).

on bones identified as deer-sized or rabbit-sized mammals. Including such loosely defined categories, the ratio of leporids to artiodactyls was approximately 7:1; without such categories, the ratio was only slightly higher, 9:1. The lagomorph index for this period, calculated at 0.17, fell compared to the Early/Middle Formative, which had a considerably higher lagomorph index score of 0.38. However, this could also be an artifact of screen size, in that cottontail remains can easily fall through $^1/_4$-inch screens, which were, along with finer screens, employed during excavations. The lagomorph index does not specifically measure the relative abundance of cottontails compared to jackrabbits, but a simple ratio calculation demonstrates that jackrabbits (NISP = 125) outnumbered cottontails (NISP = 26) by nearly 5:1. In earlier periods, there were either no cottontail bones identified (Late Archaic) or very few specifically identified leporids overall (Early/Middle Formative), and so that statistic cannot be comparatively evaluated.

Artiodactyls from Middle Formative contexts also presented quite a different picture from previous periods. Dominated by deer, as usual in the Southwest, the number of artiodactyls identified for contexts dated to this period was quite a bit less than identified for previous periods. Only 75 such elements were identified, which was reflected the large-game index's figure for this collection, 0.14, considerably lower than previously. The obvious conclusion, stemming from the comparative abundance of leporids vs. artiodactyls, is that large-game hunting dropped considerably in importance, or practicality, by or during this period. Therefore, the question is one of why, a point to which this chapter will return after summarizing the evidence from the remaining periods.

Middle Formative A

The Middle Formative A period contained the largest portion of the Mescal Wash faunal collection, a collection of at least 21 species represented by over 6,000 pieces of bone (Table 151). Among the species present were a single amphibian (Sonoran Desert toad) and four reptiles, not only the two endemic turtle species (desert tortoise and mud turtle) but also fence lizards and rattlesnakes. The latter two species, as well as the toad, may have been accidental inclusions in the collection. At least two species of birds were also present, mainly Gambel's quail, but also a few unidentified bones from one or more perching birds, as well as unidentified avian eggshell. In addition to these rather rare species were a variety of rodents. Although some or many of these species, particularly small mice and rats, could also have been accidental inclusions of animals that had burrowed into pits attracted by the food stored there, Szuter (1989) makes a convincing case for rodents having been common dietary components in the general region. The species in the site collection included two species of rat and two each of mice and squirrels, in addition to pocket gophers. Based on Szuter's research there is no doubt that at least some of the gophers and squirrels, scant though their remains are, were sometimes food items. Many more squirrel and gopher bones may have been included in the squirrel-to-rabbit-sized mammal category, to which was assigned more than 300 fragments.

Leporid remains were extremely common in the collection, making up 25 percent of the identified bones. These represented, for the first time, three definite species: cottontails, black-tailed jackrabbits, and antelope jackrabbits. Not surprisingly, black-tailed jackrabbits were by far the most common of the three species, nearly twice as abundant as cottontails and far more common than the few antelope jackrabbit bones that could be distinguished. This imbalance between the two species of jackrabbits was no doubt at least partly because of the difficulty inherent in separating the two species, such that there may well have been many more antelope jackrabbit bones amidst the bones identified only to the family or rabbit-sized mammal categories. In any event, it seems to have been the pattern at this site, that jackrabbits, of either or both species, were far more commonly (or successfully) hunted than cottontails.

Table 151. Species List for Middle Formative A Contexts at Mescal Wash

Taxon	Common Name	NISP	Percent
Bufo alvarius	Sonoran Desert toad	1	<0.1
Testudinata	turtles and tortoises	7	0.1
Kinosternon sp.	Sonoran mud turtle	5	0.1
Gopherus agassizi	desert tortoise	10	0.2
Sceloporus sp.	spiny lizard	2	<0.1
Crotalus sp.	rattlesnakes	5	0.1
Callipepla gambelii	Gambel's quail	14	0.2
Passeriformes, large	robin-sized perching bird	3	0.0
Aves (eggshell)	indeterminate bird eggshell	8	0.1
Carnivora	carnivore	1	<0.1
Canis familiaris/*latrans*	dog/coyote	4	0.1
Urocyon cinereoargenteus	gray fox	1	<0.1
	coyote-to-deer-sized mammal	21	0.3
Rodentia	rodent	5	0.1
Thomomys sp.	pocket gopher	7	0.1
Sciuridae	squirrels	11	0.2
Spermophilus sp.	squirrel	2	<0.1
Ammospermophilus sp.	antelope ground squirrel	14	0.2
	squirrel-sized mammal	3	<0.1
	squirrel-to-rabbit-sized mammal	320	5.3
Perognathus sp.	pocket mouse	4	0.1
Cricetidae	New World mice, rats, lemmings and voles	20	0.3
Sigmodon hispidus	cotton rat	1	<0.1
Peromyscus sp.	white-footed or deer mouse	1	<0.1
Neotoma sp.	wood rat	6	0.1
Mouse-size	mouse-sized mammal	4	0.1
Leporidae	rabbits and hares	310	5.1
Sylvilagus sp.	cottontail	397	6.5
Lepus alleni	antelope jackrabbit	3	<0.1
Lepus californicus	black-tailed jackrabbit	778	12.8
	rabbit-sized mammal	3,665	60.3
Odocoileus sp.	mule or white-tailed deer	31	0.5
Odocoileus/*Ovis* sp.	deer/bighorn sheep	4	0.1
	deer-sized mammal	187	3.1
Antilocapra americana	pronghorn	1	<0.1
Artiodactyla (medium)	even-toed hoofed mammal	28	0.5
	unidentifiable	189	3.1
Total		6,073	
Large-game index		0.05	
Lagomorph index		0.37	

Key: NISP = number of identified specimens.

The Middle Formative A lagomorph index score, 0.34, is similar to that for the site as a whole. It is also roughly similar to that for the Early/Middle Formative period materials, but twice as high as the scores for the Middle Formative B and the more general Middle Formative period.

A quick perusal of the artiodactyl section of the species list reveals these taxa to be relatively few in number, especially in comparison to the overwhelming numbers of leporids/rabbit-sized mammal remains. There were only between 275 and 300 artiodactyl bones, depending on whether coyote-to-deer-sized mammal bones were included in the count. This represented only 4 percent of the overall faunal collection and returned a large-game index score of 0.05. The latter score was again a significant decline from prior periods' scores, and in fact was the lowest such statistic among all the periods represented. There appears to have been a clear trend over time up to this point, wherein the amount of deer and other artiodactyls in the phases of this site decreased, in favor of a dramatic increase in the amount of leporids. Several related causes or catalysts for the changes could be suggested. These include (1) the intensification of farming, (2) labor directed toward crops and away from large-game hunting, (3) the depletion of local large-game populations due to overhunting by larger human populations, and (4) turning better forage lands into fields. To address these and other hypotheses, however, the remaining periods must be examined and compared with one another, thus distilling all trends through all periods.

Middle Formative B

Features from this period yielded a rather modest total number of bones, approximately 760, with a concomitant, relatively narrow range of species (Table 152). Small numbers of species other than leporids and grazing animals were present, including venomous and nonvenomous snakes, squirrels and other rodents, as well as a single bone from either a dog or a coyote. However, the bulk of the collection was made up of the bones from various leporid and artiodactyl species. Leporids outnumbered artiodactyls by a ratio of more than 3:1. The lagomorph and large-game indexes both repeated trends seen in some of the previous periods. In contrast to the preceding phase, the importance of artiodactyls relative to the overall contribution of grazing animals plus leporids increased to 0.18, on par with the Middle Formative score of 0.14, but well above the score for the Middle Formative A. On the other hand, the contribution of cottontail during the Middle Formative B shrank relative to all preceding periods, as the lagomorph index returned a score of 0.17. The indexes, unlike percentages, are independent of one another, such that the two trends expressed by each calculation must represent subtly divergent hunting decisions.

In this period, the diet was very nearly uniformly made up of leporids and artiodactyls, even more so than usual for this region; other species were represented by only a handful of bones in total. In addition, the importance of large-game animals increased during this period after declining during the prior period. Possibly, following Szuter's (1989) model, cottontail declined to a level that was half their previous abundance, perhaps in response to more intensive farming and irrigation which destroyed their preferred habitat—thick vegetation that provided cover. As Dean (2007b:8) has pointed out, however, researchers have proposed a variety of causes for lagomorph index changes, ranging from environmental prime movers to various social causes.

Late Formative

The combined Middle and Late Formative period collection consists of only 11 bones (Table 153), too few for extensive comments. All but 2 of these remains were of leporids or at least rabbit-sized animals. The remaining 2 bones were of much larger animals, either deer-sized or coyote-sized creatures. Because this small collection spans the temporal eras represented by the Middle and Late Formative periods, we decided to include the discussion of the faunal collection from the Late Formative period here.

The Late Formative B period collection numbered nearly 600 specimens (Table 154). This collection came from four dated adobe structures, Features 1575, 4683, 4684, and 4729, all in Locus D. Some of the species recovered from these contexts were represented by only one or just a few elements, including several reptile species (turtles and snakes), as well as three bird taxa. The avian taxa included the Gambel's quail, which no doubt was hunted as food, and also included one bone each from a hawk and a woodpecker. These birds may have been hunted for their feathers rather than for food. Several rodent species were also in this collection, mainly gophers and ground squirrels, but there were also one or more unidentified species of rats and/or mice.

Despite the diversity of species in the collection, it was very similar to all the other collections from the site, both larger and smaller, in that it principally contained the bones of artiodactyl and leporids. Yet, the relative abundance of these two taxonomic orders was intriguing, because of the unusually high number of artiodactyl or artiodactyl-sized bones identified. Remains so classified made up 33 percent of the bones dated to this period, a threshold of big-game abundance attained in only two of the other periods at the site, namely, the Late Archaic (50 percent artiodactyl elements) and the Early and Middle Formative period (75 percent artiodactyls). Artiodactyl percentages for the Late Archaic correspond to those reported from a contemporary site, the San Pedro phase at Christiansen Border Village (Griffitts 2009), situated in the same region as Mescal

Table 152. Species List for Middle Formative B Contexts at Mescal Wash

Taxon	Common Name	NISP	Percent
Thamnophis sp.	garter snake	3	0.4
Crotalus sp.	rattlesnake	1	0.1
Serpentes	snakes	2	0.3
Canis familiaris/*latrans*	dog/coyote	1	0.1
	coyote-to-deer-sized mammal	20	2.6
Sciuridae	squirrels	1	0.1
Spermophilus sp.	ground squirrel	1	0.1
Ammospermophilus sp.	antelope ground squirrel	3	0.4
	squirrel-to-rabbit-sized mammal	147	19.4
Cricetidae	New World mice, rats, lemmings, and voles	2	0.3
	mouse-sized mammal	1	0.1
Leporidae	rabbits and hares	31	4.1
Sylvilagus sp.	cottontail	19	2.5
Lepus californicus	black-tailed jackrabbit	92	12.1
	rabbit-sized mammal	280	36.9
Odocoileus sp.	mule or white-tailed deer	8	1.1
Odocoileus/*Ovis* sp.	deer/bighorn sheep	4	0.5
	deer-sized mammal	94	12.4
Artiodactyla (medium)	even-toed hoofed mammal	20	2.6
	unidentifiable	29	3.8
Total		759	
Large-game index		0.18	
Lagomorph index		0.17	

Key: NISP = number of identified specimens.

Table 153. Species List for Middle/Late Formative Contexts[a] at Mescal Wash

Period	Date Range (A.D.)	Taxon	Common Name	NISP
Formative	500–1390		deer-sized mammal	1
Middle Formative/Late Formative	700–1300	*Lepus californicus*	black-tailed jackrabbit	1
Middle Formative/Middle Formative B/ Late Formative	990–1160	*Lepus californicus*	black-tailed jackrabbit	1
Middle Formative/Middle Formative B/ Late Formative	990–1160		coyote-to-deer-sized mammal	1
Middle Formative/Middle Formative B/ Late Formative	990–1160		rabbit-sized mammal	7
Total				11

Key: NISP = number of identified specimens.

[a] These are features with dates spanning these periods but with no further subdivision possible.

Table 154. Species List for Late Formative B Contexts at Mescal Wash (Locus C and D)

Taxon	Common Name	NISP	Percent
Testudinata	turtles and tortoises	1	0.2
Kinosternon sp.	Sonoran mud turtle	3	0.5
Gopherus agassizi	desert tortoise	1	0.2
Thamnophis sp.	garter snake	2	0.3
Callipepla gambelii	Gambel's quail	5	0.9
Accipitridae	hawks, eagles, and relatives	1	0.2
Picidae	woodpeckers and flickers	1	0.2
Canis familiaris/*latrans*	dog/coyote	5	0.9
	coyote-to-deer-sized mammal	25	4.4
Thomomys sp.	pocket gopher	3	0.5
Sciuridae	Sciuridae	4	0.7
Spermophilus variegatus	rock squirrel	1	0.2
Spermophilus sp.	ground squirrel	2	0.3
	squirrel-to-rabbit-sized mammal	8	1.4
Cricetidae	New World mice, rats, lemmings and voles	5	0.9
Leporidae	rabbits and hares	12	2.1
Sylvilagus sp.	cottontail	59	10.3
Lepus alleni	antelope jackrabbit	1	0.2
Lepus californicus	black-tailed jackrabbit	40	7.0
	rabbit-sized mammal	191	33.3
Odocoileus sp.	mule or white-tailed deer	24	4.2
Cf. *Odocoileus* sp.	probable deer	1	0.2
Odocoileus/*Ovis* sp.	deer/bighorn sheep	3	0.5
	deer-sized mammal	136	23.7
Antilocapra americana	pronghorn	1	0.2
Artiodactyla (medium)	even-toed hoofed mammal	24	4.2
	unidentifiable	14	2.4
Total		573	
Large-game index		0.41	
Lagomorph index		0.59	

Key: NISP = number of identified specimens.

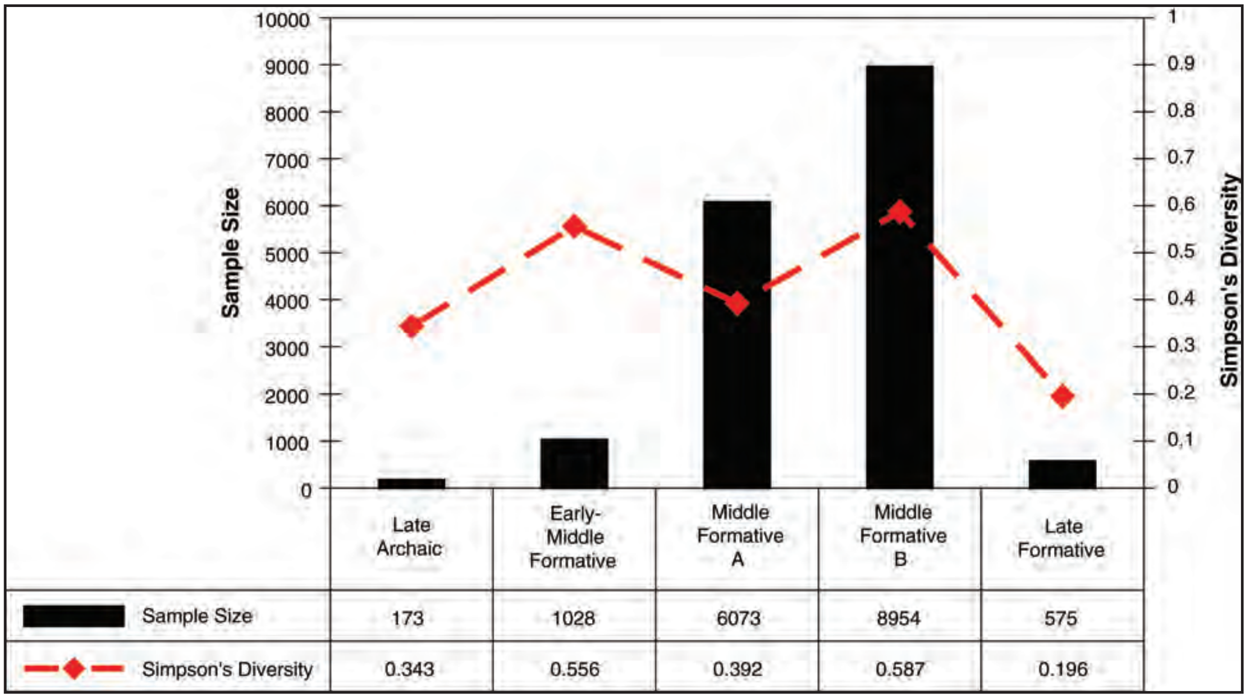
Wash. The high large-game index statistic, 0.41, reflects the abundance of these mammals in this collection.

Perhaps even more interesting was the numerical relationship between the rabbit taxa. Cottontails were more abundant within this collection (10 percent) than in any preceding one, reversing the prior trend wherein this animal seemed to all but disappear as an important dietary component, possibly a result of the destruction of its habitat. Whatever the cause, the species apparently either recovered from a population decline (from possibly overhunting or habitat loss), or it regained popularity as an animal to hunt or trap. Reflecting that rise, the 0.59 returned the highest value of any of the preceding periods. Measured according to the index, cottontails were obviously an important food, and that idea was reinforced by the fact that, among leporid bones identifiable to species, cottontails were slightly more abundant than either black-tailed or antelope jackrabbits, a pattern not seen earlier at this site.

This collection demonstrates the start of a dietary shift, similar in some ways to the earlier periods of the Late Archaic and Early Formative, in the population's increased interest and success in hunting artiodactyls, but it differed in the emphasis on cottontails. Although the increased deer hunting may have been linked to intensive agriculture and garden hunting, the same cannot be said for the contemporary turn toward cottontails. The cottontails probably were taken via trapping or digging them out of their burrows (Dean 2003:290), because they, unlike jackrabbits, hide rather than run from predators. Therefore, the increase in cottontails may be an indicator of decreased population, such that communally organized drives became difficult to engineer. At the same time, if less land was under cultivation, there may have been more brush for cottontails to hide in and burrow near, making the species more prevalent than during previous periods.

Overview: Dietary Variation through Time

Taxonomic diversity at Mescal Wash varied through time, but the range of species exploited was never great. Aside from the well-known dietary mainstays, the population also hunted rodents, especially squirrels and gophers, mud turtles and desert tortoises, quail, and possibly snakes (unless they were intrusive). Up to this point we have discussed diversity simply as a count of number of identifiable taxa, but here we use Simpson's diversity index, a statistic that examines taxonomic richness (the number of taxa present) and evenness (the relative abundance of taxa). The inverse of Simpson's index is used later in this chapter to calculate evenness. This method estimates evenness using the number of groups (identifiable taxa) and the proportion of the total number of individuals. Dietary diversity varied over time, and it was not strongly correlated with sample size (Pearson's *r* = 0.56, *p* = .5). For example, although the Middle Formative A collection contained the second-largest number of specimens, its corresponding diversity statistic was lower than that from the Early/Middle Formative period, which contained several thousand less bones (Figure 139). Added to this, several of the 21 taxa identified in the Middle Formative A collection were likely intrusive (mice, rats, and snakes) and others, such as the birds and turtles, were represented by only a few bones. By contrast, Dean (2003:252–255) observed that in Sedentary and Classic period Hohokam settlements, dietary diversity increased and indeed reached its peak, including a variety of fish, birds, small mammals, as well as both elk and bighorn sheep. Certainly, some of that variety, as opposed to the narrower species composition at Mescal Wash, must have been based on the locations of the Hohokam sites, for example, in montane areas and near perennial water sources like the Salt and Gila Rivers. The Mescal Wash site is located along a creek, formerly perennial, with associated marshes, and thus it could well have supported fish and shellfish. Although the turtles identified may have been aquatic, none of the identified bird species was endemic to riparian habitats. Indeed, the only substantial variation in the temporally distinct faunal collections was the fluctuation between cottontails and jackrabbits on the one hand, and the relative abundance of artiodactyls species on the other. The abundance of the different leporid species relative to one another may be an indicator several things, natural and cultural, including local vegetation types (both the natural and anthropogenically altered landscapes), site



	Late Archaic	Early-Middle Formative	Middle Formative A	Middle Formative B	Late Formative
▬ Sample Size	173	1028	6073	8954	575
—◆— Simpson's Diversity	0.343	0.556	0.392	0.587	0.196

Figure 139. Correspondence between sample sizes and taxonomic richness by period.

location, and human preferences and hunting decisions (Dean 2003:278).

As detailed in the descriptions of the species lists by period, the most obvious features of the faunal collections that varied over time were the two indexes, large game and lagomorph. The indexes showed two distinct patterns over time, and the results of those calculations are shown in Table 155. The large-game index was fairly high in the Late Archaic period, it reached its peak during the Early/Middle Formative, and was at its lowest point during Middle Formative A (see Table 155). Later in time, the statistic produced by that index once again climbed higher, but it never reached the level attained in the earliest two periods represented at the site. The lagomorph index shows moderatly high scores for the Early/Middle Formative and Middle Formative, and low scores for the Middle Formative B and the more general Middle Formative period. The score increased dramatically in the Late Formative B. (see Table 155). Within the best-represented period, the Middle Formative A, the large-game index was low (see Table 155). The patterning over time in the large-game index may have been consistent with the intensity of human settlement at Mescal Wash. During the Middle Formative periods, when the site supported its largest human populations, both artiodactyls and cottontails were rare in comparison to some earlier and later eras. Dean (2003:200), however, has effectively argued that artiodactyl index statistics, and presumably large-game index scores as well, do not correlate with human population highs and lows in over 100 sites in the region. As Dean (2003:202) has suggested, artiodactyl index results are not strongly correlated with collection sample size, as the data from Mescal Wash also demonstrate, which one might expect if the two phenomena were closely related (large human populations presumably leaving behind larger numbers of animal bones).

Table 155. Large Game and Lagomorph Indexes for Each Period

Time Period	Large-Game Index	Lagomorph Index
All periods	0.21	0.32
Late Archaic	0.56	—
Early Formative	—	—
Early/Middle Formative	0.92	0.38
Middle Formative	0.14	0.17
Middle Formative A	0.05	0.34
Middle Formative B	0.18	0.17
Middle/Late Formative	—	—
Late Formative B	0.41	0.59

Evaluation of the Large-Game Index

An explanation for the variation observed in the artiodactyl index at this site is elusive. One of Dean's (2003) principal observations about the large-game index based on her extensive survey of regional faunal collections was that the proportion of artiodactyl remains in site collections varied according to site elevation. Higher-elevation sites have greater proportions of artiodactyls, apparently because of lower population densities for these animals at low elevations, either as a result of habitat preference or hunting pressure in lower elevation settings (Dean 2003:198). Mescal Wash is located at a moderately high elevation (1,100 m). Its position on the banks of a creek means that the settlement could have had irrigated fields, albeit sediment analysis (see Chapter 3, Volume 3) demonstrated such soils to be limited in extent. The average large-game index for the site, calculated across all periods, was 0.21, which falls within Dean's (2003:196–197) expected range for villages and farmsteads at or below 800 m, as well as at the bottom range for sites above that elevation. Sites above 800 m tend to have artiodactyl indexes above 0.3. Overall, Mescal Wash appears to have had a relatively low proportion of artiodactyl remains for a site of this elevation. The overall figure may be explained by the site's structure as a small settlement throughout its occupational history. In addition, this site sits within the Chihuahua grasslands, an environment distinct from the Sonoran Desert, the setting for the sites that Dean (2007c) assembled for her article. Multiple features at the site, although they dated to a single period, most likely represented discrete occupations. More-typical higher-elevation sites, such as various types of specialized encampments, that generally produce high artiodactyl index values seem to have been occupations larger than Mescal Wash. Artiodactyl index and large-game index scores are not strictly comparable, but the large-game index reflects trends similar to those of the artiodactyl index.

It is at the settlement's height in terms of number of dated features that the large-game index plummets to its lowest level of 0.05. The low index value therefore supports the interpretation of the site as a place of repeated occupations where only a few people lived at any one time. On the basis of her work, Dean (2003:198) predicted that villages, at least those at or below 800 m, would contain the highest artiodactyl index figures. Although no mention was made of villages above that elevation, Dean (2003:197–198) did suggest that farmsteads and other small settlements in higher elevations would display higher artiodactyl indexes. If the large-game index statistic can serve as an indicator for site function (see Table 155), then it seems that Mescal Wash was some type of specialized settlement during the Late Archaic and Early Formative. By the Middle Formative A, the settlement had become a hamlet. But subsequently, by the Middle Formative B period, it reverted to a more diffuse type of settlement, consisting of a series of farmsteads, and remained as such through the Late Formative.

Certainly, the site's location—in grasslands at the confluence of the creek and a wash, and in the midst of *cienegas* (now dried-up) (Altschul et al. 2000:5)—would seem an attractive area for grazing animals such as deer and pronghorn. Perhaps the most suitable explanation for the variation in the relative abundance of artiodactyls over time is, simply, frequency and duration of occupation, and possibly variation in the size of the settlement itself. In the Mescal Wash faunal collection, artiodactyls reached their lowest levels during the Middle Formative, the period to which most of the pit houses and other features dated. Although the presumably increased area under cultivation might have been an attraction for jackrabbits and deer, the larger human population at the same time may have intensively hunted them and decreased their numbers.

Evaluation of the Lagomorph Index

Interpretation of the artiodactyl and large-game index becomes more complicated when the lagomorph index is evaluated alongside it. Higher-elevation sites tend to contain greater proportions of cottontails than do lower-level ones, and therefore have higher lagomorph index numbers. Mescal Wash sits at an elevation well above 800 m, and the lagomorph index for all periods together, was 0.32. That is, in part, predicted by Dean's (2003) study, albeit the overall percentages of leporids in the collections of Mescal Wash were consistently well above the 20 percent threshold defined for high-elevation sites.

In some ways, the lagomorph index presents a converse trend from the large-game index. Calculation of the index for the collections spanning the Early Formative through Middle Formative B produced values, ranging from 0.17 to 0.59 (see Table 155). Dean (2003:281–283) explored the long-held idea that the variability in leporid abundance was related to, among other things, vegetation around settlements. Cottontails favor dense vegetation and may not have been disturbed by intensive farming because they could have found refuge in wooded stands along the creek or elsewhere outside of cultivated areas. If that was the case, and presuming that the population of Mescal Wash was at all interested in hunting cottontails either as a concerted effort or opportunistically, then the proportion of these animals should have been high during the time when the site was more frequently occupied and the area farmed. However, during the Middle Formative A, only about 25 percent of the collection consisted of leporid species, of which slightly more than half that amount were bones of cottontails. If bones identified as rabbit-sized mammal were included, the percentage of Leporids skyrocketed to 75 percent of the collection, albeit in that case containing an unknown proportion of cottontails.

The faunal collections from later periods at the site present somewhat different indications of leporid exploitation. During the Late Formative B periods, the lagomorph index reached a zenith of 0.59, with cottontails outnumbering jackrabbit bones. The lagomorph indexes for Mescal Wash reached their high points—the greatest number of cottontails in relation to all rabbit species—at a point in time when the settlement apparently was occupied either less intensively or less often. According to the models explored by Dean (2003), cottontails were more frequent at higher elevations as well as within sites located near dense vegetation, whether natural communities or anthropogenic stands such as irrigated fields. To some extent, the calculated results of the artiodactyl and lagomorph indexes imply contradictory explanations about the site.

These results suggest that the Late Archaic and Early Formative periods were characterized by an emphasis on artiodactyls and leporids. Too few leporid specimens could be identified to taxa in the Late Archaic and Early Formative materials, but jackrabbits appear to have been a mainstay in the Early/Middle Formative period, although cottontails were important also. Cottontails continued to be important during Middle Formative A, but artiodactyls declined dramatically. That decline may be related to overhunting or a strong focus on agricultural activities. Occupational intensity in terms of persistence and number of households was greatest at this time, which may be related to the decline in artiodactyls. The Middle Formative B saw a decline in cottontails relative to jackrabbits, but an increase in the proportion of artiodactyls relative to leporids. This increase continued into Late Formative B, accompanied by a spike in cottontail use. In the Late Formative, the data indicate reduction in occupational intensity even while there was increased hunting of artiodactyls, as well as cottontails. The interpretation of these results is difficult. One possibility may be the adoption or increased use of a garden-hunting strategy (Neusius 2008), wherein farmers took advantage of animals attracted to their fields. Although such arguments are usually applied to scenarios of increased hunting of grazing animals such as deer, Dean (2007b:18) has made the case that irrigation agriculture in the southwestern United States produced habitat attractive for cottontails, via the construction or growing of hedgerows, living fences, and other vegetational cover around settlements.

Intrasite Temporal Analysis of Diet

Lengyel (Chapter 2) defined "contemporaneity groups" among the Middle Formative features of Loci C and D, as well as synthetically across the site. These were constructed by evaluating the dates of features based on archaeomagnetic determinations, radiocarbon dates, stratigraphic relationships, and the presence of temporally diagnostic artifacts. The faunal content from these dated groups of features are examined in this section in order to detect finer-scale differences in diet over time. Lengyel identified five temporally distinct groups of features in Locus C and seven groups in Locus D. Overall, across the excavated portion of the site, there were apparently six temporally discrete feature clusters. The evaluation of faunal patterning within each temporal cluster of features was made difficult by the fact that each contemporaneity group, which consisted of archaeomagnetically dated features, contained widely varying numbers of bones. Most of the Locus C contemporaneity groups dated between A.D. 925 and 1175. The contemporaneity groups of Locus D mainly fell within the time span A.D. 700–900. The two oldest feature groups of this locus were each made up of one feature and contained few bones: the first group had six specimens and the second produced none. Two other Locus D feature groups, Groups 4 and 6, were also problematic. The former contained nine bones and the latter only three. Because of these difficulties in sample size, comparisons were only made between feature groups that contained workable numbers of bones. Although some feature groups contained too few bones to enable discussion, the contents of each group and locus are listed in accompanying tables.

Feature groups were compared with one another on three levels, when possible. First, the overall faunal content of each feature was evaluated and compared both in terms of the range of species and their relative abundance. Second, the relative frequency of large-mammal skeletal elements was evaluated as well as grouped together in body regions in order to examine the question of interhousehold hunting cooperation and meat exchange. In addition to a relatively broad temporal comparison, these groupings also made it possible to examine the spatial distribution of dietary remains, by comparing the content of individual features from the same temporal groups with those having more than a handful, and generally equivalent numbers, of bones.

Comparisons of Contemporaneity Groups in Locus C

Group 1, consisting of Feature 6129, contained too few bones for purposes of comparison and discussion; the feature produced only three bones. Even the comparisons of contemporary feature groups having more or less equivalently large numbers of bones, Groups 2, 3, and 4, produced limited insights into temporal differentiation. The groups exhibited similar emphases on leporids and deer and deer-sized animals, and also displayed the same number of species, at least for Groups 2 and 4 (Table 156). Group 3 contained approximately half the number of species as the other two groups, but given that its sample size was less than Groups 2 and 4, that narrowed diversity was to be expected. In comparing the distribution of large-mammal bones by body area, only three of the groups contained bones of large mammals, and Group 2 was the sole cluster that produced more than a handful (Table 157). Any comparison between groups was therefore suspect. Group 2 did demonstrate that most large-mammal elements were from the limbs (either front or back, or both), but this did not say much about dietary preferences or meat redistribution, given that limb-bone diaphyses were typically split open for marrow and grease extraction, or for tool manufacture, and therefore, because of fragmentation, tend to be overrepresented (see Binford 1981; Bunn et al. 1988; Lyman 2008). Evidence from the bone collection argues for a great deal of continuity in the population's diet during the intervals represented by these five groups of features.

Within each of the temporal groups of Locus C, only one feature in each of three groups (Groups 2, 3, and 4) contained enough bones for within-group comparison. However, because only one feature per group contained substantial numbers of bones, no such comparison could be constructed. A between-group comparison using the three features would, in large part, have repeated the results displayed for the three groups in Table 157. We therefore decided to abandon this form of comparison for the Locus C temporal groups. Additionally, the number of large-mammal elements in the overall collection from Locus C, 56 specimens, was rather low—too few to usefully apply an analysis of body-part selection according to Binford's (1978) modified general meat utility index (hereafter MGUI) and concomitant strategies for carcass transport.

Comparisons of Contemporaneity Groups in Locus D

The seven temporal groups making up this locus produced a bone collection much larger (n = 1,646) than that found in Locus C (n = 367). These bones were distributed unevenly through the many features of the locus, with the vast majority emerging from Group 3, and, secondarily, Group 5. Groups 1, 4, 6, and 7 collectively contained a total of 59 bones, and Group 2 produced no bones at all. The faunal content of the former four groups was too low to warrant comparison and discussion, but the identified species are presented in Table 158.

It was, however, possible to compare Groups 3 and 5 but keeping in mind that the collection from Group 3 consisted of 1,267 specimens, whereas that from Group 5 consisted of only 320. Given the discrepancy in sample size, it is interesting that the features making up Group 5 (see Chapter 2, Table 10) contained at least 8 identified species,

Table 156. Faunal Content of Locus C Contemporaneous Groups

Taxon	Common Name	Oldest to Youngest (left to right)				Total
		Group 1	Group 2	Group 3	Group 4	
Crotalus sp.	rattlesnake	—	—	—	1	1
Sciuridae	squirrel family	—	1	—	—	1
Ammospermophilus sp.	antelope ground squirrel	—	—	3	—	3
Squirrel-to-rabbit-sized		—	3	—	13	16
Rabbit-sized		2	29	36	68	135
Leporidae	rabbits and hares	1	6	5	5	17
Sylvilagus sp.	cottontail	—	—	7	3	10
Lepus californicus	black-tailed jackrabbit	2	15	14	25	56
Canis familiaris/latrans	domestic dog or coyote	—	1	—	—	1
Coyote-to-deer-sized		—	11	—	3	14
Artiodactyl (medium-sized)	even-toed hoofed mammal	—	3	—	10	13
Deer-sized		2	29	6	24	61
Odocoileus sp.	mule or white-tailed deer	—	1	—	9	10
Odocoileus/Ovis sp.	deer or sheep	—	2	—	—	2
Unidentifiable		—	—	—	24	24
Total		7	101	71	185	365
Large-game index						0.31
Lagomorph index						0.05
Shannon's diversity index (richness)						1.96
Shannon's diversity index (evenness)						0.72

Key: Groups 1–4 are feature groups that date from A.D. 650–1690.

Table 157. Large-Mammal Element Distribution within Locus C Contemporaneous Groups

Body Portion	Group 1	Group 2	Group 3
Cranial	1	6	—
Forelimb	—	1	—
Axial	—	1	—
Hindlimb	—	2	—
Limb	1	39	6
Extremities	—	—	—

as opposed to the 12 taxa identified within Group 3. In other words, even though diversity is, as a mathematical rule, correlated with sample size (Meltzer et al. 1992), and despite the fact that Group 3's collection was much more diverse than that from Group 5, the bone collection from Group 3 was only slightly richer in taxonomic variety than Group 5. Whether the one was unusually diverse, or the other oddly restricted, is difficult to know given that so few of the contemporaneous features contained bone deposits substantial enough to be used as comparisons.

Each of these two feature groups contained mainly bones of leporids or rabbit-sized animals. Furthermore, essentially no difference in the relative abundance of these two taxonomic groups (artiodactyl and leoprids) was detectable. Although Group 3 contained some 83 percent Leporidae or at least rabbit-sized mammal bones, Group 5 produced 89 percent. Similarly, 8 percent of the collection from Group 3 consisted of Artiodactyla or similarly sized animals, and this figure was only slightly lower, 7 percent, for Group 5. Although it appears from Table 158 that the population at the time the Group 3 features were in use ate a somewhat greater variety of small taxa, this view should be tempered by the following cautions: (1) there is a confounding relationship between sample size and diversity, and (2) at least some of these species could have been accidental inclusions in the features rather than the detritus of purposeful hunting and trapping.

The frequency of large-mammal elements, as grouped into body regions, was studied for each of the groups (Table 159). Body regions used here are simplified compared to those used earlier in this chapter, grouping thoracic and pelvis

Table 158. Faunal Content in Locus D Contemporaneous Groups

Taxon	Common Name	Group 1 pre- A.D. 825	Group 3 ca. A.D. 825	Group 4 ca. A.D 600-700	Group 5 ca. A.D.600-700	Group 6 No Date Calculable	Group 7 ca. A.D 1025-1250	Total
Bufo retiformis	Sonoran green toad	—	—	—	1	—	—	1
Testudinata	turtles and tortoises	—	1	—	—	—	—	1
Gopherus agassizi	desert tortoise	—	2	2	—	—	—	4
Kinosternon sp.	mud turtle	—	4	—	—	—	—	4
Aves	birds	—	8	—	—	—	—	8
Meleagris gallopavo	turkey	—	—	—	1	—	—	1
Callipepla gambelii	Gambel's quail	—	3	—	—	—	—	3
Robin-sized		—	2	—	—	—	—	2
Thomomys sp.	pocket gopher	—	2	—	—	—	—	2
Sciuridae	squirrel family	—	1	—	—	—	—	1
Ammospermophilus sp.	antelope ground squirrel	—	—	—	5	—	—	5
Spermophilus sp.	ground squirrel	—	6	—	—	—	—	6
Cricetidae	New World mice, rats, lemmings and voles	—	4	—	1	—	—	5
Perognathus sp.	pocket mouse	—	1	—	—	—	—	1
Mouse-sized mammal		—	3	—	—	—	—	3
Squirrel-to-rabbit-sized mammal		—	88	3	2	—	5	98
Rabbit-sized mammal		3	706	6	169	2	11	897
Leporidae	rabbits and hares	—	47	2	20	—	2	71
Sylvilagus sp.	cottontail	2	78	2	6	—	—	88
Lepus californicus	black-tailed jackrabbit	1	142	2	89	2	3	239
Canis familiaris/latrans	domestic dog or coyote	—	9	—	—	—	—	9
Coyote-to-deer-sized		—	—	—	4	—	—	4
Medium-sized artiodactyl	even-toed hoofed mammal	—	7	—	1	—	—	8
Deer-sized mammal		—	79	7	12	—	2	100
Odocoileus sp.	mule or white-tailed deer	—	10	1	4	—	—	15
Antilocapra americana	pronghorn	—	—	—	1	—	—	1
Unidentifiable		—	64	—	4	—	1	69
Total		6	1,267	25	320	4	24	1,646
Large-game index								0.10
Lagomorph index								0.27
Shannon's Diversity (Richness)								1.66
Shannon's Diversity (Evenness)								0.50

uppper and lower bones into a forelimb and hindlimb, respectivly, and combining neck bones with other axial elements. Unfortunately, this effort was essentially without success because, although four of the seven groups contained large-mammal bones, three of these only held small numbers of them. Only Group 3 produced a sizeable sample of large-mammal bones, from all bodily regions but dominated by limb elements. The other groups with large-mammal bones contained only limb elements, a pattern also observable in Table 157. Given that limb elements tend to be more fragmented than other bones (in order to access marrow and grease), the dominance of such bones is hardly surprising (Binford 1978). Thus, there is a greater chance of recovering more limb elements than other body parts. Given that some temporal groups of Locus D (as well as Locus C) contained only large-mammal limb elements, it is possible that large-mammal carcasses were distributed among, for example, related households.

If the rest of the Mescal Wash site was excavated, more limb bones and bones from other body areas might be discovered within contemporary features. On the other hand, the observed pattern may reflect one of the well-known carcass-transport strategies as outlined by Binford (1978). A widely accepted heuristic model of hunter-gatherer decisions regarding which portions of large animal bodies to take back to their homes, the model delineates between *bulk, gourmet,* and *unbiased* strategies. The first strategy is one where carcass parts of both high and moderate utility (as defined by Binford's [1978] MGUI calculations) are brought back with the hunter, but those of low utility are mostly left at the kill site. The second pattern is recognizable by dominance of parts with high value and abandonment of body areas having moderate and low utility. Finally, the unbiased strategy is one in which "skeletal elements are transported in direct proportion to their economic utility" (Faith and Gordon 2007:873). On the basis of general frequencies of carcass portions, it seems that hunters at this site brought back to the farmsteads only those body parts having high meat, marrow, and grease utility, a gourmet approach. It should be noted that this scenario is offered without the calculation of the MGUI and application of a quantitative curve fit of this collection to Binford's models, as advocated by Faith and Gordon (2007).

Table 159. Large-Mammal Element Distribution within Locus D Contemporaneous Groups

Body Portion	Group 3	Group 4	Group 5	Group 7
Cranial	15	—	—	—
Forelimb	3	—	—	—
Axial	4	—	—	—
Hindlimb	1	—	—	—
Limb	82	7	15	2
Feet	5	1	4	—

In addition to examining the contemporaneity groups as wholes, it was also possible, in a few cases, to study and compare the features that made them up, individually. For Locus D, this was possible for four features within Group 3, which contained two pairs of features with similar numbers of bones. The two comparisons consisted of Feature 3679 (a Middle Formative A structure) with Feature 11,342 (a Middle Formative A structure), and Feature 438 (an Early Formative/Middle Formative A structure) with Feature 7880 (a Middle Formative A structure). The former comparison suffered from rather small sample sizes for both samples: 39 bones for Feature 3679 and 28 from Feature 11342 (Table 160). In general, however, it appears that there were no differences between the two features apart from those most readily attributable to either sample-size effects and/or the extent to which fragments from Feature 11342 were identifiable; Feature 3679 had more identifiable species/animal categories. That is the case for both collection aspects evaluated in Table 160: species range and representation of bodily portions.

Table 160. Comparison of Features 3679 and 11342 at Locus D

Taxon	Common Name	Body Portions					
		Cranial	Axial	Forelimb	Hindlimb	Limb	Foot
	Feature 3679 (Middle Formative A structure)						
Spermophilus sp.	ground squirrel	—	1	—	—	—	—
	rabbit-sized mammal	—	—	—	—	3	—
Lepus californicus	black-tailed jackrabbit	—	—	5	2	1	1
	coyote-to-deer-sized mammal	—	—	—	—	5	—
	deer-sized mammal	—	—	—	—	15	—
Artiodactyla, medium-sized	even-toed hoofed mammal	6	—	—	—	—	—
	Feature 11342 (Middle Formative A activity surface)						
Spermophilus sp.	ground squirrel	—	1	—	2	—	—
	rabbit-sized mammal	—	—	11	—	12	—
	deer-sized mammal	—	—	—	—	2	—

With respect to the comparison between Feature 438 and Feature 7880, small sample sizes were not an issue. The former feature produced 679 bone fragments and the latter contained 476 (Table 161). One visible difference was that Feature 438 contained a greater number of animal species than did Feature 7880—not only leporids and deer, but also mud turtles, desert tortoises, quail, a songbird, and a dog or coyote (see Table 161). This may, however, be attributable to sample size, given that the former sample was nearly 1.5 times the size of the latter. In terms of body-part representation, there were again no clear differences. With the more numerous animals, that is, leporids and deer, limb elements were abundant in both features. With respect to leporids, this was probably more a function of taphonomic factors—limb elements tend to fragment but remain identifiable—rather than a predilection for meat from those areas. Artiodactyls hold significant amounts of muscle on their limbs, especially the upper front and rear, and the lower limb elements are useful for marrow extraction and for the fabrication of bone tools.

Comparison of Synthetic Groups (Loci C and D)

In addition to forming separate chronological groups based on features within each of the two loci, Lengyel (Chapter 2) also took the chronological information from all those features and combined them to form synthetic contemporary groups. The range of species and their relative abundance is displayed in Table 162 according to the feature groups defined by Lengyel. Although for the most part all six groups were much alike in terms of species range and the emphasis on certain species or groups of species, some features did stand out. First, it is clear that the largest collection, from Group 1 and dated to the Middle Formative period, was taxonomically the most diverse and included small numbers of animal classes—reptiles and birds—that were all but absent from the other groups. The only other feature group with avian bones, consisting of a single turkey bone, was Group 3, a temporal cluster also dating to the Middle Formative period. This group featured the sole turkey bone found at Mescal Wash (in Feature 3545). Thus, the earliest two contemporaneous Middle Formative groups contained the only bird bones within those features selected for use in the synthetic contemporaneity study. The general of paucity of avian and reptile bones may, of course, have been the result of taphonomic factors, in that avian and reptile bones are relatively fragile and difficult to distinguish from small mammal bones in a fragmented state.

Another distinction between the feature groups was the relative emphasis on large mammals, principally deer and perhaps other artiodactyls. These animals were rather scarce in Groups 1 and 3, making up just 8 and 7 percent, respectively. The two latest groups, Groups 5 and 6, on the other hand, contained much larger proportions large-mammal bones, 42 percent within Group 5 and 19 percent in Group 6. Although the high percentage of artiodactyl-sized bones in Group 5 may have been biased because of that cluster's relatively small sample size of identifiable bones (n = 119), that problem should not have been the case with respect to Group 6. The latter group contained nearly the identical number of identifiable bones (n = 302) as did Group 3 (n = 324), and yet there was clearly a stark difference in the representation of large mammals. In the preceding discussion, where faunal collections were grouped and compared by period, a somewhat U-shaped pattern appeared in artiodactyl popularity, with both the early and late collections containing more such bones than those in the middle periods. All 40 of the features within the synthetic contemporaneity study date, however, to the Middle Formative period. The trend toward increased hunting of deer and related animals, which appears to have picked up again in the Middle Formative B after a decrease during the Middle Formative A, can therefore be more accurately dated. According to Lengyel (Chapter 2), Group 5 probably dated between A.D. 700 and 900, and Group 6 dated to somewhat later, probably around A.D. 1000–1250.

Comparison of large-mammal body-part frequencies among the feature groups (Table 163) showed no reliable indicators of difference. Most bones from all the groups that had more than a few specimens came from limb elements. Curiously, no limb elements were identified among the large-mammal bones from features belonging to Group 5, most likely a product of small sample size, given that only eight large-mammal specimens were recovered. Notably absent, or nearly so, among all the groups' large-mammal bone collections were axial elements, here understood as the sternum, vertebrae, and ribs. These elements tend to be more friable than limb bones and are harder to identify to species. Yet, amidst a collection made up primarily of rabbit and smaller animals, even the broken axial elements of large grazing animals should have been readily recognizable and identifiable at least to order or a coarser category like coyote-to-deer-sized mammal. It is also difficult to explain the bones' absence by relating it to bone tool production, as vertebrae were not normally used as raw materials for that purpose in the region (e.g., Cameron et al. 2006).

At least two scenarios may provide the explanation for the observed distribution of elements. As discussed above, it is possible that there was differential transport of large-mammal carcass parts, specifically, the gourmet transport strategy first defined by Lewis Binford (1978). That hypothesis appears to fit the evenness and correlation statistics calculated for the distribution of elements in Locus D. Within the groups defined by Lengyel, the dominance of limb elements was clear, but there were too little data in other body-region categories to calculate those statistics for this comparison. Another possible explanation is that large-mammal carcasses were

Table 161. Comparison of Features 438 and 7880 at Locus D

Taxon	Common Name	Body Portions									
		Eggshell	Carapace	Plastron	Cranial	Axial	Forelimb	Hindlimb	Limb	Foot	Indeterminate
	Feature 438 (Early Formative/Middle Formative A structures)										
Testudinata	turtles and tortoises	—	1	—	—	—	—	—	—	—	—
Gopherus agassizi	desert tortoise	—	1	1	—	—	—	—	—	—	—
Kinosternon sp.	mud turtle	—	3	1	—	—	—	—	—	—	—
Aves	birds	8	—	—	—	—	—	—	—	—	—
Callipepla gambelii	Gambel's quail	—	—	—	—	—	1	2	—	—	—
Passeriformes, large	songbirds	—	—	—	—	—	1	—	1	—	—
Thomomys sp.	pocket gopher	—	—	—	—	—	1	—	—	—	—
	squirrel-sized mammal	—	—	—	—	—	—	—	3	—	—
	mouse-sized mammal	—	—	—	—	—	1	1	—	1	—
Cricetidae	New World mice, rats, lemmings and voles	—	—	—	—	—	—	2	—	2	—
	squirrel-to-rabbit-sized mammal	—	—	—	—	1	—	—	46	—	—
	rabbit-sized mammal	—	—	—	1	2	3	7	3	—	—
Leporidae	rabbits and hares	—	—	—	1	2	—	—	384	1	—
Sylvilagus sp.	cottontail	—	—	—	8	2	3	7	3	5	—
Lepus californicus	black-tailed jackrabbits	—	—	—	—	1	37	8	—	45	—
Canis familiaris/latrans	domestic dog or coyote	—	—	—	—	—	—	—	—	1	—
	coyote-to-deer-sized mammal	—	—	—	—	—	—	—	1	—	—
	deer-sized mammal	—	—	—	3	1	1	—	25	—	—
Artiodactyla, medium-sized	even-toed hoofed mammal	—	—	—	1	—	—	—	—	—	—
Odocoileus sp.	mule or white-tailed deer	—	—	—	3	—	—	—	—	1	—
	unidentifiable	—	—	—	—	—	—	—	11	—	30
	Feature 7880 (Middle Formative A activity surface)										
Sciuridae	squirrels	—	—	—	—	—	—	1	—	—	—
Perognathus sp.	pocket mouse	—	—	—	1	—	—	—	—	—	—
	squirrel-to-rabbit-sized mammal	—	—	—	—	—	—	1	40	—	—
	rabbit-sized mammal	—	—	—	—	1	—	—	297	—	—
Leporidae	rabbits and hares	—	—	—	6	5	—	1	—	10	—
Sylvilagus sp.	cottontail	—	—	—	2	1	7	5	—	5	—
Lepus californicus	black-tailed jackrabbits	—	—	—	2	—	7	4	—	25	—
	coyote-to-deer-sized mammal	—	—	—	—	—	—	—	2	—	—
	deer-sized mammal	—	—	—	1	—	—	—	28	—	—
Odocoileus sp.	mule or white-tailed deer	—	—	—	—	—	—	—	—	1	—
	unidentifiable	—	—	—	—	—	—	—	11	—	12

Table 162. Faunal Content of Synthetic Groups (Loci C and D)

Taxon	Common Name	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Total
Bufo retiformis	Sonoran green toad	—	—	1	—	—	—	1
Testudinata	turtles and tortoises	1	—	—	—	—	—	1
Gopherus agassizi	desert tortoise	2	—	—	—	—	—	2
Kinosternon sp.	mud turtle	4	—	—	—	—	—	4
Crotalus sp.	rattlesnake	—	—	—	—	—	1	1
Aves	birds	8	—	—	—	—	—	8
Meleagris gallopavo	turkey	—	—	1	—	—	—	1
Callipepla gambelii	Gambel's quail	3	—	—	—	—	—	3
Robin-sized		2	—	—	—	—	—	2
Thomomys sp.	pocket gopher	1	—	—	—	—	—	1
Sciuridae	squirrels	1	—	—	—	1	—	2
Ammospermophilus sp.	antelope ground squirrel	—	—	5	—	—	3	8
Spermophilus sp.	ground squirrel	6	—	—	—	—	—	6
Cricetidae	New World mice, rats, lemmings and voles	4	—	1	—	—	—	5
Perognathus sp.	pocket mouse	1	—	—	—	—	—	1
Mouse-sized		3	—	—	—	—	—	3
Squirrel-to-rabbit-sized		91	—	2	—	3	24	120
Rabbit-sized		703	2	171	7	39	143	1,067
Leporidae	rabbits and hares	45	—	23	1	6	14	89
Sylvilagus sp.	cottontail	81	—	6	—	1	10	98
Lepus californicus	black-tailed jackrabbit	142	1	91	5	18	46	304
Canis familiaris/latrans	domestic dog or coyote	—	—	—	—	1	—	1
Coyote-to-deer-sized		9	—	4	—	14	3	30
Medium-sized artiodactyl	even-toed hoofed mammal	6	1	—	—	4	11	22
Deer-sized		79	1	14	—	29	38	161
Odocoileus sp.		11	1	—	—	1	9	22
Odocoileus/Ovis sp.		—	—	4	—	2	—	6
Antilocapra americana	pronghorn	—	—	1	—	—	—	1
Unidentifiable		64	—	4	—	1	25	94
Total		1,267	6	328	13	120	327	2,061
Large-game index								0.13
Lagomorph index								0.24
Shannon's diversity index (richness)								1.74
Shannon's diversity index (evenness)								0.52

Table 163. Large-Mammal Element Distribution in Synthetic Groups (Loci C and D)

Body Portion	Group 1	Group 2	Group 3	Group 5	Group 6
Cranial	15	—	1	6	3
Forelimb	2	—	—	1	—
Axial	3	—	—	1	—
Hindlimb	—	—	1	—	5
Limb	82	1	16	—	47
Extremities	4	1	5	—	1
MNI[a]	1	1	1	1	2

Key: MNI = minimum number of individuals

[a] Includes bone artifacts.

divided among households, different sites in the area network, or some other socially demarcated grouping, and the community based at Mescal Wash received the muscles and associated portions of the appendicular skeleton and others took the axial skeleton. Of course, that hypothesis raises its own problems, chief among them—where was the location of the features holding mainly axial skeletal elements, as generally limb elements appear to be overrepresented throughout the artiodactyl bone-bearing features of Mescal Wash?

Body-part distributions for all species can be compared between two different sets of synthetic features. Four features were selected based on the amount of bones found within them, with larger samples favored, in order to compare within temporal groups. Thus, Features 2160 (Locus A) and 6098 (Locus C) were selected from Group 5 of the synthetic Middle Formative feature groups (Table 164). The former feature contained a total of 30 bones and the latter produced 85. For Group 6, Features 379 (a Middle Formative B structure) and 7461 (Middle Formative structures) were selected because their specimen totals, 173 and 66 bones, respectively, were enough to enable such an analysis (Table 165). The other four feature groups either did not contain two features each of comparable size, as was the case for Groups 2, 3, and 4, or, as was the case for Group 1, contained features were previously compared with one another in the discussion of Locus D groups. In any event, both the comparison constructed for Group 5 and that engineered for Group 6, were hampered by the problem of small sample size. The two features in each group proved difficult to compare because they held bone collections which differed quite a bit from one another in number of specimens. Therefore, any comparative differences in the frequency of body portions from one feature to the other was obscured by the divergent sample sizes.

One pattern that again emerged, however, was the general lack of axial elements, not only for large-mammal taxa, but also for leporids. In the latter case, the answer must lie in differential processing of the axial vs. appendicular skeleton, rather than meat redistribution. A possible explanation for the observed pattern is that limbs were cut away from the trunk of the body. The trunk was then processed further, likely by pounding the flesh and bone together, as Wegener (2007:380–381) hypothesized for entire leporid skeletons in an analysis of faunal remains from southern Arizona Tohono O'odham reservation sites. That general kind of processing has been observed in both Africa, in Yellen's (1991) ethnoarchaeological fieldwork with the !Kung San, where he observed that small mammals were pounded and crushed prior to cooking, as well as in the Great Basin, where ethnographic accounts (Wheat 1967) indicate Native Americans processed leporids in much the same way. Alternatively, instead of differential transport and/or processing, the divergence in element survivorship could instead be purely taphonomic, because of much more extensive destruction of generally less-dense axial elements (Pavao and Stahl 1999).

Summary of Feature Group Comparisons

The feature groups arranged by the chronological subdivisions calculated by Lengyel (see Chapter 2) displayed few consistent changes through time or space attributable to cultural processes. Most changes observed, such as in range of species exploited or in body-part representation, apparently stemmed from processes like (1) the destruction of certain bones more than others during carcass processing (because of certain elements' shape and/or structural density [Binford and Bertram 1977]); (2) natural processes such as weathering (Behrensmeyer 1978); or (3) sample-size effects. The relative lack of artiodactyl axial elements is an intriguing pattern; it is difficult to imagine that virtually all the ribs and vertebrae were systematically smashed or had decomposed beyond all recognition, despite these elements' generally greater susceptibility to weathering processes (Behrensmeyer 1978). After all, the faunal remains were recovered,

Table 164. Comparison of Synthetic Features from Group 5

Taxon	Common Name	Body Portions						MNI
		Cranial	Axial	Forelimb	Hindlimb	Limb	Extremities	
Feature 2160 (Middle Formative structure)								
	rabbit-sized mammal	—	—	—	—	16	—	
Leporidae	rabbits and hares	—	—	—	—	—	1	
Sylvilagus sp.	cottontail	—	—	—	1	—	—	1
Lepus californicus	black-tailed jackrabbit	—	—	1	1	—	7	1
	coyote-to-deer-sized mammal	—	—	—	—	2	—	
Artiodactyla, medium-sized	even-toed hoofed mammal	1	—	—	—	—	—	1
Feature 6098 (Middle Formative structure)								
Sciuridae	squirrels	—	—	—	1	—	—	1
	squirrel-to-rabbit-sized mammal	—	—	—	—	3	—	
	rabbit-sized mammal	—	—	—	—	—	21	
Leporidae	rabbits and hares	—	—	2	2	—	1	
Sylvilagus sp.	cottontail	—	—	—	1	—	—	
Lepus californicus	black-tailed jackrabbit	2	—	2	2	—	2	1
Canis familiaris/ latrans	domestic dog or coyote	—	—	1	—	—	—	1
	coyote-to-deer-sized mammal	—	—	—	—	11	—	
	deer-sized mammal	1	—	—	—	27	—	
Artiodactyla, medium-sized	even-toed hoofed mammal	2	1	—	—	—	—	
Odocoileus/Ovis sp.	deer or sheep	2	—	—	—	—	—	
Odocoileus sp.	mule or white-tailed deer	1	—	—	—	—	—	1

Key: MNI = minimum number of individuals

Table 165. Comparison of Synthetic Features from Group 6

Taxon	Common Name	Body Portions							MNI
		Cranial	Axial	Forelimb	Hindlimb	Limb	Foot	Indeterminate	
Feature 379 (Middle Formative B structure)									
Crotalus sp.	rattlesnake	—	1	—	—	—	—	—	1
	squirrel-to-rabbit-sized mammal	—	—	—	—	13	—	—	
	rabbit-sized mammal	—	—	—	1	67	—	—	
Leporidae	rabbits and hares	1	2	1	1	—	—	—	
Sylvilagus sp.	cottontail	—	—	—	1	—	2	—	1
Lepus californicus	black-tailed jackrabbit	1	—	15	4	—	3	—	3
	coyote-to-deer-sized mammal	—	—	—	—	3	—	—	
	deer-sized mammal	2	—	—	—	22	—	—	
Odocoileus/Ovis sp.	deer or sheep	2	—	—	—	—	—	—	
Odocoileus sp.	mule or white-tailed deer	3	—	—	3	—	1	—	2
	unidentifiable	—	—	—	—	—	—	24	

continued on next pge

Taxon	Common Name	Body Portions							MNI
		Cranial	Axial	Forelimb	Hindlimb	Limb	Foot	Indeterminate	
Feature 7461 (Middle Formative structure)									
Ammospermophilus sp.	antelope ground squirrel	—	—	—	2	—	—	—	1
	rabbit-sized mammal	—	—	—	—	32	—	—	
Leporidae	rabbits and hares	1	2	1	—	—	1	—	
Sylvilagus sp.	cottontail	—	—	5	2	—	—	—	1
Lepus californicus	black-tailed jackrabbit	4	1	2	6	—	1	—	2
	deer-sized mammal	—	—	—	—	6	—	—	1

Key: MNI = minimum number of individuals

in large part, from pit features often covered relatively quickly. Indeed, even in the arid sites of the Near East, faunal collections frequently contain large numbers of large mammals' axial elements. There has been much discussion in the literature about carcass division and redistribution (e.g., Zeder 1991), and we wonder if species variation through time and element distribution patterning could be evidence of behaviors such as carcass redistribution and status-based preferential access to certain foods, instead of the environmentally driven hypotheses, which have typified zooarchaeological interpretations (for a recent overview, see deFrance 2009).

Another point of interest within the analysis of the feature groups was pinpointing an upsurge in artiodactyl remains dated to the Middle Formative B. Previously, when analyzing the Mescal Wash collection by periods rather than by feature groups, a coarser way of examining change over time, we detected that, at least by the Late Formative, there was an increase in artiodactyl remains according to the large-game index calculations. Lengyel's analysis of contemporaneity in the features selected helps to refine that pattern, placing its start before the Late Formative (A.D. 1150–1450), prior to the structures' abandonment, most likely sometime between A.D. 935 and 1040.

There were two visible patterns in the faunal data based on feature group comparison. First, there was the relative lack of artiodactyl axial elements. There was also a sequence in exploitation of artiodactyls; the animals were important early on, less important later, and then were resurgent by the time the settlement had come to an end. These variations were, however, relatively minor when all periods of occupation were compared with one another. More important than the slight differences in animal exploitation through time was a trend of continuity. There were simply few discernable changes in the faunal collection from early to late, despite the fact that the history of settlement at Mescal Wash spanned nearly three millennia.

Intersite Comparison and Game Species Depression

Hohokam Comparison

In comparison to faunal collections from sites in the Tucson Basin and the Hohokam heartland area, the stability of the Mescal Wash population's diet through time is not entirely surprising. As Dean (2007c:110) explained, "in truth, although temporal and spatial variability in faunal collections is subtle in the Hohokam cultural area, it is present." Dean (2007c) recommended assembling faunal reports and examining their variability on a regional scale, rather than local, and she also recommended a methodology grounded in ecological measures of evenness and diversity instead of using a species by species approach. Although Mescal Wash lay outside the Hohokam area, it nonetheless retained affinities to that cultural area, albeit stronger during some periods than others. Thus modeling this study on Dean's work, although not without problems, certainly seemed a valid approach.

One can, of course, take a different approach and compare reports on faunal remains excavated from any and all nearby sites. That approach was not adopted here for several reasons. First, it relies on nearby excavations having been undertaken and published. Second, because the Mescal Wash site yielded a very large number of bones, many one-to-one comparisons with other nearby sites along Cienega Creek, the San Pedro River, or elsewhere nearby, introduce problems of scale, where the present collection must be compared to much smaller ones simply because those sites are proximate. Such comparisons introduce quantitative problems related to diversity and sampling errors. As mentioned earlier in this chapter, many excavated sites near Mescal Wash have produced either small faunal collections or the collections that principally stem from periods not well represented in the faunal collection from Mescal Wash.

Although Mescal Wash was never a purely Hohokam settlement (Vanderpot and Altschul 2007:68–69), the faunal data can nonetheless be usefully incorporated into Dean's (2007c) large data set that covered a broad area. As further justification for constructing such a comparison, we note that even if Mescal Wash was not in Hohokam territory, it was at its edge and most of the decorated ceramics found here were of Hohokam style (see Chapter 3). The one caveat, however, is that the Hohokam sites in Dean's study were located in the Sonoran Desert, whereas Mescal Wash's environment is typical for the Chihuahuan Desert grasslands.

The search for comparable faunal collections from other sites in the area also necessitates an evaluation of what research questions are worth pursuing with the faunal data on a regional level. Although Vanderpot and Altschul (2007) have suggested that the cultural alignment of Mescal Wash might be a logical avenue of research to pursue, exploration of that paradigm with faunal remains in this region does not appear likely to produce results that are interpretable as either demonstrating ethnic difference or the lack thereof. To be certain, although many (e.g., Lightfoot and Martinez 1995) have observed that ethnicity is most visible in border areas (as Mescal Wash was) and that food can be a conservative cultural element, paradoxically, it is also true that border areas are the places where populations first adopt new traditions (Dietler 2007). Although ethnic identity has been addressed through material culture in the Hohokam as well as neighboring areas (Bayman 2001; Kelly 1997; Stone 2003), the case has not been made that southwestern cultural groups can be differentiated from one another based on faunal remains. Instead, researchers in this region have attributed similarities and differences through time or space to intensity of agriculture, hunting methods, settlement size, foraging efficiency, or complex interactions between two or more of these factors (Dean 2007b, 2007c; Szuter 1989).

The hesitance of zooarchaeologists to enter into discussions concerning prehistoric ethnic affiliations no doubt stems both from the regional, Great Basin, and southwestern tradition of using optimal foraging theory (Winterhalder and Smith 1981) as the basis for dietary modeling, and assuming diet to be the product of the limited choices imposed by the environment in which they settled (Bayham 1982). An additional constraining factor has to do with the limited range of available prey in the region, which results in faunal assemblages having very similar content to one another, with most being dominated by the bones of leporids and artiodactyls. Crown's (1990) survey of Hohokam archaeology outlined differences between geographic areas within that culture's sphere of influence in terms of mortuary customs, architecture, and other social traditions but made no claim that dietary differences could be detected.

On the other hand, this unusually large faunal collection could profitably contribute to the ongoing discussion concerning resource depression in the Southwest (Bayman 2001; Crown 1990). To address that topic with faunal data, Dean (2007c:110–111) has advocated a method she terms "diversification," in essence a modification of widely employed ecological indexes calculated so as to reflect hunting methods rather than the presence or absence of fauna across habitats. In addition, Dean (2007c) recommends the calculation of the ecological statistic called evenness, derived from the inverse of Simpson's index (Simpson 1949). Simpson's index is one of several diversity indexes used in ecology as well as archaeology. Although ecologists have debated which of several such indexes provide the best measure of species variety and equability, and whether the concept is heuristically useful (Hurlbert 1971; Peet 1974), archaeologists have adopted one or the other index based on factors such as ease of calculation or familiarity.

Instead of grouping game animals that appear in prehistoric faunal collections by habitat, as an ecologist might study them, Dean (2007c:118–122) divided them according to general adaptation and the technology which would have been necessary to successfully hunt them. The five categories used were (1) fast-moving, medium-sized animals, i.e., leporids; (2) large animals which might have to be tracked over long distances, e.g., artiodactyls; (3) aquatic/semiaquatic prey such as fish as well as those mammal species spending much of their time in or near water; (4) small terrestrial game-like rodents, nonaquatic reptiles, and gallinaceous birds that are normally trapped; and (5) flying prey, birds including Anatidae, other waterfowl and shorebirds, as well as a variety of small birds. Raptors were not included in any category because these birds are often found as ritual burials, not food remains, and the resultant high NISP from the identification of an intact skeleton would skew dependent diversification statistics (Dean 2007c:113).

Dean divided these data into temporal categories, specifically the periods used for the Hohokam cultural area, to track change over time. The chronology for Mescal Wash has not been organized in that fashion, but rather by the more general periods used in the area (Archaic, Formative, and their subdivisions). For the present purpose, however, the two chronological schemes were merged into the Hohokam chronology because this was the basis upon which Dean (2007c) evaluated hunting pressures over time. The Hohokam chronology and that used by SRI for Mescal Wash can justifiably be merged: the Hohokam heartland of the Tucson Basin is some 45 km to the site's northwest and approximately 200 km from the Phoenix Basin. Further, most of the decorated ceramics (58 percent) from Mescal Wash can be attributed to either Tucson Basin–Hohokam or Phoenix Basin–Hohokam traditions (see Chapter 3). The correspondence between the Mescal Wash and Hohokam time periods and phases is provided in Table 166. Because the periods used for Mescal Wash do not match the Hohokam periods perfectly, as well as a lack or near-lack of data for some periods, we used only five of the seven periods for which Dean (2007c) presented data.

Early and late portions of the Hohokam sequence proved difficult to correlate between the general temporal and Hohokam chronological schemes. On the early end, both the San Pedro and the Cienega phases could be interpreted as belonging to the Late Archaic period. Because all but one of the Late Archaic features at Mescal Wash dated prior to ca. 800 B.C., we chose to place our Late Archaic faunal component into the San Pedro phase. We did not make use of the Cienega phase. Similar to the Late Archaic, both the Early Ceramic and the Pioneer periods can be interpreted as the equivalent of the Early Formative period. This problem was solved fairly easily because we had only seven bones from purely Early Formative contexts. That was not a large enough total from which to reliably calculate any figures, including an evenness index, and therefore we report no data from the Early Ceramic period. Instead, because the Early Ceramic period precedes the Pioneer period, and because we identified a sizeable Early/Middle Formative faunal collection (see Table 149), we placed these data into the Pioneer period. The seven bones from Early Formative contexts were added to the sample used for the Pioneer period sample to slightly enlarge the collection.

The middle periods used for Mescal Wash were easier to correlate with the periods used in Dean's (2007c) chronology. We placed the very large Middle Formative A collection from Mescal Wash into the Colonial period, and the subsequent Middle Formative B remains were classified as Sedentary period. Finally, the relatively small Late Formative collection was classified as the Classic period in the Hohokam chronology. However, this initial merging of chronologies left out several Mescal Wash collections from the diversity calculations, namely those without refined dates or those that fell between periods. Dean (2007c:113) dealt with the problem of faunal collections that spanned phases by including the data into the latest period possible, a precautionary *terminus post quem* approach. We did the same in this analysis, which allowed us to use these otherwise problematic samples and amplify two smaller collections. Specifically, the Late Formative sample was correlated with the Hohokam Classic period. The few (n = 11) bones that dated to the general Middle-to-Late Formative periods were also placed within the Late Formative temporal rubric (the Classic period in Hohokam chronology).

Discussion and Comparison

The evenness index values obtained from grouping the faunal data both into the Hohokam chronology and into Dean's categories of capture methods were compared with the results of Dean's study (Dean 2007c:123–126). Dean's findings, based on some 85 faunal collections, were that low evenness values (that is, highly uneven faunal collections) corresponded to archaeofaunas dominated by only one class of game, usually leporids. High index scores, representing faunal collections diverse in content (that is, with significant contributions from the four-category or five-category indexes, defined below), indicate that a diversified hunting strategy had been in use.

Table 166. Correspondence between Mescal Wash and Hohokam Chronologies

Mescal Wash Period	Hohokam Period	Date Range
Late Formative	Classic	A.D. 1150–1450
Middle Formative B	Sedentary	A.D. 950–1150
Middle Formative A	Colonial	A.D. 750–950
Early Formative	Pioneer	A.D. 1–750
Late Archaic	Late Archaic (Cienega, San Pedro phases)	1500 B.C.–A.D. 1

The general patterns through time seen by Dean (2007c:123–124) in both indexes generally show the same trend, namely that ancient hunters across the Hohokam area very much concentrated their efforts on leporids, especially in the earlier periods. Later in time, during the Sedentary and Classic periods, according to the five-category index, which in addition to other animal groups measures the contribution of artiodactyls, there was greater diversification in hunting strategies. Many collections' indexes registered numbers much higher than the baseline around 1.0–1.2, up to 2.4. Dean (2007c:124) interpreted the results of her index comparisons as representing increased small-mammal hunting, something best seen in the four-category index. The average index values per period demonstrated the greatest differences, however, between the Sedentary and Classic periods, and these were most dramatically visible in the five-category index. Given that this change was most apparent in the latter index, the change in hunting strategy must have been that the populations more intensively hunted artiodactyls—a long-distance, long-duration pursuit.

How do the data from Mescal Wash compare? In fact, the Mescal Wash faunal collection appears both different from and similar to the trends Dean (2007c) outlined as the average scenario for the various periods spanning the San Pedro phase to the Classic period (Figure 140). Most notably, the four-category index calculated for the Mescal Wash collection corresponded closely to Dean's averages for the same index, being low in evenness early, in the Late Archaic/San Pedro, and less even in later periods (Table 167). Where the two data sets diverged was during the Pioneer period/Early/Middle Formative, as the Mescal Wash collection was somewhat smaller (NISP = 1,028) (see Table 149) than those from the sites Dean analyzed. The Early/Middle Formative period's collection contained, in addition to leporids, a few specimens of desert tortoise, wood rat, as well as squirrel-sized mammal bones. Nonetheless, the hunters of the period certainly concentrated their efforts on rabbits

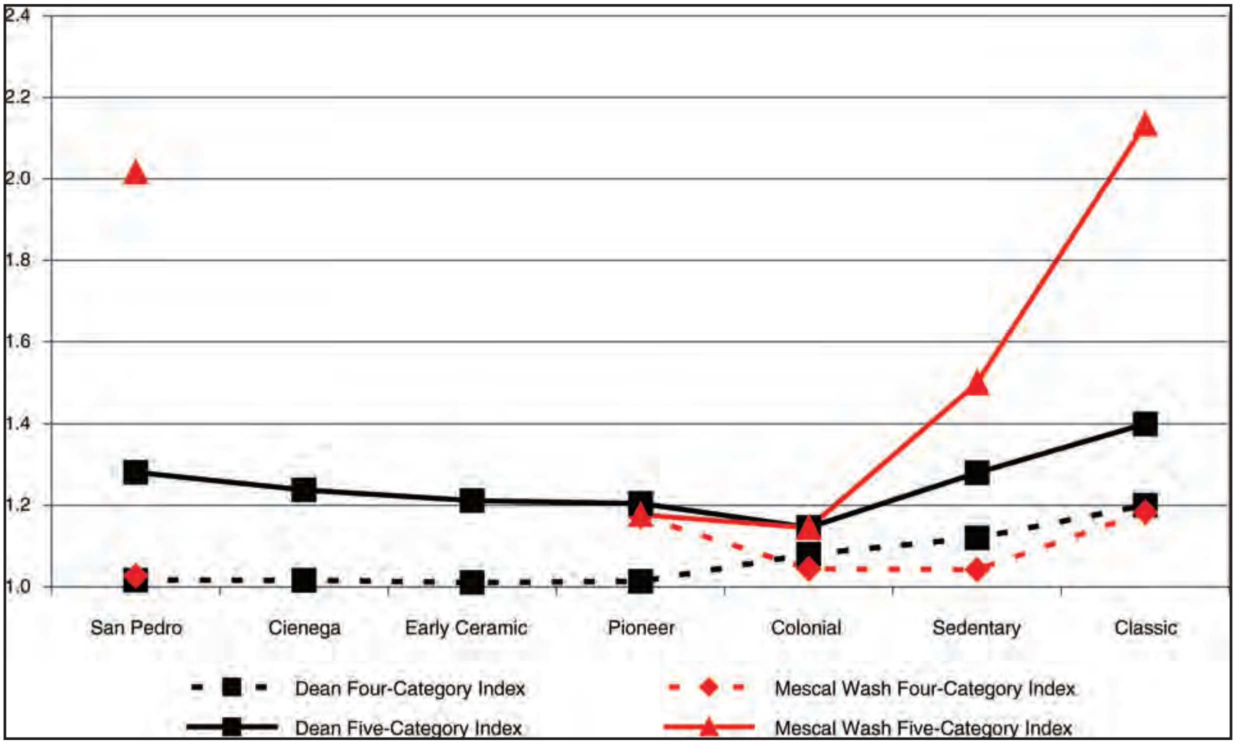


Figure 140. Dean's (2007b) four- and five-category evenness index averages vs. those for Mescal Wash.

Table 167. Simpson's Index Data from Mescal Wash for Dean's Four-Category Index

Group Number[a]	Hohokam Cultural Area Period: NISP per Group				
	San Pedro	Pioneer	Colonial	Sedentary	Classic
1	75	69	5,473	422	320
3	—	—	8	—	4
4	—	6	104	12	23
5	1	—	3	—	2
Total	76	75	5,588	434	349
Inverse of Simpson's index of evenness	1.0	1.2	1.0	1.0	1.2

[a] Definitions of groups taken from Dean (2007b).

Key: NISP = number of identified specimens.

Table 168. Simpson's Index Data from Mescal Wash for Dean's Five-Category Index

Group No.[a]	Hohokam Cultural Area Period: NISP per Group				
	San Pedro	Pioneer	Colonial	Sedentary	Classic
1	75	69	5,473	422	320
2	96	847	272	126	216
3	—	—	8	—	4
4	—	6	104	12	23
5	1	—	3	—	2
Total	172	922	5,860	560	565
Inverse of Simpson's index of evenness	2.0	1.2	1.2	1.5	2.1

Key: NISP = number of identified specimens.

[a] Definitions of groups taken from Dean (2007b).

and hares, and in fact, that evenness score, 1.2, was not much higher than the highest evenness score from Dean's (2007c) compiled data, 1.04.

The five-category index included artiodactyls in addition to the other categories already represented in the four-category index (Table 168). This inclusion makes a visible difference in the comparison of Mescal Wash's animal bone collection with those included in the survey by Dean. Figure 140 shows that the five-category index results for Mescal Wash form a broken (because of missing data for certain phases), U-shaped evenness profile over time, as the evenness statistics for the San Pedro phase and Sedentary and Classic periods were higher than those in between. The differences between the results for the four-category index vs. the five-category index lie, therefore, in the relative emphasis on hunting artiodactyls during different periods. Although it was not surprising that the evenness statistic would be strongly affected by artiodactyl hunting in the San Pedro phase/Late Archaic, given the high large-game index score obtained for that phase (see Table 155), such a result was not all expected for the Classic/Late Formative era. In both cases, those five-category index scores were well above the averages calculated by Dean. The Mescal Wash score was an outlier, as was the score for the Sedentary period, 1.5; and the Classic period score, 2.1, was an outlier compared to most of the Classic period scores from Dean, with the exception of two (Figure 141; see Table 168).

A more nuanced look at the same phenomenon can be seen in Figure 142, which demonstrates that in the Late Archaic period (San Pedro phase on figure), the faunal collection from Mescal Wash was visibly less even than any of the similarly dated collections assembled by Dean. In most of the periods succeeding the Late Archaic, the dietary pattern from Mescal Wash fell comfortably into the range of variation established by the many Hohokam collections. Yet, in the last two periods, the evenness statistics calculated for Mescal Wash were again quite high, and indeed were higher than all but one of those calculated by Dean (2007c:123). Nonetheless, the trend overall is that the Mescal Wash evenness statistics demonstrate a similar pattern to those generated by Dean. Dietary diversity in the Hohokam region increased over time, most markedly at or within the Classic period. Dean (2007c:124–125) attributed this Classic period rise in diversity to a combination of factors, namely that Hohokam society human labor was sufficiently organized so that men could be spared from agricultural labor to go on long-distance/several-day hunting expeditions, a social structure achieved at a time when, it seems, population levels were in decline. The population decline may have allowed artiodactyl populations, in earlier eras heavily hunted, to rebound and thus have been more available to be hunted, by hunters recently spared from tasks that had kept them closer to the settlement.

The Classic period was a time of population concentration in fewer and larger villages compared to a more dispersed settlement system during the pre-Classic period (Crown 1990:234). As such, and although agricultural production was intensified, it was intensified in fewer select locations. Therefore, an alternative explanation for the observed patterns might be that large tracts of the landscape were used by logistical task groups rather than for single or multiple household habitations. This settlement pattern would have allowed the biotic community to rebound and for terrestrial mammal populations, especially cottontails and deer, to increase in number.

In essence, the sole significant difference in evenness between the many faunal collections surveyed by Dean (2007c) and Mescal Wash lies in the relative contribution of artiodactyls. The four-category index comparisons demonstrated that most Hohokam faunal collections, at least those from sites at or below 800 m in elevation, do not contain large numbers of bones from large and mobile game animals such as deer. That situation is apparent in collections dated between the San Pedro phase through the Sedentary or Classic, when faunal collections contained

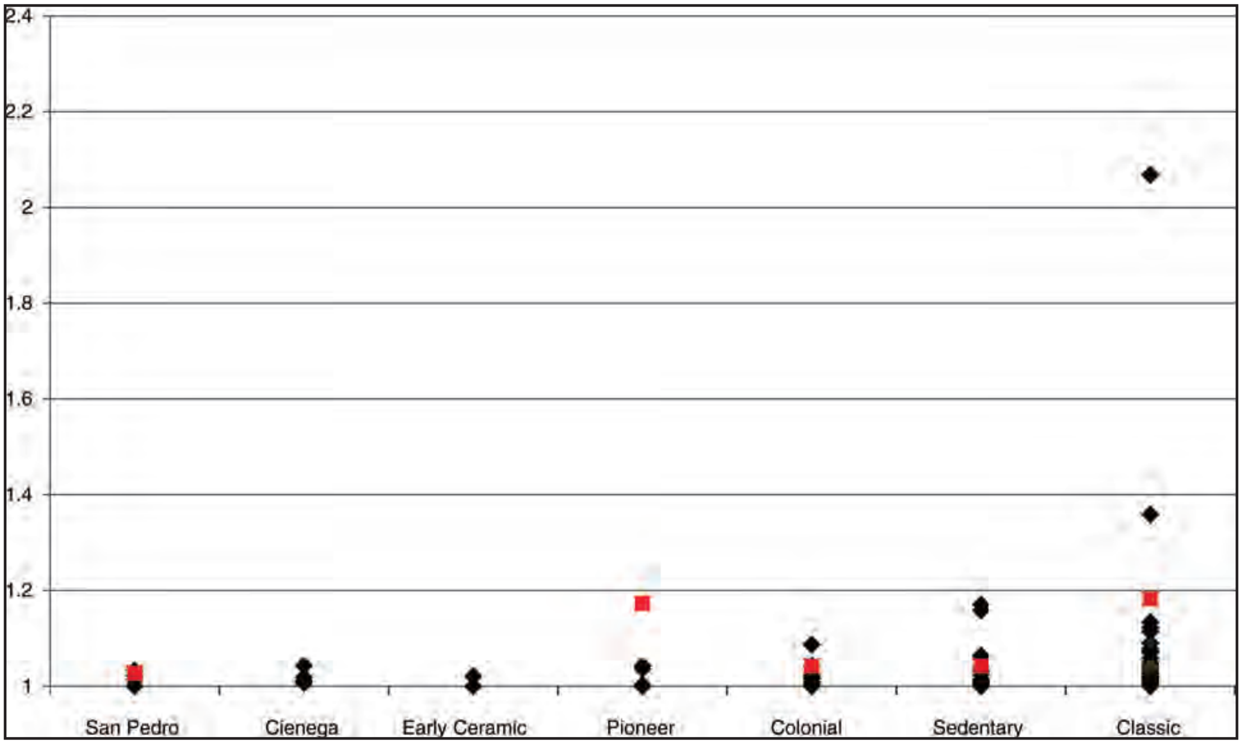


Figure 141. Four-category evenness index values for individual sites (black diamonds) from Dean (2007b) vs. Mescal Wash (red squares).

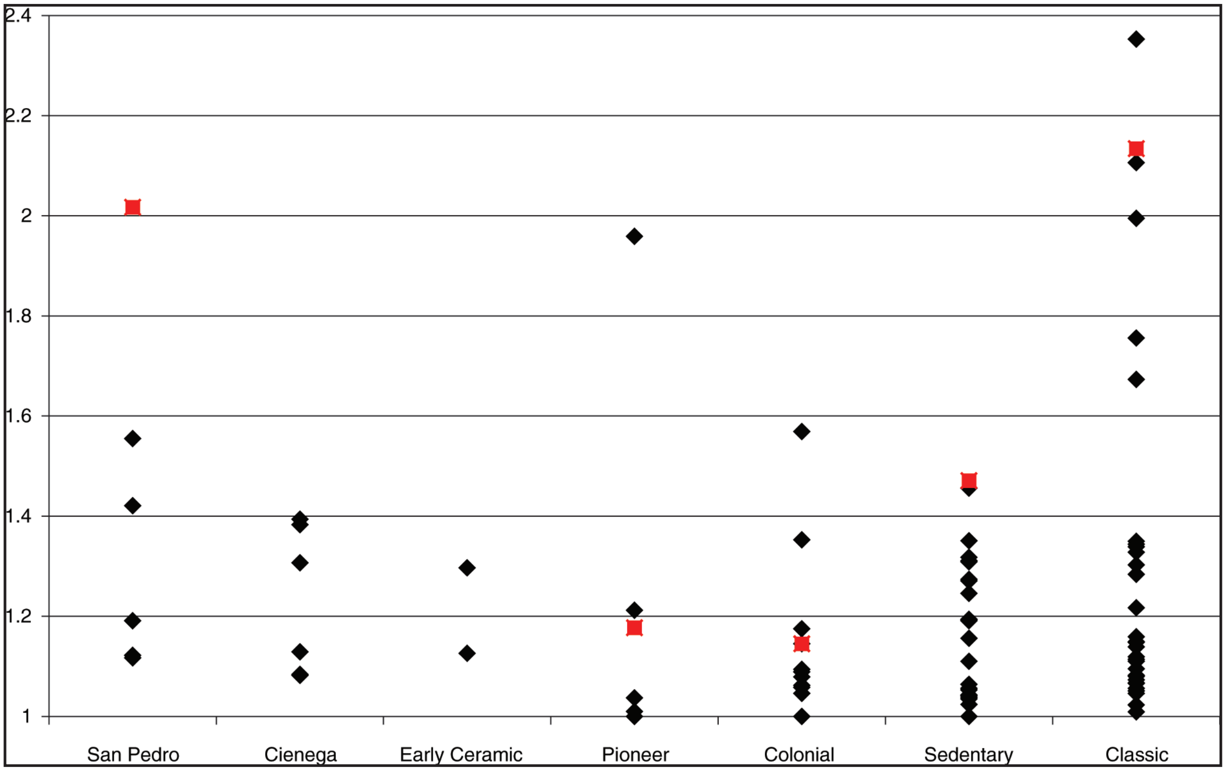


Figure 142. Five-category evenness index values for individual sites (black diamonds) from Dean (2007b) vs. Mescal Wash (red squares). Refer to Table 166 for concordance between Hohokam chronology used in this figure and chronological terminology used for Mescal Wash.

greater numbers of bones from such animals. This could either be a reflection of a true phenomenon, such as artiodactyl populations suffering a significant decrease, or an artifact of zooarchaeological quantification. The four-category index results from Mescal Wash compared with the Hohokam sites displayed similarity in general dietary trends (see Figures 140 and 141). The indexes demonstrated highly even faunal collections—in other words, roughly equal contributions from the four animal groups—until the Pioneer (in the case of Mescal Wash) or Colonial (with respect to the Hohokam sites) periods. At that point, the faunal collections became somewhat less equable, because of increased numbers of leporids. At Mescal Wash, that increase came earlier, then declined and rebounded strongly in the Classic period. The Hohokam collections become less even later and more uneven as time went by, a steady decrease in equability until the Classic period when both the Hohokam and Mescal Wash data reached the same peak.

One could argue that the apparent increase in rabbit hunting made the relative contribution of large-game animals appear to drop. Clearly, however, as the contents of the Late Archaic faunal collection demonstrate (see Table 147), the residents of Mescal Wash followed a distinct hunting regimen wherein they successfully hunted deer and other large game, possibly frequently. In that respect, the population of this site enjoyed a strikingly different diet from many communities in the Hohokam heartland of the Phoenix and Tucson Basins. On the other hand, the increased presence of artiodactyls may have been a reflection of the site's relatively high-altitude location, because artiodactyls in the Southwest tend to frequent higher elevations. This also may have been a reflection of seasonality, if high-elevation sites like Mescal Wash were inhabited during only part of the year, and other parts of the year people lived at lower elevations. Unfortunately, there is very little information from the Mescal Wash collection by which to gauge the seasons or yearly duration of settlement there.

Why is it that the Late Archaic period faunal collection from Mescal Wash contained so many artiodactyl bones? How or why did the population construct that hunting strategy when neighboring settlements, those in the Hohokam area summarized by Dean (2007c) or the Clearwater site (Cameron et al. 2006:13.5), seemingly did not? The reasons were possibly many but come down to environmental or cultural explanations, or some combination of the two. In terms of ecological causes, artiodactyls in the Southwest tend to be more plentiful in higher elevations (Szuter 1989), with the 800-m mark being the general threshold below which these animals are more scarce, and above which they are more abundant. Mescal Wash sits at an elevation of about 1,100 m, well above the latter threshold. That may, in part, explain the high large-game index for the Late Archaic and Early/Middle Formative periods, as well as the evenness scores in the former era that indicate a diversified diet. Similarly, contemporary faunal remains (San Pedro phase) from Christiansen Border Village (Griffitts 2009), a recently excavated settlement at a similarly high-elevation area of southern Arizona, also demonstrate a high large-game index score of 0.71.

Nonetheless, geography presumably does not explain everything because the amount of artiodactyl hunting, or at least success, clearly varied over time. Certainly, population/settlement size and settlement dynamics and settlements inhabited only seasonally, are other factors which may have affected the animals' availability. The Mescal Wash settlement, based on the number of datable features, appears to have been at its smallest in the Late Archaic, a period coincident with one of the highest totals of artiodactyl remains. In other words, small populations may not have depleted artiodactyls as much as larger ones. Although the amount of large-game hunting that took place in the Late Archaic may have been connected to factors such as population size and elevation, these merely were conditions that made hunting possible. Many researchers in hunter-gatherer studies are interested in the relative abundance of large-bodied game, what they consider to be high-ranked prey (e.g., Broughton 1994), who see it as sign of population stress. That may be the case, but it need not be. Dean (2007c) has pointed out that higher numbers of large mammals have been used as evidence both for and against resource stress. Therefore, part of the explanation may be that the big-game hunting culture of earlier periods persisted into the era of early farming, perhaps when populations were less aggregated and agriculture less extensive and time-intensive.

Seasonality

Only a few very general indicators of seasonality could be found in the Mescal Wash faunal materials. No fish or migratory waterfowl were identified. Juvenile artiodactyls were present, but no erupting teeth were recovered. Immature dog or coyote bones were recovered, but since these taxa breed throughout the year, they are of little use in determining seasonality. The greatest number of immature bones were assigned to leporids, but black-tailed jackrabbits breed 11 months of the year, eastern cottontails from February to August, and desert cottontails from January to August (Hoffmeister 1986), and so they, too, provide little information concerning the time of the year. Immature pocket gophers were identified, but these burrowers may well be intrusive. Eggshell was present in Feature 438 (a Middle Formative A period pit structure in Locus D), and if that eggshell could be identified to taxon, it might potentially give clues to the time of year it was deposited. Immature antelope ground squirrel remains in Locus D Features 7833 (a post–A.D. 500 pit), 3681 (a Middle Formative A period structure), and 3545 (a Middle Formative period structure) may suggest a possible spring or summer occupation. These tiny squirrels are usually born in spring but can be born later into June or July (Hoffmeister 1986). Some other ground squirrels, too, are generally born in the spring, but some Arizona ground squirrels have two litters per year, as do some wood rats (Hoffmeister 1986). Thus, we cannot use unspeciated juvenile ground squirrel or wood rat bone to suggest occupation season. One humerus was identified as belonging to a juvenile Gambel's quail (Feature 438). Gambel's quail breed in spring and early summer (2009 Arizona Game and Fish). The Sonoran, Arizona, and yellow mud turtles all hibernate underground in late fall and winter, and the yellow mud turtle also retreats underground in the heat of the summer (Brennan 2008a, 2008b, 2008c). The mud turtles found in three Locus D structures (Features 438, 4684, and 5986) would likely have been more easily found in the spring and summer when they could have been pulled from the nearby marsh or captured on land, rather than dug out of their burrows. One fragment from Feature 5986 was burned, and one from Feature 438 may have been polished, but, since these turtles burrow underground, some of the other turtle shell fragments may also have made their way into the archaeological record on their own. In short, the antelope squirrel, quail, and mud turtles suggest a spring or summer occupation.

Conclusions

The faunal collection from the Mescal Wash site is important for its size and its time depth. Beyond that, the collection reveals interesting aspects of food choices, which, especially early in the sequence, differ appreciably from what is known for the Tucson and Phoenix Basins. More specifically, the people living in this settlement early on showed an emphasis on hunting artiodactyls, perhaps mainly a matter of being located at a relatively high elevation. During the Formative period, however, the population maintained a diet that was, for the most part, indistinguishable from settlements in lower elevations, at least the many documented Hohokam settlements.

One significant difference between the lowland and highland collections, the latter including collections from both Mescal Wash and Christiansen Border Village (a site recently excavated by SRI [Griffitts 2009]), was that there were no fish bones from the higher-elevation sites. This cannot be dismissed as a by-product of recovery methods because some soil samples from Mescal Wash were fine-screened ($^1/_8$-inch mesh) and others were processed as flotation samples. This sort of nonriparian dietary tradition persisted despite the fact that Mescal Wash sits at the confluence of Cienega Creek and Mescal Wash, the former a perennial stream and the latter a seasonal water channel. Although fish and other aquatic animals may not have formed a large part of the diet in this region at any time, they did contribute minority components to many Tucson and Phoenix Basin sites (Dean 2007c). If fish inhabit the creek even at today's lowered water levels (Bodner et al. 2007), then it seems all the more likely that, given pioneers' accounts, both they and waterfowl were formerly abundant in such places (Carmony and Brown 1982). It is therefore surprising that the Native Americans who once lived here made essentially no use of riparian species. If we cannot ascribe that lack of aquatic fauna to local ecology, is it possible, even likely, that some cultural factor(s), whether activity scheduling, ritual prohibitions, or something else, prevented people from hunting waterfowl and fishing? The problem is all the more puzzling given that worked-shell analysis (see Chapter 6) demonstrates that the people collected freshwater mollusks, not inconceivably from Cienega Creek, and thus may have used the stream itself for collecting fauna.

Intrasite analysis of house and other features at the site demonstrated no significant differences in either taxonomic or element composition. Thus, despite ceramic and architectural distinctions, the population(s) maintained a standardized diet, at least so far as species ratios and carcass divisions. In that sense, it may be more accurate to say that the site's residents held in common a certain approach to hunting, whether dictated by taste preferences or solely by what animals could be taken in sufficient numbers without too much investment in time and energy. Many zooarchaeologists (e.g., Ugan and Bright 2001) demonstrate that, given certain assumptions, they can predict prehistoric foraging patterns based on ideas of efficiency/optimality. It is much more difficult to develop competing models that predict how people will dine based on ethnic, status-based, or even religious ideas of what is good to eat and when (but see McGuire and Hildebrandt 2005). The dietary profile from Mescal Wash may accord with either approach: although it may have been efficient to hunt the animals they did, it might also have been beneficial to exploit aquatic resources, at least to the extent to which they were available from the nearby creek, perhaps by means of trapping or poisoning. After the Late Archaic, was the meat-sharing necessitated by large-game kills no longer so socially favorable? Clearly, alternative approaches to rational optimality models may offer viable competing hypotheses.

On another analytical level, how do the results of the faunal analysis fit within the persistent place model adopted to understand the history of settlement at this site? Clearly, the site was advantageously positioned for hunters to exploit the intersecting biotic communities for animals. Perhaps most remarkable was their success in hunting artiodactyls, especially during the Late Archaic, part of the Early and/or Middle Formative, and Late Formative (see Table 155). This intermittent intensity of large-game hunting coincided with a remarkably subdued (or unsuccessful?) pursuit of cottontails. The temporally uneven exploitation of large game, coupled with the predominately low numbers of cottontails through most periods, may indicate that the settlers found the area particularly attractive over time for its location that was advantageous to artiodactyl populations. Whether the locale's apparently advantageous location for such a purpose in fact qualifies it as a persistent place in the sense of having been settled repeatedly and in different arrangements is a complex question best addressed by examining together all classes of artifacts.

CHAPTER 9

Plant Remains

Katharine D. Rainey and Karen R. Adams

The Mescal Wash site is located at an elevation of 3,590–3,650 feet AMSL in an area of wide plant diversity at the transition between the Chihuahuan and Sonoran deserts (see Volume 1, Chapter 2). The site was uniquely placed along a perennial stream (Cienega Creek) with lush adjacent marshland and within easy reach of riparian, grassland, desert, and even mountain resources. Arable land would have been available on the nearby Cienega Creek floodplain. The site's vast array of houses and pits accumulated over a period of nearly 3,000 years attests to the attractiveness of this varied environment. Most of the features were found in three discrete archaeological areas (Loci A, C, and D). Locus D, in particular, yielded evidence of intensive and long-lived use from as early as 1200 B.C. to about A.D. 1450. Thus, the site's longevity makes it a perfect vehicle to study subsistence practices by different people in the same place over a long period of time.

In this chapter, we describe the archaeobotanical materials collected from the Mescal Wash site and use these materials to reconstruct prehistoric subsistence and offer comments about the site's surrounding environment. The study also had a field component, focusing on the modern plant population in the site vicinity, which is presented in Appendix 9.A.

This study was driven by several research questions:

1. What sorts of plants did the people living at the site use, and how did this use change through time? (In particular, we would like to know the mix of wild vs. cultivated plants, and the importance of grasses and agave [Agave])

2. Can we make any inferences about the availability through time of plants growing near the site today?

3. Do the plant remains from the site suggest seasonal or year-round occupation?

4. Is there spatial variation in plant use between the various loci?

5. Do different feature types have different macrobotanical signatures?

In the following sections, we will first summarize our sample and describe the methods used to collect and analyze the data. We then use the results of the analyses to address the research questions.

The Sample

The analyzed data consisted of 112 flotation samples (Table 169) and over 200 fragments of larger, charred plant remains commonly referred to as macrobotanical specimens (Appendix 9.B; see Table 169). The data represent the three principal excavation loci (Loci A, C, and D) (see Table 169). One flotation sample was analyzed from Locus B. The samples represent time periods from about 1200 B.C. to the middle of the fifteenth century A.D (Table 170). The analyzed flotation samples were selected by SRI and represent a variety of feature types from all time periods identified at the site. Sample contexts included structure floor fill and floor pits, extramural thermal and nonthermal pits, and trash areas, with pits the most-common feature type represented (Table 171). Bell-shaped pits—several of which were dated to the Archaic period—were emphasized during sample selection, whereas only three *hornos* (a rare feature at Mescal Wash) were represented. In the field, care was taken to collect the samples from areas with the best integrity. Floor-fill samples were scraped from the first few centimeters of house fill immediately above the floor, so as to minimize the inclusion of

Table 169. Analyzed Flotation Samples from the Mescal Wash Site, by Locus

Feature No.	Feature Type	Pit Profile/ Structure Type	PD No.	Unit No.	Unit Type	Age	Period	Comments
						Locus A		
200	structure	recessed-hearth style	1259	2	half	A.D. 935–1040	Middle Formative B	southern half
			1363	1363	point provenienced	A.D. 935–1040	Middle Formative B	from underneath vessel (PD 1152)
			11359	86	subfeature	A.D. 935–1040	Middle Formative B	sealed hearth deposit
207	structure	house-in-pit	1235	1224	test pit	A.D. 935–1150	Middle Formative B	floor fill
			1366	1	subfeature	A.D. 935–1150	Middle Formative B	hearth (all fill)
290	structure	house-in-pit	1177	1176	test pit	A.D. 1010–1150	Middle Formative B	floor fill
			1265	1	subfeature	A.D. 1010–1150	Middle Formative B	hearth (all fill)
522	trash mound		1103	1101	test pit	not dated	Middle Formative	2-by-2-m unit, Level 1
1146	roasting pit	basin	8352	1	half	not dated	Middle Formative	
1149	*horno*	conical	8342	1	half	not dated	Middle Formative	from general fill
1180	nonthermal pit	basin	2142	2142	point provenienced	A.D. 950–1150	Middle Formative B	storage pit, contents of pot break
2157	structure	house-in-pit	6384	6382	test pit	A.D. 935–1040	Middle Formative B	burned structural debris
2160	structure	recessed hearth	6448	1	subfeature	A.D. 935–1040	Middle Formative B	ash fill of hearth
2184	nonthermal pit	cylindrical	8199	8199	point provenienced	A.D. 950–1150	Middle Formative B	storage pit, ash layer at bottom of pit
2192	structure	recessed hearth	8239	7	subfeature	A.D. 700–1150	Middle Formative	ash pit fill (all ash)
			8249	1	subfeature	A.D. 700–1150	Middle Formative	hearth fill (all ash)
2195	structure	house-in-pit	2201	1	subfeature	A.D. 860–990	Middle Formative	hearth (all fill)
						Locus B		
1018	midden		1108	1105	test pit	not dated	not dated	2-by-2-m unit, Level 2
						Locus C		
276	structure	house-in-pit	10252	1	subfeature	A.D. 650–1150	Middle Formative	hearth (all fill)
278	roasting pit	basin	10412	1	half	A.D. 500–1450	Formative	
379	structure	recessed hearth	7378	75	subfeature	A.D. 1010–1140	Middle Formative B	possible communal structure
			7397	81	subfeature	A.D. 1010–1140	Middle Formative B	possible communal structure
			7399	82	subfeature	A.D. 1010–1140	Middle Formative B	possible communal structure
917	roasting pit	basin	10478	10478	point provenienced	not dated	not dated	

Feature No.	Feature Type	Pit Profile/ Structure Type	PD No.	Unit No.	Unit Type	Age	Period	Comments
922	roasting pit	conical	10481	1	half	not dated	not dated	
995	structure	recessed hearth	8459	1	subfeature	A.D. 935–1100	Middle Formative B	hearth (all fill)
6026	nonthermal pit	bell	10447	1	half	not dated	not dated	
6040	roasting pit	basin	10408	1	half	not dated	not dated	
6085	roasting pit	basin	11219	1	half	not dated	not dated	ashy fill
6099	roasting pit	basin	11199	1	half	not dated	not dated	general fill; no artifacts in pit
6135	roasting pit	basin	11233	1	half	A.D. 950–1150	Middle Formative B	ashy fill
6136	roasting pit	basin	11235	1	half	2000 B.C.–A.D. 1150	Archaic–Middle Formative	fill with charcoal chunks
6140	nonthermal pit	basin	8494	1	half	not dated	not dated	ash-filled pit, spatially associated with pit structure Feature 6154
6171	nonthermal pit	bell	10468	1	half	A.D. 700–1450	Formative	
6187	rock-lined roasting pit	basin	10464	1	half	not dated	not dated	
7153	*horno*	cylindrical	11167	1	half	A.D. 985–1040	Middle Formative B	from general fill of southern half
7163	roasting pit	basin	11159	1	half	not dated	not dated	general fill
7180	nonthermal pit	cylindrical	10485	1	half	not dated	not dated	
7182	nonthermal pit	conical	10489	1	half	not dated	not dated	
7195	hearth	basin	11175		feature	not dated	not dated	all fill (except portion at bottom taken as pollen)
411	nonthermal pit	bell	925	1	half	1100–900 B.C.	Late Archaic	AMS dates derived from columnar-celled seed coats (melon-loco-type)
415	roasting pit	basin	935		feature	not dated	not dated	
432	rock-lined roasting pit	cylindrical	837		feature	not dated	not dated	
446	roasting pit	irregular	903		feature	not dated	not dated	
457	roasting pit	conical	885		feature	A.D. 500–1450	Formative	
491	roasting pit	cylindrical	888		feature	A.D. 500–1450	Formative	
493	nonthermal pit	unknown	902		feature	not dated	not dated	pit with slab

continued on next page

Feature No.	Feature Type	Pit Profile/ Structure Type	PD No.	Unit No.	Unit Type	Age	Period	Comments
494	roasting pit	bell	848	1	half	not dated	not dated	
			849	2	half	not dated	not dated	
572	roasting pit	basin	904		feature	not dated	not dated	
723	nonthermal pit	unknown	817		feature	A.D. 500–1450	Formative	
724	nonthermal pit	bell	781	781	point provenienced	A.D. 500–1450	Formative	content of vessel
			818		feature	A.D. 500–1450	Formative	with Dos Cabezas sherds
1555	fire pit	basin	11321	1	half	A.D. 1–1450	Formative	
1575	structure	adobe-walled	1880	16	subfeature	A.D. 1385–1690	Late Formative B	pit fill
1794	fire pit	basin	11300	1	half	A.D. 1–1450	Formative	
1812	nonthermal pit	bell	11296	1	half	not dated	not dated	
3545	structure	house-in-pit	2397	2397	point provenienced	A.D. 860–1015	Middle Formative	point-located on floor
			2524	1	subfeature	A.D. 860–1015	Middle Formative	hearth (all fill)
3557	nonthermal pit	bell	7694	1	half	1060–880 B.C.	Late Archaic	
3569	structure	house-in-pit	1886	1	subfeature	A.D. 935–1015	Middle Formative B	hearth (all fill)
3617	structure	house-in-pit	3135	1	subfeature	A.D. 700–950	Middle Formative A	hearth (all fill)
3668	rock-lined roasting pit	basin	3321	1	half	A.D. 835–915	Middle Formative A	
			3382	1	half	A.D. 835–915	Middle Formative A	
3679	structure	house-in-pit	1945	1	subfeature	A.D. 835–865	Middle Formative A	southern hearth (all fill)
			1949	2	subfeature	A.D. 835–865	Middle Formative A	northern hearth (all fill)
3710	structure	house-in-pit	2703	1	subfeature	A.D. 685–915	Middle Formative A	hearth (all fill)
3711	nonthermal pit	bell	5131	1	half	A.D. 1–1450	Formative	
3878	rock-lined roasting pit	basin	2418		feature	A.D. 860–1450	Middle/Late Formative	intrusive in structure Feature 5518
3879	structure	house-in-pit	2473	1	subfeature	A.D. 700–950	Middle Formative A	hearth (all fill)
3963	roasting pit	basin	5827	1	half	A.D. 1–1450	Formative	
3976	nonthermal pit	bell	5778	1	half	1280–1010 B.C.	Late Archaic	AMS dates derived from corn/maize

Feature No.	Feature Type	Pit Profile/ Structure Type	PD No.	Unit No.	Unit Type	Age	Period	Comments
3983	nonthermal pit	bell	2589		feature	1070–900 B.C.	Late Archaic	AMS dates derived from walnut shells
4053	roasting pit	basin	5856	1	half	A.D. 1–1450	Formative	
4120	rock-lined roasting pit	basin	2499	1	half	A.D. 500–1450	Formative	
4149	nonthermal pit	basin	11255		feature	A.D. 1–1450	Formative	
4220	*horno*	cylindrical	11247	11247	point provenienced	A.D. 500–1450	Formative	upper fill
			11249	11249	point provenienced	A.D. 500–1450	Formative	lower fill: includes area of charcoal concentration
4295	nonthermal pit	bell	2793	1	half	not dated	not dated	float combined with float from PD 2899
			2899	1	half	not dated	not dated	float combined with float from PD 2793
4310	nonthermal pit	basin	6238	1	half	not dated	not dated	probably Archaic period
Nonfeature			9901	6801	stripping unit	not dated	not dated	
4312	nonthermal pit	bell	5861	1	half	1500 B.C.–A.D. 300	Late Archaic/ Early Formative	
4326	nonthermal pit	conical	5854	1	half	A.D. 1–300	Late Archaic/ Early Formative	trash-filled
4635	nonthermal pit	basin	6235		feature	A.D. 1–1450	Formative	
4660	nonthermal pit	bell	6229	1	half	A.D. 1–1450	Formative	
			6236	1	half	A.D. 1–1450	Formative	
4684	structure	adobe-walled	5326	2	half	A.D. 1310–1690	Late Formative B	house fill: structural debris (reed, grasses, lumber, etc.)
4702	rock-lined roasting pit	cylindrical	5018	1	half	A.D. 600–865	Early/Middle Formative	
4728	nonthermal pit	cylindrical	5835	1	half	A.D. 1–1450	Formative	
4729	structure	adobe-walled	6728	1	subfeature	A.D. 1340–1390	Late Formative B	hearth fill
4735	nonthermal pit	cylindrical	5845	1	half	A.D. 500–1450	Formative	trash-filled

continued on next page

Feature No.	Feature Type	Pit Profile/ Structure Type	PD No.	Unit No.	Unit Type	Age	Period	Comments
4780	nonthermal pit	basin	6237	1	half	not dated	not dated	
4849	nonthermal pit	bell	5852	1	half	820–590 B.C.	Late Archaic	trash filled
4871	roasting pit	bell	6227	1	half	A.D. 990–1160	Middle Formative B	bottom half fill
4902	roasting pit	cylindrical	6211	1	half	A.D. 1–1450	Formative	
4931	roasting pit	basin	6233	1	half	A.D. 985–1315	Middle/Late Formative	
4996	nonthermal pit	basin	11331	1	half	not dated	not dated	possibly Archaic period
5505	nonthermal pit	bell	11339	1	half	1110–900 B.C.	Late Archaic	AMS dates derived from *Zea mays*
5624	nonthermal pit	basin	6230	1	half	not dated	not dated	
5809	nonthermal pit	bell	5869		feature	A.D. 1–300	Early Formative	two floats from PD 5869 combined
5980	nonthermal pit	bell	10775	10775	point provenienced	A.D. 1–1450	Formative	composite sample from profile
7501	cache	basin	7502		feature	A.D. 1–1450	Formative	all fill, except for artifacts already collected
7558	structure	pole-and-brush	3190	1	subfeature	A.D. 710–740	Middle Formative A	bell-shaped pit (all fill)
7827	roasting pit	bell	7828	1	half	A.D. 660–790	Middle Formative A	
8655	structure	house-in-pit	8976	8974	test pit: Level 1	A.D. 825–1090	Middle Formative	float combined with float from PD 9643
			9643	1	half	A.D. 825–1090	Middle Formative	float combined with float from PD 8976
8798	roasting pit	bell	8799	1	quarter	A.D. 1–865	Early/Middle Formative	
10507	roasting pit	bell	10511	1	half	A.D. 600–1000	Early/Middle Formative	float combined with float from PD 10515
			10515	2	half	A.D. 600–1000	Early/Middle Formative	float combined with float from PD 10511
10612	nonthermal pit	bell	10636	10636	point provenienced	not dated	not dated	
10692	fire pit	basin	10693		feature	2000 B.C.–A.D. 600	Archaic–Early Formative	

Key: AMS = accelerator mass spectrometry; PD = provenience designation.

postoccupational trash. Similarly, sampling pits considered stratigraphic differences. For example, ashy, bottom pit fill was collected separately from overlying trash or rake-in debris. From hearths and other small pits, all fill was collected as flotation samples. For more details on sample collection for individual features, see Table 169.

Table 170. Time Periods Represented by the Flotation Samples

Period	Number of Flotation Samples
Late Archaic (1500 B.C.–A.D. 1)	6
Late Archaic/Early Formative	2
Archaic–Early Formative	1
Archaic–Middle Formative	1
Early Formative (A.D. 1–750)	1
Early/Middle Formative	4
Middle Formative (A.D. 750–1150)	15
Middle Formative A (A.D. 750–950)	9
Middle Formative B (A.D. 950–1150)	11
Middle/Late Formative	2
Middle Formative B–Late Formative B	1
Late Formative B (A.D. 1300–1450)	3
Formative	24
Not dated	32
Total	112

Methods

Two types of plant materials were used in this study: light fractions found in flotation samples and larger macrobotanical specimens. Flotation samples are bulk sediment samples that are poured into water to let the plant materials float to the top to be skimmed off and saved. Katharine Rainey analyzed the flotation samples. Macrobotanical specimens are plant materials visible to the naked eye that are collected during excavation. These plant remains are often much larger than the average size of microscopic plant materials recovered by flotation. The macrobotanical specimens, consisting primarily of charred construction timber, fuel wood, and food items, were analyzed by Karen Adams.

Table 171. Feature Types Represented by the Flotation Samples

Feature Type, by Locus	Number of Flotation Samples
A	
Horno	1
Pit (basin)	1
Pit (cylindrical)	1
Roasting pit	1
Structure (ash pit)	1
Structure (entry)	1
Structure (floor)	4
Structure (hearth)	6
Trash mound	1
Subtotal	17
B	
Midden	1
C	
Bell-shaped pit	2
Hearth	1
Horno	1
Pit (basin)	1
Pit (conical)	1
Pit cylindrical	1
Roasting pit	9
Rock-lined roasting pit	1
Structure (hearth)	4
Structure (pit fill)	1
Subtotal	22
D	
Bell-shaped pit	19
Bell-shaped roasting pit	8
Fire pit	3
Horno	2
Pit	1
Pit (basin)	7
Pit (conical)	1
Pit (cylindrical)	2
Roasting pit	8
Rock-lined roasting pit	6
Structure	1
Structure (floor)	3
Structure (hearth)	8
Structure (pit fill)	1
Thermal pit	1
Nonfeature	1
Subtotal	72
Total	112

Flotation Samples

When sediment samples are processed by flotation, "heavy fraction" items that are denser than water (e.g., sediments, rocks, and artifacts) sink to the bottom, whereas "light fraction" materials that float (primarily vegetal materials) are skimmed off. The present analysis concerns the light fraction samples. The volume of sediment collected varied between 0.5 and 35.33 liters, but this information was always recorded, allowing us to make all samples comparable. Samples were floated in the SRI laboratory using a Flo-Tech flotation machine. Further steps were carried out at the analyst's laboratory. Next, the light fraction was weighed, and the approximate volume measured. (The volumes ranged between 2 and approximately 1,400 ml). If the sample was of a large, unwieldy size, the sample was split using a sample splitter until a subsample volume of approximately 50–75 ml was reached. The unanalyzed subsamples were bagged and labeled separately within the light fraction bag for possible future analysis. Before analysis, samples were poured through graded geologic sieves (after splitting, if necessary) to segregate the pieces into 4.0-, 2.0-, 1.4-, 0.7-, and 0.5-mm size fractions. The materials that fell to the bottom pan were kept but not analyzed. The analyst examined the light fractions under a binocular dissecting microscope at magnifications varying between 10× and 40×.

Wood Charcoal

The first stage of analysis focused on identifying the wood charcoal pieces. From each sample, 20 pieces of charcoal were randomly selected. Then, five wood fragments considered morphologically different from the 20 randomly selected pieces were selected for examination. Following that, any additional pieces that were also morphologically unique were included in the analysis. Wood charcoal pieces were broken in two to get a transverse (cross) section and then identified.

Reproductive Parts

Once the pieces of wood charcoal had been selected and identified, the samples were sorted by their graded sieve sizes. The 4.0-, 2.0-, and 1.4-mm fractions were completely sorted and the specimens identified, where possible. Next, the 0.7 and 0.5 mm fractions were scanned for seeds or other reproductive parts. For each identifiable piece, the most-precise taxonomic level possible was recorded, along with a confidence level for the assignment, including "absolute," "type," or "confer (cf.)." The state of charring also was recorded, and the collected pieces were counted and weighed. The unknowns were described for further identification work. Unknown specimens were identified by consulting items from the modern plant inventory, reference collections at Arizona State University, pictures in Martin and Barkley (1961), and consultation with peers. The flora of record for the project is the Arizona-Nevada Academy of Sciences series "A New Flora for Arizona" (Vascular Plants of Arizona Editorial Committee 1992–2001). Because this is a work in progress, there were some species that could not be identified with this resource. In these cases, *Arizona Flora* (Kearney and Peebles 1960) was consulted.

Karen Adams (2001) highlighted the need for more-thorough grass grain descriptions in archaeobotanical analysis. Because the Mescal Wash site is located in a grasslands environment, identifying grass grains is an important research objective for the present study. To further this end, every grass grain or suspected grass grain was described using her suggested framework (Adams 2001:70). The attributes that were measured and described were shape, dimensions, nature of grain compression, embryo length relative to the entire grain, facet profile, condition, and other features.

Agavaceae

Vorsila Bohrer's (1987:71–74) identification criteria for identifying members of Agavaceae (agave, sotol [*Dasylirion*], beargrass [*Nolina*], and yucca [*Yucca*]) were used in this study. A common feature for many of these plants is vascular bundle fibers running the length of the leaves. Charred fibrovascular bundles, which look like small tubes or pieces of hair, were commonly found in the Mescal Wash flotation samples. Agave fibrovascular bundles are often U-shaped and may have white calcium oxalate crystals, but these are not definitive characteristics (Bohrer 1987:72). Unless the fibrovascular bundle fragments were U-shaped, we conservatively identified the tissues as "monocotyledon" fibrovascular bundles.

Ubiquity Calculation

Once the flotation samples had been sorted and tabulated, ubiquity was calculated for each taxon and part. Ubiquity is a measure of the presence of an item in the collection of samples (Popper 1988:60–64). Calculating ubiquity allows us to overcome differences in techniques, methods, and approaches used by various archaeobotanists. Analysts generally use one of two basic methods of ubiquity evaluation: sample ubiquity and feature ubiquity. Most researchers use sample ubiquity, which is the percentage of the total number of samples in a population in which a taxon is found. This is the method used in the present analysis. Although maximizing use of the sample population, this method can lead to bias in the results due to the disproportionate attention given to certain features when selecting samples for analysis. By determining ubiquity by feature (the percentage of the total number of features in which a taxon is found), this problem can be alleviated, resulting in truer correlations with extent of use. With either method, higher figures are thought to represent greater use, although issues such as intensity of use and percentage of diet cannot be addressed. Overall, ubiquity identifies trends and is useful for general comparisons only. Ubiquity shows us the rank order of taxa for a particular site or project but is at its most useful when used to compare the analysis results between various projects or sites. Even so, differences in sampling methods between projects can strongly influence the ubiquity outcome. Also, of course, we must guard against indiscriminately comparing sample and feature ubiquity.

In calculating sample ubiquity, we combined samples from the same context to avoid overrepresenting a particular feature in the results. This happened three times: two samples each from Feature 4295 (PDs 2793 and 2899), Feature 8655 (PDs 8976 and 9643), and Feature 10507 (PDs 10511 and 10515) were combined (see Table 169). These duplicate samples were submitted for analysis in order to maximize data diversity from unique contexts. As a result of combining these samples, the number of samples used for ubiquity calculations is 109 (out of the total of 112 analyzed samples). It is for this reason that tables in this chapter providing ubiquity data list 109 samples instead of 112. Fragments and whole specimens of taxon parts were combined for ubiquity calculation purposes, as well as items with confidence levels of “absolute” and “type.” Finally, although both uncharred and charred specimens were recorded, only charred specimens are discussed in this chapter, as they are considered the most likely to represent prehistoric use (Miksicek 1987).

Diversity Calculation

We examined the diversity of the seed and nonreproductive taxa through time and between areas of the site using Keith Kintigh’s DIVERS program (Kintigh 1998). This program calculates richness and evenness for samples and then compares the actual data sets with the richness and evenness values for simulated random data sets. This allows the researcher to “control for the influence of sample size” (Kintigh 1998:51). Richness and evenness are concepts borrowed from ecology. Richness is the number of different taxa observed, whereas evenness is the measure of how evenly the individual pieces are distributed across the categories (Kintigh 1998:51). Although there are no tests to evaluate the significance of differences in richness and evenness measures (Popper 1988:67), it is possible to compare actual assemblages with simulated assemblages to estimate richness and evenness for various sample sizes. These provide confidence intervals of what values might be expected by chance. The DIVERS tool complements ubiquity measures, because its analyses are based on counts of plant taxon parts, providing a second approach to the data. In composing the data sets, we only used data from the flotation samples, because they were systematically obtained. Also, only taxa that were found in more than one flotation sample were included (Table 172). To compare plant use through time, we combined all the selected taxa counts by period: Late Archaic, Early Formative, Early/Middle Formative transition, Middle Formative, and Late Formative (see Table 170 for date ranges). To compare plant use across different areas of the site, the selected taxa counts were combined by locus. We ran 10,000 simulated data sets, and then used the DIVPLT program (Kintigh 1998) to plot the results. The actual diversity measures for each period were plotted next to 90 percent confidence intervals generated by the sample data sets.

Table 172. Taxa Used in Diversity Testing

Common Name	Taxon	Parts
Burrobush	*Hymenoclea*	wood
Catclaw	*Acacia*	wood
Cheno-am	cheno-am	utricle
Cottonwood/willow	*Populus/Salix*	wood
Creosote bush	*Larrea*	wood
Grass family	Poaceae	caryopsis, stem
Hedgehog cactus	*Echinocereus*	seed
Juniper	*Juniperus*	seed, wood
Knotweed/canaigre	*Polygonum/ Rumex*	achene
Melon-loco	*Apodanthera*	seed coat
Mesquite	*Prosopis*	seed, wood
Pine	*Pinus*	wood
Pine/oak?	*Pinus*/*Quercus*?	thin nutshell
Prickly pear, cholla	*Opuntia, Cylindropuntia*	seed
Purslane	*Portulaca*	seed
Reed	*Phragmites*	stem
Saltbush	*Atriplex*	utricle, wood
Silk-tassel	*Garrya*	wood
Squash	*Cucurbita*	rind
Walnut	*Juglans*	wood
Yucca	*Yucca*	seed, tissue

Macrobotanical Specimens

Macrobotanical specimens (the larger pieces) were examined in SRI’s Tucson laboratory. For each sample, plant materials were first spread out and examined for reproductive and other nonwood specimens. These were described and bagged separately. Subsequently, as many as 20 pieces of wood with a broad cross-sectional surface to view anatomical details were identified. All identifications were accomplished using a Zeiss binocular microscope at magnifications ranging from 8×–50× and comparison photographs from of an extensive modern collection of regional charred and uncharred plant materials backed by herbarium specimens deposited in the University of Arizona herbarium in Tucson.

Although the majority of macrobotanical specimens were charred, some were not (see Appendix 9.B). Charred plant parts are assumed to have been burned as the result of actions taken by the site's inhabitants. Typically uncharred plant specimens are considered to represent postoccupational intrusions into archaeological site deposits. However, at Mescal Wash, a number of juniper (*Juniperus*) wood specimens that were either uncharred or partially charred, some of them retrieved from postholes, appeared ancient and likely represent prehistoric use. The only uncharred specimens that are not likely related to the occupation of the Mescal Wash site are two uncharred hackberry (*Celtis*) seed fragments from Feature 2192. It is unlikely that such uncharred seeds would have been preserved in the 500 years since the site had been abandoned.

Modern Plant Study

The authors made three visits to the Mescal Wash site area in March, April, and September 2001 to record the plants on the modern landscape. The purpose of this study was to understand what plants might have been available to the site's inhabitants at different times of the year. We recorded plants at eight different collection-stop areas, reflecting a range of environments from stream bottomlands to upland terraces.

The results of the modern plant survey are discussed in detail in Appendix 9.A. From our reconnaissance, it appears that the Mescal Wash site had a rich environment of plants to support construction, firewood, food, and other needs (Tables 173 and 174). The areas of greatest plant diversity were the upland terraces and the floodplain of Cienega Creek. A variety of edible plants would have been available at different times of the year to supplement

Table 173. Modern Landscape Study Plants Also Found as Charred Pieces in Flotation Samples and Macrobotanical Specimens, by Landform

Common Name	Taxon	Disturbed Ground	Upland Terraces	Slopes	Floodplains/ Riparian
Blue tansy mustard	*Descurainia obtusa*		X	X	X
Burrobush	*Hymenoclea*				X
California poppy	*Eschscholzia*				X
Canaigre cf. dock	*Rumex* cf. *hymenosepalus*		X	X	X
Carelessweed	*Amaranthus palmeri*	X			
Catclaw	*Acacia*			X	
Cholla	*Cylindropuntia*		X		
Christmas cactus	*Opuntia leptocaulis*		X	X	X
Cottonwood	*Populus*				X
Creosote bush	*Larrea*		X	X	X
Fingerleaf gourd	*Cucurbita digitata*	X			
Goosefoot	*Chenopodium* sp.		X	X	X
Hedgehog cactus	*Echinocereus*		X	X	X
Melon-loco	*Apodanthera undulata*	X			
Palmer agave	*Agave palmeri*			X	
Payson tansy mustard	*Descurainia pinnata* ssp. *paysonii*		X	X	X
Prickly pear	*Opuntia*		X	X	X
Rocky Mountain goosefoot	*Chenopodium salinum*				X
Saltbush	*Atriplex*				X
Velvet mesquite	*Prosopis velutina*		X	X	X
Yewleaf willow	*Salix taxifolia*				X

Table 174. Taxon and Common Names of Charred Plant Taxa Identified in This Study

Common Name	Taxon	Parts	Uses[a]	Seasonal Availability of Edible Parts
	Group 1 Fruits (Weedy/Annual)			
Amaranth	*Amaranthus*	embryo, utricle	food, medicine, ritual, other	fall
Carpetweed	*Mollugo verticillata*	seed	no uses currently known	fall, winter
Cheno-am	cheno-am	embryo, utricle	food, medicine	fall
Goosefoot	*Chenopodium*	embryo, utricle	food, medicine	fall
Goosefoot family	Chenopodiaceae	seed, utricle	food, medicine	fall
Melon-loco	*Apodanthera undulata*	seed coat	food, medicine	fall
Purslane	*Portulaca*	seed	food, medicine, ritual	fall
Squash	*Cucurbita*	rind	food, medicine, ritual, other	fall
Squash family	Cucurbitaceae	rind, seed	food, medicine, ritual, other	fall
Tansy mustard	*Descurainia*	seed	food, medicine	spring
	Group 2 Fruits (Nonweedy/Perennial)			
Agave	*Agave*	fibrovascular bundle, stem, tissue	food, other	varies
Ash	*Fraxinus*	wood	construction, fuel, ritual, other	
Banana yucca	*Yucca baccata*	seed, tissue	construction, food, medicine, ritual, other	summer
Barrel cactus	*Ferocactus*	seed	food	summer, fall
Burrobush	*Hymenoclea*	twig, wood	food, fuel, other	summer, fall
Cactus family	Cactaceae	seed	food, other	varies
California poppy	*Eschscholzia*	seed	food, medicine, other	spring
Canaigre	*Rumex*	achene	food, fuel, medicine, ritual, other	summer
Catclaw	*Acacia greggii*	bark, wood	construction, food, fuel, other	summer, fall
Chokecherry	*Prunus*	seed	food, medicine, ritual, other	summer
Cottonwood	*Populus*	wood	construction, food, fuel, medicine, ritual, other	spring
Creosote bush	*Larrea*	twig, wood	fuel, medicine, other	
Hedgehog cactus	*Echinocereus*	seed	food, medicine, ritual, other	summer, fall
Ironwood	*Olneya*	wood	construction, food, fuel, other	summer
Juniper	*Juniperus*	seed, wood	construction, food, fuel, medicine, ritual, other	fall
Knotweed	*Polygonum*	achene	food, medicine, ritual	summer, fall
Legume family	Fabaceae	bark, seed, wood	construction, food, fuel, medicine, other	varies
Mesquite	*Prosopis*	knot, seed, twig, wood	construction, food, fuel, medicine, other	summer
Oak	*Quercus*	wood	construction, food, fuel, medicine, other	fall
Palo verde	*Cercidium*	wood	food, other	summer
Pine	*Pinus*	wood	construction, food, fuel, medicine, other	fall
Prickly pear, cholla	*Opuntia, Cylindropuntia*	embryo, seed, seed coat	construction, food, medicine, ritual, other	summer, fall
Reed	*Phragmites*	stem, stem segment	construction, fuel, medicine, ritual, other	
Saltbush	*Atriplex*	twig, utricle, wood	food, fuel, medicine, ritual, other	fall, winter
Silk-tassel	*Garrya*	wood	medicine, other	
Sotol	*Dasylirion*	tissue	food, other	summer, fall

continued on next page

Common Name	Taxon	Parts	Uses[a]	Seasonal Availability of Edible Parts
Walnut	*Juglans*	wood	construction, food, medicine, other	summer
Willow	*Salix*	wood	construction, food, medicine, ritual, other	spring
	Mixed Group Fruit			
Dicotyledon		knot, twig, wood		varies
Grass family	Poaceae	caryopsis, stem, stem segment	construction, food, fuel, other	varies
Monocotyledon		fibrovascular bundle, stem, stem segment, tissue		varies
Spurge family	Euphorbiaceae	seed	medicine	varies
Sunflower family	Asteraceae	achene	food, medicine, other	varies
	Domesticated/Likely Managed Crops			
Corn/maize	*Zea mays*	cupule, embryo, kernel	food, fuel, ritual	cultivated
Cotton	*Gossypium*	seed	food, medicine, ritual, other	cultivated
Squash	*Cucurbita*	seed	food, medicine, ritual, other	cultivated

[a] For further details regarding the uses of these plants, see Appendix 9.A; Rainey and Adams (2004); Murray and Adams (2008) (please see also SWCA's Animas–La Plata project interactive databases hosted at www.crowcanyon.org); Native American Ethnobotany Database (http://herb.umd.umich.edu/); and Fire Effects Information System, U.S. Department of Agriculture Forest Service, Rocky Mountain Research Station, Fire Sciences Laboratory (http://www.fs.fed.us/database/feis/).

agricultural harvests. Some overlap exists between the modern and ancient plant taxa, but each study identified taxa not present in the other study.

When the ubiquity of plant taxa as a whole is considered, the ancient plant inventory from the Mescal Wash site is a good approximation of plants growing on the surrounding landscape today.

Results

Paleobotanical Inventory

This section provides an overview of the different categories of plant remains and compares the flotation samples and the macrobotanical specimens.

Reproductive Parts

Both the flotation samples and the macrobotanical specimens included a variety of seeds. The six most ubiquitous plant reproductive parts + from the flotation samples that could represent food use are (in order of decreasing ubiquity): corn/maize (*Zea mays*), melon-loco (*Apodanthera*), cheno-ams (goosefoot/amaranth [*Chenopodium*/*Amaranthus*]), hedgehog cactus (*Echinocereus*), nuts with thin shells (potentially pine [*Pinus*] or oak [*Quercus*]), prickly pear (*Opuntia*), and cholla (*Cylindropuntia*), and squash (*Cucurbita*). The macrobotanical specimens included seeds generally similar to those found in the flotation samples (Table 175). Mesquite (*Prosopis*) seeds, banana yucca (*Yucca baccata*) seeds, and unidentified nutshell fragments were found in both sample types. A possible apodanthera seed fragment was found among the macrobotanical specimens, similar to the large quantities of apodanthera seed-coat fragments in the flotation samples.

The nongrass seeds from the Mescal Wash site represented a mix of weedy and nonweedy species (Table 176).

Table 175. Charred Reproductive Taxa Present in the Macrobotanical Specimens

Common Name	Taxon	Parts
Banana yucca–type	*Yucca baccata*–type	seed
Corn/maize	*Zea mays*	cob fragment, kernel fragment
Mesquite-type	*Prosopis*-type	nutshell fragment
Walnut-type	*Juglans*-type	nutshell fragment

Table 176. Overall Ubiquity of Plant Taxa from Flotation Sample Contexts

Common Name	Taxon	Parts	Number of Flotation Samples	Ubiquity (%) (n = 109)
	Group 1 Fruits (Weedy/Annual)			
Cheno-am	cheno-am	utricle, embryo, fragment	64	59
Squash family–type	Cucurbitaceae-type	rind fragment	8	7
Squash-type	*Cucurbita*-type	rind fragment	7	6
Purslane-type	*Portulaca*-type	seed	3	3
Goosefoot family–type	Chenopodiaceae-type	utricle	1	1
Melon-loco-type	*Apodanthera*-type	seed coat fragment	69	63
Squash family–type	Cucurbitaceae-type	seed	1	1
Tansy mustard–type	*Descurainia*-type	seed	1	1
Carpetweed-type	*Mollugo verticillata*–type	seed	1	1
	Group 2 Fruits (Nonweedy/Perennial)			
Hedgehog cactus–type	*Echinocereus*-type	seed, fragment	20	18
Cactus-type	*Opuntia*-type	embryo, seed, fragment	12	11
Thin-shelled-type nuts		nutshell fragment	10	9
Knotweed/canaigre-type	*Polygonum/Rumex*-type	achene, fragment	9	8
Mesquite-type	*Prosopis*-type	seed, fragment	5	5
Yucca, banana yucca–type	*Yucca*, *Yucca baccata*–type	seed, fragment	4	4
Saltbush-type	*Atriplex*-type	utricle	2	2
Juniper-type	*Juniperus*-type	seed, fragment	2	2
Unknown shell-type nuts		nutshell fragment	2	2
California poppy–type	*Eschscholzia*-type	seed	1	1
Legume family–type	Fabaceae-type	seed	1	1
Barrel cactus–type	*Ferocactus*-type	seed	1	1
Thick-shelled-type nuts		nutshell fragment	1	1
	Mixed Group Fruits			
Unknown		disseminule, fragment	30	28
Unknown		seed, seed coat, fragment	24	22
Grass family–type	Poaceae-type	caryopsis	8	7
Unknown		bud	2	2
Unknown		embryo	2	2
Sunflower family–type	Asteraceae-type	achene	1	1
Spurge family–type	Euphorbiaceae-type	seed	1	1
Unknown		reproductive part	1	1
	Domesticated/Likely Managed Crops			
Corn/maize	*Zea mays*	cupule, fragment	76	70
Corn/maize	*Zea mays*	kernel, embryo, fragment	7	6
Agave-type	*Agave*-type	fibrovascular bundle fragment	1	1
Cotton-type	*Gossypium*-type	seed	1	1
	Woods and Vegetative Parts			
Mesquite-type	*Prosopis*-type	knot, twig, wood	94	86
Unknown		unknown	70	64
Dicotyledon-type		knot, twig, wood	65	60

continued on next page

Common Name	Taxon	Parts	Number of Flotation Samples	Ubiquity (%) (n = 109)
Legume family–type	Fabaceae-type	bark, wood	66	61
Unknown		plant tissue fragment	65	60
Unknown		bark, knot, twig, wood	42	39
Monocotyledon-type		stem, stem segment fragment	39	36
Grass family–type	Poaceae-type	stem, stem segment fragment	31	28
Monocotyledon-type		tissue fragment	26	24
Juniper-type	*Juniperus*-type	wood	24	22
Saltbush-type	*Atriplex*-type	wood, twig	23	21
Catclaw	*Acacia, Acacia greggii*	wood	23	21
Monocotyledon-type		fibrovascular bundle fragment	22	20
Ring-porous-type		bark, wood	9	8
Diffuse-porous-type		wood	6	6
Burrobush-type	*Hymenoclea*-type	twig, wood	6	6
Pine-type	*Pinus*-type	wood	5	5
Unknown		stem fragment	5	5
Catclaw/mesquite-type	*Acacia/Prosopis*-type	wood	4	4
Black spherical-type		disseminule	4	4
Reed-type	*Phragmites*-type	stem, stem segment fragment	4	4
Cottonwood/willow-type	*Populus/Salix*-type	wood	4	4
Unknown		epidermis fragment	4	4
Mycorrhizal fungus	*Cenococcum*-type	sclerotium	3	3
Walnut-type	*Juglans*-type	wood	3	3
Creosote bush–type	*Larrea*-type	wood	3	3
Yucca-type	*Yucca*-type	tissue fragment	3	3
Silk tassel–type	*Garrya*-type	wood	2	2
Termite-type		fecal pellet, fragment	2	2
Palo verde–type	*Cercidium*-type	wood	1	1
Palo verde/ mesquite–type	*Cercidium/Prosopis*-type	wood	1	1
Sotol-type	*Dasylirion*-type	tissue fragment	1	1
Unknown		fecal pellet	1	1
Unknown		fruit	1	1

Note: Data are presented in decreasing order of number of flotation samples.

These can be termed Group 1 and Group 2 species, based on a classification system previously published in Adams and Bowyer (2002:136). Group 1 plants are annual and weedy, and can have high food productivity with lower processing cost, whereas Group 2 plants are perennial and nonweedy, and generally have lower productivity with higher processing cost. Goosefoot, amaranth, and apodanthera (Group 1 plants) are very common in disturbed areas. On the September 2001 visit to record the modern plants near the site, the backfilled completed excavations at the site were populated with carelessweed (*Amaranthus palmeri*) tumbleweeds and melon-loco vines. Weedy species are prolific producers, but the ancient residents were also using abundant amounts of hedgehog cactus and prickly pear and cholla, which belong to Group 2. Group 2 plants would be especially useful in times of drought, when weedy plants are less productive.

The flotation samples contained thirteen grass family (Poaceae) grains, technically called caryopses, in 12 different samples (Table 177). Eight of these were long/slender type and 4 were of a short/sturdy type. Long/slender grains are more than two times longer than wide, and short/sturdy grains are less than two times longer than they are wide (Adams 2001:70). Some of the grains listed in

Table 177. Description of Grass Family Grains

Feature No.	PD No.	Grain No.	Shape	Length (mm)	Width (mm)	Thickness (mm)	Compression Type	Ratio[a] (%)	Facet	Broken	Comment	Feature Type	Feature Age
379	7397	56-1	long/ slender	2.0	1.0	0.5	dorsoventral	50	equal	no	longitudinal striations	recessed hearth	A.D. 1010–1140
411	925	107-1	long/ slender	1.0	0.5	0.5	rounded	<25	equal	no		bell-shaped pit	1100–900 B.C.
724	818	99-1	short/ sturdy	1.0	0.5	0.5	rounded	<25	above embryo	yes		bell-shaped pit	post–A.D. 500
2157	6384	82-1	long/ slender	1.0	0.5	0.5	dorsoventral	<25	middle	no		pit structure	A.D. 935–1040
3976	5778	71-1	long/ slender	1.0	0.5	0.5	lateral	<25	equal	no		bell-shaped pit	1280–1010 B.C.
4120	2499	43-1	short/ sturdy	1.0	1.0	0.5	rounded	<25	middle	yes	possibly not grass	rock-lined roasting pit	post–A.D. 500
4220	11249	60-1	long/ slender	1.0	0.5	0.5	lateral	<25	equal	no		*horno*	post–A.D. 500
4326	5854	53-1	long/ slender	1.0	0.5	0.5	rounded	<25	equal	yes	possibly not grass	pit (conical)	A.D. 1–300
4660	9229	93-1	short/ sturdy	1.0	0.5	0.5	rounded	33	obovate	no		bell-shaped pit	post–A.D. 1
4871	6227	63-1	long/ slender	1.0	0.5	0.5	lateral	<25	equal	no	possibly not grass	bell-shaped roasting pit	A.D. 990–1160
5980	10775	102-1	long/ slender	1.0	0.5	0.5	lateral	<25	middle	no		bell-shaped pit	post–A.D. 1
		102-2	long/ slender	1.0	0.5	0.5	lateral	<25	middle	no		bell-shaped pit	post–A.D. 1
6171	10468	25-1	short/ sturdy	0.8	0.6	0.5	dorsoventral	<25	middle	yes	possibly not grass	bell-shaped pit	post–A.D. 700

Note: All grains were burned.

Key: PD = provenience designation.

[a] The ratio of the relative length of the embryo to the entire grain.

Table 177 are listed as tentative identifications; this means that although the item had a form consistent with that of a grass grain, we cannot say for certain that it belongs to the grass family. (Examples of confounding factors might be breakage or erosion.) Many different species of grasses seem to be represented, as the grass grains did not fall into any clear groupings.

Some of the grass grains recovered from the flotation samples likely correspond to grass family species recorded during the modern landscape study. We have listed native grasses from the modern landscape study in Table 178, along with our best guess as to their shape. Identification of archaeological grass grains is made difficult by the different morphological emphases in descriptions and depictions of the grains in the botanical literature. For example, the size of the palea and lemma (the two bracts covering a grass grain) are often helpful in identifying a modern grass plant, but these are rarely found in flotation samples because of their small size and delicate fabric. Some examples of archaeobotanical grass species from other sites in southern and central Arizona include wheatgrass (*Agropyron*), bromegrass (*Bromus*), lovegrass (*Eragrosti*s), little barley (*Hordeum*), panic grass (*Panicum*), and dropseed (*Sporobolus*) (Adams 2004:225; Bohrer 1970:415; Huckell 1995:83).

Many archaeological sites from southern Arizona and northern Mexico have yielded small, thin fragments of a "palisade"-celled material that appeared to be the coat of some seed, possibly in the squash family (Cucurbitaceae) (e.g., see Adams and Hanselka 2004; Huckell 1995:94; Mabry 2006b:19.3). These were referred to as "columnar celled seed coat fragments" (CCSCs), but no species was identified. During a late-summer site visit to the backfilled Mescal Wash excavations, melon-loco (*Apodanthera undulata*) was growing on the disturbed ground in copious amounts. Fruits were collected, and the seeds were examined under a microscope. The modern melon-loco seeds have several layers: a hard dry outer layer, then a palisade (columnar-celled) layer, then a fuzzy layer, then a papery green layer, then seed tissue. The unknown columnar-celled seed coat materials from the Mescal Wash site are 1.4 mm in thickness. The palisade layers of modern melon-loco seeds vary in thickness between 1.5 and 2.0 mm thick and appear to be a good match for the archaeological CCSCs. Based on this similarity, we believe that the CCSCs represent apodanthera seeds.

Wood and Other Nonreproductive Parts

The most-common woods found in the flotation samples and among the macrobotanical specimens were also the most-common types of trees and shrubs growing in the site area today (Table 179; see Table 176). The most-common charcoal types in the flotation samples were catclaw (*Acacia*), saltbush (*Atriplex*), juniper, and mesquite. Juniper and mesquite were prevalent in the macrobotanical samples. These trees and shrubs were complemented

Table 178. Native Grasses Found on the Modern Landscape near the Mescal Wash Site

Common Name	Taxon	Grain Shape
Arizona cottontop	*Digitaria californica*	short/sturdy
Bigelow bluegrass	*Poa bigelovii*	
Blue three-awn	*Aristida purpurea* var. *nealleyi*	long/slender
Bush muhly	*Muhlenbergia porteri*	long/slender (?)
California brome	*Bromus carinatus*	long/slender
Feather fingergrass	*Chloris virgata*	short/sturdy (?)
Low woollygrass	*Erioneuron pulchellum*	short/sturdy (?)
Mexican panic grass	*Panicum hirticaule*	short/sturdy
Needle grama	*Bouteloua aristidoides*	long/slender
Sacaton	*Sporobolus wrightii*	short/sturdy
Side-oats grama	*Bouteloua curtipendula*	long/slender
Six-weeks grama	*Bouteloua barbata*	long/slender
Six-weeks three-awn	*Aristida adscensionis*	long/slender
Squirreltail	*Elymus elymoides*	long/slender (?)
Streambed bristlegrass	*Setaria leucopila*	short/sturdy

Note: Shapes marked with a "?" are tentative identifications.

Table 179. Nonreproductive and Wood Taxa Present among the Macrobotanical Specimens

Common Name	Taxon	Parts
Cottonwood/willow-type	*Populus*/*Salix*-type	stem fragment, wood
Creosote bush–type	*Larrea*-type	stem, twig, and wood
Ironwood-type	*Olneya*-type	wood
Juniper-type	*Juniperus*-type	wood (charred, partially charred, and uncharred)
Mesquite-type	*Prosopis*-type	wood
Monocotyledon-type		stem fragment, tissue fragment
Pine-type	*Pinus*-type	wood
Reed-type	*Phragmites*-type	stem fragment

with mesic (damp) habitat taxa such as reed (*Phragmites*) and various grass family stems, presumably from the bottomlands of Cienega Creek.

One nonlocal wood was found in the archaeological sample that does not currently (and likely never did) grow in the larger Cienega Creek basin. Ironwood (*Olneya*) charcoal was found in macrobotanical specimens from each period except the Late Formative. (It was not found in any flotation samples.) Ironwood typically grows at elevations of 2,500 feet AMSL or lower (Kearney and Peebles 1960:442), which is over 1,000 feet below the elevation of the Mescal Wash site. We did not record any ironwood trees at the collection stops, which were at elevations of 3,600 feet AMSL or higher (see Appendix 9.A).

Interpreting the Plant Record

We will now examine how the plant data from the Mescal Wash site may address the research questions listed at the beginning of this chapter.

Question 1: Wild vs. Cultivated

The first question concerned the mix of wild and cultivated or encouraged plants at Mescal Wash, and whether we can detect changes through time in this mix. In the overall site record, reproductive parts from at least 5 native annual and 10 native perennial plants were found that hint at what wild plants were used as food (see Tables 174 and 176). Additionally, the residents grew corn/maize and cotton (*Gossypium*), and may have managed agave plants. The data also show at least 15 unique types of wood charcoal or tissue fragments, which most likely represent nonfood uses such as construction, fuel, and fiber use. Some of these plants (such as the grass stems, agave fibrovascular bundles, and sotol tissue) indicate both food and nonfood use.

Domesticates or Likely Managed Plants

Corn/maize cupules (the portion of cobs where kernels are attached) were found in 69 percent of the contexts (see Table 176). Approximately 60 corn/maize-type or cf. corn/maize kernels and fragments were found in the flotation samples, usually from extramural pit features, although slightly over half were collected from the floor of a single structure (Feature 200) in Locus A.

Cotton was also grown at Mescal Wash, although only one definite and one likely seed were found, both in Middle Formative period contexts at Locus C. One cotton-type seed was found in the hearth of a structure (Feature 995), and a cf. cotton seed was found in the recessed hearth of the large, possibly communal structure in Locus C (Feature 379). Cotton was mainly used for its fibers, but the Pima ate the seeds as lower-choice resources in famine times (Castetter and Underhill 1935:37; Rea 1991:5). It is uncertain whether Mescal Wash residents managed agave plants. This plant—abundant along Mescal Wash today—would have been an important resource for fibers as well as food. Agave plants had a low ubiquity in the flotation samples (see Table 176), but this is probably owing to our conservative approach to identifying plant tissues as agave in this analysis. Monocotyledon-type fibrovascular bundles, which probably include some agave tissue, had a ubiquity of 20 percent in the overall site record (see Table 176). The agave-type fibrovascular bundle fragments were found in a structure (Feature 2157 in Locus A) floor context, whereas the cf. agave fibrovascular bundle fragments were found in a bell-shaped pit, a cylindrical pit, a structure floor, and a structure hearth context. Monocotyledon-type fibrovascular bundles were found across many feature types, although in slightly more thermal feature contexts than nonthermal feature contexts (Table 180).

Wild-Plant Resources: Reproductive Parts

When considering reproductive parts from wild plants, it is helpful to divide them into two groups: annual/weedy

Table 180. Flotation Sample Ubiquity, by Feature Type

Common Name	Taxon	Parts	Ubiquity (%)											
			Thermal Features						Nonthermal Features					
			Firepit (n = 3)	Horno (n = 4)	Structure (Hearth) (n = 18)	Bell-Shaped Roasting Pit (n = 9)	Roasting Pit (n = 18)	Rock-Lined Roasting Pit (n = 7)	Bell-Shaped Pit (n = 20)	Pit (Basin) (n = 9)	Pit (Conical) (n = 2)	Pit (Cylindrical) (n = 4)	Structure (Floor) (n = 7)	Structure (Pit Fill) (n = 2)
Group 1 Fruits (Weedy/Annual)														
Cheno-am, amaranth, goosefoot	cheno-am, *Amaranthus*, *Chenopodium*	utricle, embryo, fragment	33	100	50	44	44	57	90	33	50	50	57	50
Goosefoot family–type	Chenopodiaceae-type	utricle	—	—	—	—	—	—	—	—	—	—	14	—
Melon-loco-type	*Apodanthera*-type	seed coat fragment	33	50	56	33	44	57	100	67	100	75	71	100
Purslane-type	*Portulaca*-type	seed	—	25	—	11	—	—	5	—	—	—	—	—
Squash-type	*Cucurbita*-type	rind fragment	—	—	6	33	—	14	—	—	—	25	—	—
Squash family–type	Cucurbitaceae-type	rind fragment	33	—	17	11	6	—	5	—	50	—	—	—
		seed	—	—	6	—	—	—	—	—	—	—	—	—
Tansy mustard–type	*Descurainia*-type	seed	—	—	—	—	—	—	—	—	—	—	14	—
Group 2 Fruits (Nonweedy/Perennial)														
Barrel cactus–type	*Ferocactus*-type	seed	—	—	—	—	—	—	5	—	—	—	—	—
Cactus-type	*Opuntia*-type	embryo, seed, fragment	—	—	11	—	6	28	20	—	—	—	14	—
California poppy–type	*Eschscholzia*-type	seed	—	—	6	—	—	—	—	—	—	—	—	—
Hedgehog cactus–type	*Echinocereus*-type	seed, fragment	—	50	6	11	17	—	40	22	—	—	28	—
Juniper-type	*Juniperus*-type	seed, fragment	—	—	—	—	—	—	5	—	—	—	14	—
Knotweed/canaigre-type	*Polygonum*/ *Rumex*-type	achene, fragment	33	—	—	11	11	28	5	—	—	—	14	—
Legume family–type	Fabaceae-type	seed	—	—	—	—	—	—	5	—	—	—	—	—

Common Name	Taxon	Parts	Ubiquity (%)											
			Thermal Features						Nonthermal Features					
			Firepit (n = 3)	Horno (n = 4)	Structure (Hearth) (n = 18)	Bell-Shaped Roasting Pit (n = 9)	Roasting Pit (n = 18)	Rock-Lined Roasting Pit (n = 7)	Bell-Shaped Pit (n = 20)	Pit (Basin) (n = 9)	Pit (Conical) (n = 2)	Pit (Cylindrical) (n = 4)	Structure (Floor) (n = 7)	Structure (Pit Fill) (n = 2)
Mesquite-type	*Prosopis*-type	seed, fragment	—	—	—	22	6	—	—	—	—	—	—	—
Saltbush-type	*Atriplex*-type	utricle	—	—	—	—	6	—	—	—	—	—	14	—
Thick-shelled-type nuts		nutshell fragment	—	—	—	—	—	—	5	—	—	—	—	—
Thin-shelled-type nuts		nutshell fragment	—	—	6	11	6	—	25	—	—	—	28	—
Unknown shell-type nuts		nutshell fragment	—	—	—	12	6	—	—	—	—	—	—	—
Yucca, banana yucca–type	*Yucca, Yucca baccata*–type	seed, fragment	—	—	—	11	—	—	15	—	—	—	—	—
	Mixed Group Fruits													
Grass family–type	Poaceae-type	caryopsis	—	25	6	—	—	—	25	—	—	—	14	—
Spurge family–type	Euphorbiaceae-type	seed	—	—	—	—	—	14	—	—	—	—	—	—
Sunflower family–type	Asteraceae-type	achene	—	—	—	—	—	—	—	—	—	—	—	50
Unknown		bud	—	—	—	11	—	—	5	—	—	—	—	—
		disseminule, fragment	—	25	17	44	28	—	40	—	50	50	71	—
		embryo	—	—	6	11	—	—	—	—	—	—	—	—
		reproductive part	—	—	—	—	—	—	—	—	—	25	—	—
		seed, seed coat, fragment	33	25	28	22	6	28	15	22	50	—	57	—
	Domesticated/Likely Managed Crops													
Agave-type	*Agave*-type	fibrovascular bundle fragment	—	—	—	—	—	—	—	—	—	—	14	—
Corn/maize	*Zea mays*	cupule, fragment	33	100	72	67	44	86	90	33	100	100	71	—
		kernel, embryo, fragment	—	—	—	—	—	28	10	11	—	—	28	—

continued on nex page

Common Name	Taxon	Parts	Ubiquity (%)											
			Thermal Features						Nonthermal Features					
			Firepit (n = 3)	Horno (n = 4)	Structure (Hearth) (n = 18)	Bell-Shaped Roasting Pit (n = 9)	Roasting Pit (n = 18)	Rock-Lined Roasting Pit (n = 7)	Bell-Shaped Pit (n = 20)	Pit (Basin) (n = 9)	Pit (Conical) (n = 2)	Pit (Cylindrical) (n = 4)	Structure (Floor) (n = 7)	Structure (Pit Fill) (n = 2)
Cotton-type	*Gossypium*-type	seed	—	—	6	—	—	—	—	—	—	—	—	—
	Woods and Vegetative Parts													
Black spherical-type		disseminule	—	25	—	11	—	—	—	—	50	—	—	—
Burrobush-type	*Hymenoclea*-type	twig, wood	—	—	6	11	—	—	5	—	—	25	14	—
Catclaw	*Acacia, Acacia greggii*	wood	—	25	22	—	22	28	35	11	50	25	28	—
Catclaw/mesquite-type	*Acacia*/ *Prosopis*-type	wood	—	—	11	11	6	—	—	—	—	—	—	—
Cottonwood/willow-type	*Populus*/ *Salix*-type	wood	—	—	6	—	—	—	—	—	—	—	28	—
Creosote bush–type	*Larrea*-type	wood	—	—	11	11	—	—	—	—	—	—	—	—
Dicotyledon-type		knot, twig, wood	33	50	44	44	50	43	85	89	—	100	57	50
Diffuse-porous-type		wood	—	—	11	33	—	—	—	11	—	—	—	—
Grass family–type	Poaceae-type	stem, stem segment fragment	—	25	39	22	28	28	20	11	50	25	43	100
Juniper-type	*Juniperus*-type	wood	33	—	28	11	17	28	20	33	—	25	28	—
Legume family–type	Fabaceae-type	bark, wood	67	100	39	22	89	71	70	22	100	75	57	50
Mesquite-type	*Prosopis*-type	knot, twig, wood	100	75	67	78	100	86	95	78	100	100	86	50
Monocotyledon-type		fibrovascular bundle fragment	—	50	17	33	33	14	—	22	—	—	43	50
		stem, stem segment fragment	—	100	44	22	22	28	25	33	—	50	86	50
		tissue fragment	—	—	28	33	17	14	20	11	50	25	43	100
Mycorrhizal fungus	*Cenococcum*-type	sclerotium	—	—	—	—	—	—	—	—	50	—	14	—
Palo verde/ mesquite–type	*Cercidium*/ *Prosopis*-type	wood	—	—	—	11	—	—	—	—	—	—	—	—

			Ubiquity (%)											
			Thermal Features						Nonthermal Features					
Common Name	**Taxon**	**Parts**	**Firepit (n = 3)**	**Horno (n = 4)**	**Structure (Hearth) (n = 18)**	**Bell-Shaped Roasting Pit (n = 9)**	**Roasting Pit (n = 18)**	**Rock-Lined Roasting Pit (n = 7)**	**Bell-Shaped Pit (n = 20)**	**Pit (Basin) (n = 9)**	**Pit (Conical) (n = 2)**	**Pit (Cylindrical) (n = 4)**	**Structure (Floor) (n = 7)**	**Structure (Pit Fill) (n = 2)**
Palo verde–type	*Cercidium*-type	wood	—	—	—	—	—	—	5	—	—	—	—	—
Pine-type	*Pinus*-type	wood	—	—	6	—	—	14	5	—	—	—	14	50
Reed-type	*Phragmites*-type	stem, stem segment fragment	—	—	11	—	—	—	—	—	—	—	14	—
Ring-porous-type		bark, wood	—	—	6	33	6	—	5	22	—	—	—	—
Saltbush-type	*Atriplex*-type	wood, twig	—	75	—	22	6	28	35	22	—	50	14	—
Silk tassel–type	*Garrya*-type	wood	—	—	6	—	—	—	—	—	—	—	14	—
Sotol-type	*Dasylirion*-type	tissue fragment	—	—	—	11	—	—	—	—	—	—	—	—
Termite-type		fecal pellet, fragment	—	—	—	—	—	—	5	—	50	—	—	—
Walnut-type	*Juglans*-type	wood	—	—	6	—	—	—	5	—	—	—	14	—
Yucca-type	*Yucca*-type	tissue fragment	—	—	6	—	—	—	—	—	—	—	28	—
Unknown		bark, knot, twig, wood	—	25	33	22	50	28	50	44	50	75	14	—
		epidermis fragment	—	—	—	11	—	14	—	—	—	25	14	—
		fecal pellet	—	—	—	—	—	—	5	—	—	—	—	—
		plant tissue fragment	67	100	72	56	33	43	60	56	50	100	57	—
		stem fragment	—	—	—	22	6	—	—	—	—	—	14	—
		unknown	33	100	44	67	—	—	75	78	50	75	86	—

plants (Group 1) and perennial plants (Group 2) (Adams 2004:226; Adams and Bowyer 2002). Annual plants are often "weedy" and are more sensitive to precipitation; in good years, they can provide abundant foods. Perennial plants are less sensitive to precipitation; their presence on the landscape is more stable, and their fruit production more predictable. Although annual plants are more commonly found in disturbed environments such as cleared ground, trash middens, and agricultural fields, perennial plants are usually found in established plant communities. Annual plants such as goosefoot or amaranth commonly produce prolific seeds and fruits that require less effort for gathering than perennial plants. Perennial plants, such as prickly pear and cholla fruits (which have spines) may require extra processing. Although they may take more effort, they are more dependable in years when annuals fail to produce.

Group 1 plants from the Mescal Wash site were dominated by a few taxa. Melon-loco and the cheno-ams were prevalent in 60 percent or more of the samples (see Table 176). Cheno-am seeds and greens were certainly eaten, and—based on the abundance of CCSCs in the flotation samples—so were melon-loco seeds. Melon-loco gourds have a bitter taste and the plant has a foul smell, but Lira and Caballero (2002:381) have mentioned that roasted melon-loco seeds are eaten in the Mexican state of Zacatecas. The seeds are very nutritious, being high in protein and fat, but need special processing to make them palatable (Bemis et al. 1967:2,637). If a suitable method of processing existed at Mescal Wash, they would have been a prolific food source.

Beyond these common plants, other annual/weedy plants were present in much lower amounts. These less ubiquitous plant taxa were squash family–type, squash, purslane (*Portulaca*), tansy mustard (*Descurainia*), and carpetweed (*Mollugo verticillata*). Apart from carpetweed, these lower-frequency plants have been recorded as foods by ethnobotanists (see Table 174). Carpetweed is a common agricultural weed growing along or on corn/maize and cotton fields and was probably not a food source (Chapman et al. 1974:412; Culpepper and York 2000; Davis 2008:505). The lower ubiquity of these plants suggests that they may not have been as important economically. In this way, the complement of Group 1 plants likely reflects both potential food uses, as well as the background disturbed environment of the settlement.

Reproductive parts from Group 2, the perennial plants, make up the other portion of the wild-plant resources. In this category, the most-common plants were cacti and nut-bearing trees. The parts include hedgehog cactus, prickly pear, and cholla seeds, along with thin-shelled-type nutshells (see Table 176). These represent baseline resources that the Mescal Wash residents could have relied on most years. Knotweed/canaigre (*Polygonum/Rumex*) achenes, mesquite seeds, and yucca seeds probably also represent food. Yucca fruits, named as an important food in the ethnobotanical literature (see Table 174), may have been underrepresented in the flotation samples for the same reasons mentioned previously for agave. In the modern landscape study (see Appendix 9.A), we recorded agave plants as most common, followed by yucca, with sotol as a distant third. Although it was not recorded at any collection stops, beargrass (*Nolina*) grows in the Mescal Wash immediate area, based on Karen Adams's previous observations. These plants are perennial sources of edible fruits and fibers and would have been important. We suggest that the monocotyledon tissues could represent any of the four taxa, including, in decreasing order of likelihood, agave, yucca, sotol, and beargrass.

Change in Diet through Time

Looking at how the Mescal Wash plant mix changed through time, two trends are apparent. The first trend is the consistent use of corn/maize through the Late Archaic, Early Formative, and Middle Formative periods (Table 181). Several AMS radiocarbon dates were measured for corn/maize fragments from Locus D. Of these, four nonthermal bell-shaped pits returned corn/maize dates from the Late Archaic period, with calibrated dates of 1060–880 B.C. (Feature 3557), 1280–1010 B.C. (Feature 3976), 620–590 B.C. (Feature 4849), and 1110–900 B.C. (Feature 5505) (see Table 4). Corn/maize cupules from Feature 3668 (a rock-lined roasting pit in Locus D) returned a calibrated AMS date of A.D. 770–980, corresponding to the Middle Formative A period. No corn/maize kernels or cupules were recovered from Late Formative period contexts (see Table 181), likely owing to the small sample size from this relatively sparse site component.

The second trend is a decline in the sample ubiquity of wild-plant resources through time (see Tables 176 and 181). As an example, grass family grains, of particular interest for the present study, peaked in the Late Archaic period (29 percent ubiquity) and declined thereafter. Other taxa that declined are melon-loco seed coat fragments, cheno-am seeds (utricles), hedgehog cactus seeds, thin-shelled-type nuts, and yucca seeds. Of note is an AMS date of 1100–900 B.C. obtained from melon-loco-type seed coats from another nonthermal bell-shaped pit in Locus D (Feature 411), indicating the early importance of this wild plant not previously recognized in macrobotanical collections. As the population peaked in the Middle Formative period, people may have chosen to concentrate on corn/maize; alternatively, the greater population may have made wild-plant resources scarcer. The decline in ubiquity affected both Group 1 and Group 2 plants. There is no visible diachronic pattern of Group 1 plants consistently rating high and Group 2 plants rating low, or vice versa. Instead, the frequency of individual Group 1 and Group 2 plants varied independently of the other members of their group.

Table 181. Flotation Sample Ubiquity of Taxa, by Time Period

Common Name	Taxon	Parts	Ubiquity (%)					
			Late Archaic (n = 6)	Early Formative (with Middle Formative Overlap) (n = 5)	Middle Formative[a] (n = 9)	Middle Formative A (n = 9)	Middle Formative B (n = 11)	Late Formative (n = 3)
Group 1 Fruits (Weedy/Annual)								
Cheno-am	cheno-am	utricle, embryo, fragment	83	60	67	78	27	33
Goosefoot family–type	Chenopodiaceae-type	utricle	—	—	—	—	9	—
Melon-loco-type	*Apodanthera*-type	seed coat fragment	100	40	53	67	45	100
Squash family–type	Cucurbitaceae-type	rind fragment	—	20	13	—	—	33
		seed	—	—	—	—	9	—
Squash-type	*Cucurbita*-type	rind fragment	—	40	7	11	9	—
Tansy mustard–type	*Descurainia*-type	seed	—	—	7	—	—	—
Group 2 Fruits (Nonweedy/Perennial)								
Barrel cactus–type	*Ferocactus*-type	seed	17	—	—	—	—	—
Cactus-type	*Opuntia*-type	embryo, seed, fragment	17	—	7	22	18	—
California poppy–type	*Eschscholzia*-type	seed	—	—	—	—	9	—
Hedgehog cactus-type	*Echinocereus*-type	seed, fragment	83	40	20	—	—	—
Juniper-type	*Juniperus*-type	seed, fragment	17	—	7	—	—	—
Knotweed/canaigre-type	*Polygonum*/ *Rumex*-type	achene, fragment	—	20	7	22	—	—
Mesquite-type	*Prosopis*-type	seed, fragment	—	20	—	—	—	—
Saltbush-type	*Atriplex*-type	utricle	—	—	7	—	—	—
Thick-shelled-type nuts		nutshell fragment	17	—	—	—	—	—
Thin-shelled-type nuts		nutshell fragment	50	20	20	—	—	—
Yucca, banana yucca–type	*Yucca*, *Yucca baccata*–type	seed, fragment	33	20	—	—	—	—
Mixed Group Fruits								
Grass family–type	Poaceae-type	caryopsis	33	—	—	—	18	—

continued on next pge

Common Name	Taxon	Parts	Ubiquity (%)					
			Late Archaic (n = 6)	Early Formative (with Middle Formative Overlap) (n = 5)	Middle Formative[a] (n = 9)	Middle Formative A (n = 9)	Middle Formative B (n = 11)	Late Formative (n = 3)
Spurge family–type	Euphorbiaceae-type	seed	—	—	—	11	—	—
Sunflower family–type	Asteraceae-type	achene	—	—	—	—	9	—
Unknown		bud	—	20	—	—	—	—
		disseminule, fragment	33	20	40	11	9	33
		embryo	—	—	7	—	—	—
		reproductive part	—	—	—	—	9	—
		seed, seed coat, fragment	17	20	47	33	9	33
Domesticated/Likely Managed Crops								
Agave-type	*Agave*-type	fibrovascular bundle fragment	—	—	—	—	9	—
Corn/maize	*Zea mays*	cupule, fragment	100	40	73	100	45	—
		kernel, embryo, fragment	17	—	7	11	9	—
Cotton-type	*Gossypium*-type	seed	—	—	—	—	9	—
Woods and Vegetative Parts								
Black spherical-type		disseminule	—	20	—	—	—	—
Burrobush-type	*Hymenoclea*-type	twig, wood	—	20	20	—	—	—
Catclaw	*Acacia*, *Acacia greggii*	wood	50	20	33	11	18	33
Catclaw/mesquite-type	*Acacia*/ *Prosopis*-type	wood	—	20	7	—	9	—
Cottonwood/willow-type	*Populus/Salix*-type	wood	—	—	20	—	9	—
Creosote bush–type	*Larrea*-type	wood	—	20	13	—	—	—
Dicotyledon-type		knot, twig, wood	83	60	67	56	55	67
Diffuse-porous-type		wood	—	40	7	—	18	—
Grass family–type	Poaceae-type	stem, stem segment fragment	17	20	47	22	45	33
Juniper-type	*Juniperus*-type	wood	—	20	27	22	18	—
Legume family–type	Fabaceae-type	bark, wood	100	40	53	44	45	67

Common Name	Taxon	Parts	Ubiquity (%)					
			Late Archaic (n = 6)	Early Formative (with Middle Formative Overlap) (n = 5)	Middle Formative[a] (n = 9)	Middle Formative A (n = 9)	Middle Formative B (n = 11)	Late Formative (n = 3)
Mesquite-type	*Prosopis*-type	knot, twig, wood	83	80	73	89	73	67
Monocotyledon-type		fibrovascular bundle fragment	—	20	13	11	36	100
		stem, stem segment fragment	—	20	73	22	73	33
		tissue fragment	17	20	27	11	55	67
Mycorrhizal fungus	*Cenococcum*-type	sclerotium	—	—	7	—	—	—
Palo verde/ mesquite–type	*Cercidium/ Prosopis*-type	wood	—	20	—	—	—	—
Pine-type	*Pinus*-type	wood	—	—	7	11	18	—
Reed-type	*Phragmites*-type	stem, stem segment fragment	—	—	13	—	18	—
Ring-porous-type		bark, wood	—	20	7	—	9	—
Saltbush-type	*Atriplex*-type	wood, twig	17	40	20	11	9	—
Silk tassel–type	*Garrya*-type	wood	—	—	7	—	9	—
Sotol-type	*Dasylirion*-type	tissue fragment	—	—	—	11	—	—
Termite-type		fecal pellet, fragment	17	—	—	—	—	—
Walnut-type	*Juglans*-type	wood	17	—	7	—	—	33
Yucca-type	*Yucca*-type	tissue fragment	—	—	7	—	—	14
Unknown		bark, knot, twig, wood	83	20	27	33	45	—
		epidermis fragment	—	20	7	11	—	—
		fecal pellet	17	—	—	—	—	—
		plant tissue fragment	50	40	67	67	64	67
		stem fragment	—	20	7	—	—	—
		unknown	100	40	53	78	55	33

[a] This column contains contexts that were dated to the Middle Formative period but could not be further specified to the Middle Formative A or B periods.

Another way of looking at the mix of wild plants is by comparing taxon diversity in successive periods. The reproductive taxa richness values of Early Formative, Early/Middle Formative transition, and Middle Formative period seeds were in line with the expected DIVERS-generated values (Figure 143). The Late Archaic and Late Formative period samples had much lower seed taxa richness than was expected; there is a less than 5 percent likelihood of seeing richness values as low as those observed for these two cases, given their sample sizes. Because the DIVERS test takes into account the small Late Archaic and Late Formative period sample sizes, this suggests that people at Mescal Wash were using fewer types of plants in the Late Archaic and Late Formative periods than they did in other periods. This could have been because they were carrying out different activities at the site or their cuisine involved a narrower range of plants. The dietary strategies for these two periods were probably different, however. The Late Archaic period richness value is only slightly less than the confidence interval, whereas the Late Formative period richness value is far below the confidence interval.

During the Early Formative and Middle Formative periods, the site residents used plant reproductive taxa as evenly as expected from the simulation data (Figure 144). The Middle Formative period samples had higher evenness than would be expected, based on sample size (less than 5 percent likelihood). This could mean that the Middle Formative period diet involved a broader range of plants. The Late Archaic and Late Formative period plant remains showed lower evenness than would be predicted, with a less than 5 percent likelihood of getting this result, based on sample size. This suggests that at that time people concentrated on a few food taxa. The high ubiquity of corn/maize cupules in the Late Archaic period contexts suggests a focus on maize, but the ubiquity of wild-plant resources is also highest at this time (see Table 181). The driving force behind the evenness values appears to be the disproportionately high number of melon-loco seed coat fragments recorded for the Late Archaic and Late Formative periods.

Wood Use Change through Time

The people at Mescal Wash used three principal types of wood, catclaw, mesquite, and saltbush, the mix of which did not change significantly over time (see Table 181). Using DIVERS, most of the taxon richness values for the flotation samples were lower than would be expected 95 percent of the time because of their sample size (Figure 145). The exception to this was the heavily sampled Middle Formative period, in which 12 different types of charcoal were found in the flotation samples. When evenness values were considered, the Late Archaic, Early Formative, and Late Formative period samples were all within the expected range (Figure 146). The Middle Formative period wood taxa had higher evenness than would be expected, whereas the Early/Middle Formative period samples had lower evenness than expected. This suggests that the Middle Formative period residents of the site used a broader selection strategy for nonfood plants than their counterparts in other time periods. The Middle Formative period was the time when the site population was greatest, thus is it possible that they were beginning to put stress on their surrounding resources. The high evenness of the Middle Formative period represents a departure from the wood-use strategies of the Early/Middle Formative, where mesquite seems to have been preferred over other woods. The absence of ironwood wood from the flotation samples supports the argument that the wood may have served specialized purposes and was not a frequent source of firewood and construction timber. Even if it does not grow in the Mescal Wash area, it would have been a useful material, because ironwood wood makes excellent tool handles (Curtin 1984:93). Although the wood is dense and heavy to carry, people might have been willing to make strategic trips to lower elevations to procure the wood. Additionally, because the Mescal Wash site may have been a place frequently visited by other people, the ironwood wood could have been brought by the visitors as part of their own toolkits or for trade with Mescal Wash site residents.

Question 2: Availability of Plants through Time

The possible shifts in wood use between the Early Formative and the Middle Formative periods lead into our second question, whether we can make any inferences about plant availability through time. We examine this issue from several angles: wood use, food use, landform/mobility, and comparisons with the modern landscape.

Availability of Wood through Time

The people living at Mescal Wash do not seem to have depleted their surrounding wood resources. If they had done so, a decline in desirable taxa would be expected. A desirable wood might be one that has properties suiting it for a particular use, such as sturdiness or resistance to insects (for construction) or producing an even flame (for fuel, such as mesquite). Additionally, we might expect ubiquity to vary between time periods. If deforestation had occurred, one might expect to see an increase in the number of shrubby woods like saltbush, burrobush (*Hymenoclea*), and creosote bush (*Larrea*). These three shrubby taxa were found in the flotation samples but not in a manner indicating a lack of more-desirable woods in the landscape (see Table 181). For example, saltbush and creosote bush

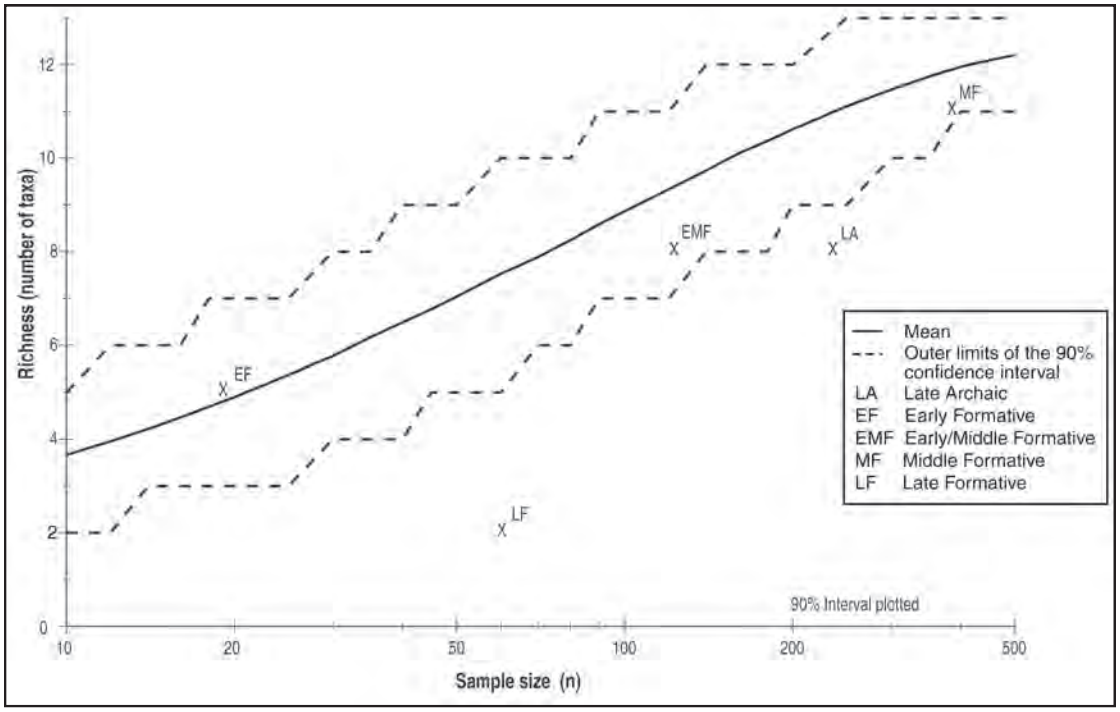


Figure 143. Richness for Mescal Wash site reproductive taxa, by time period. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall.

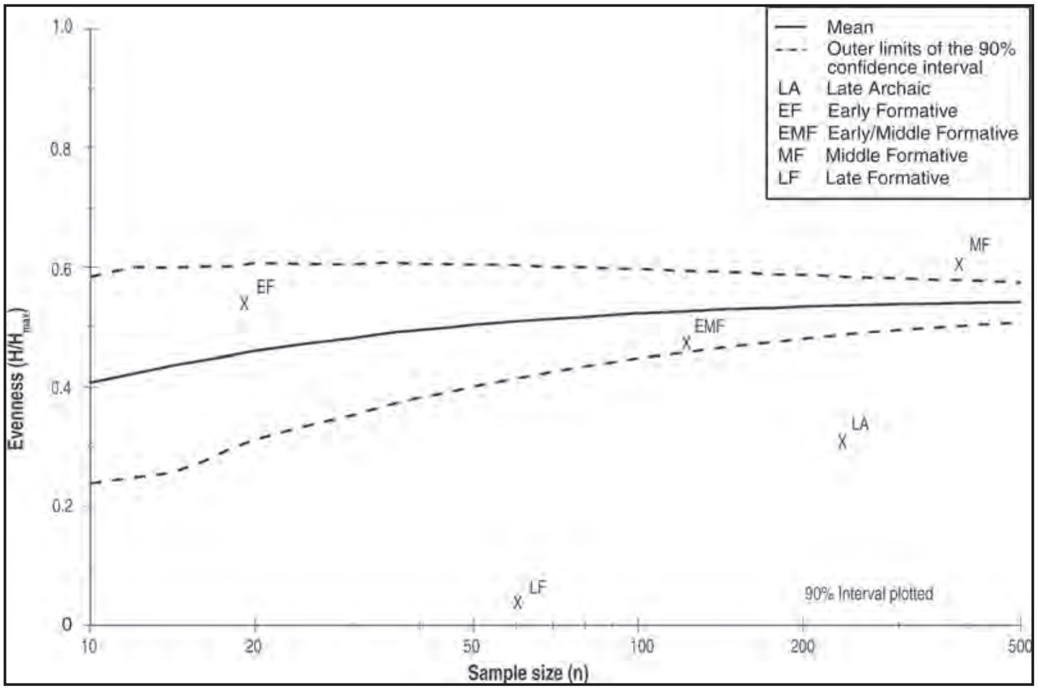


Figure 144. Evenness for Mescal Wash site reproductive taxa, by time period. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall. Evenness (H/H_{max}) is based on the Shannon index, which measures how evenly the members of population are distributed among possible categories of membership.

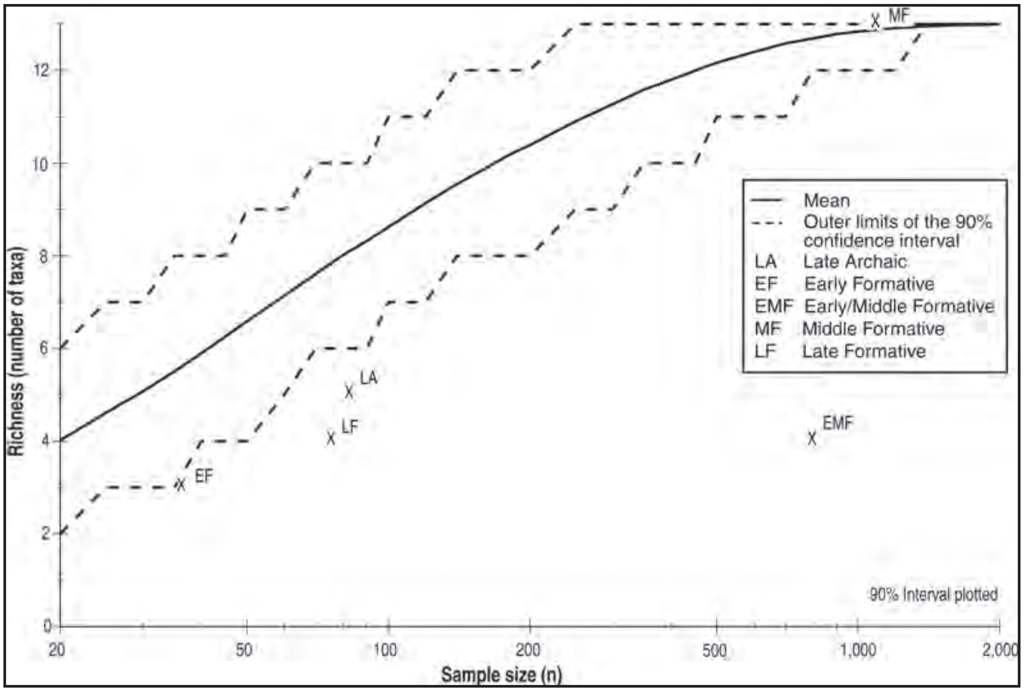


Figure 145. Richness of Mescal Wash site nonreproductive and wood taxa, by time period. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall.

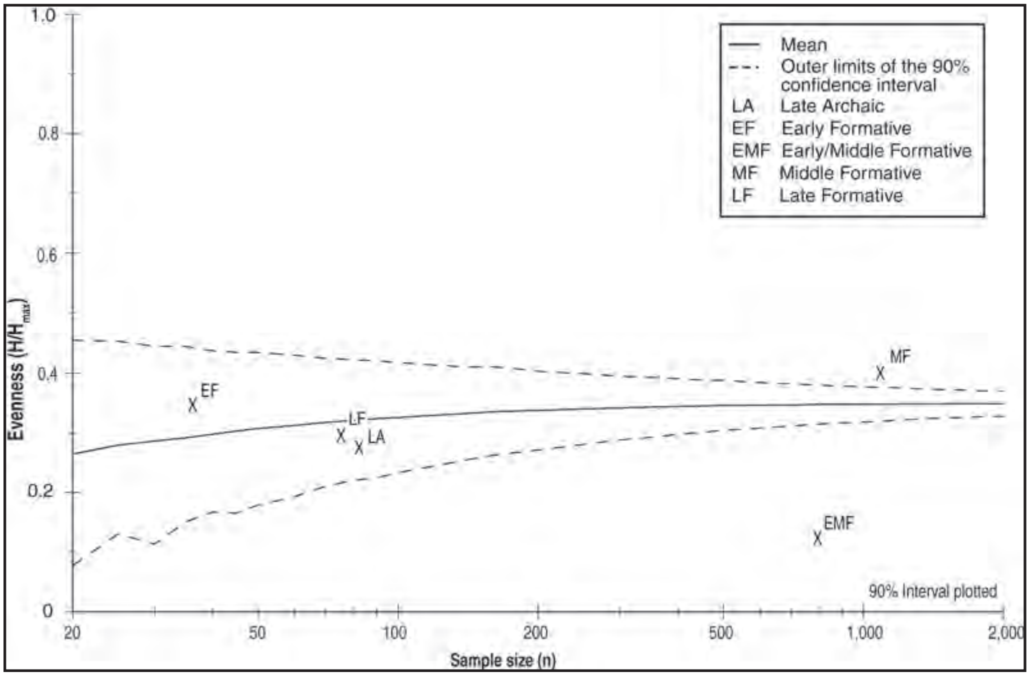


Figure 146. Evenness of nonreproductive and wood taxa, by time period. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall. Evenness (H/H_{max}) is based on the Shannon index, which measures how evenly the members of population are distributed among possible categories of membership.

ubiquity peaked in the samples that overlapped the Early/Middle Formative period. Catclaw wood ubiquity declined over time, but at the same time, mesquite ubiquity stayed relatively constant. Based on the assumption that desirable woods should have higher ubiquity rates, we assume that catclaw and mesquite were desirable at Mescal Wash, because they had higher ubiquity rates in the Late Archaic and Early Formative periods. Although their ubiquity rates decreased in the Middle Formative period, the tree species do not seem to have been completely eradicated from the landscape. It seems that instead of indicating depletion, the differences in richness and evenness between the Early/Middle Formative and the Middle Formative periods suggest that people were expanding the number of wood taxa they used.

Sustainability of Food Taxa through Time

It is harder to determine whether certain plant foods were ever depleted in the site area. If the Group 2 plants were less-desirable food sources because they required more effort to harvest and process, then we would expect their use to increase in times of plant resource scarcity. Still, evidence for depletion of food resources in the site area is inconclusive. The ubiquity measures for Group 2 taxa varied through time, but not in any consistent way that would indicate a trend of resource depletion (see Table 181). Instead, the data most likely reflect the varied everyday diets and periodic scarcity caused by drought and other factors. As mentioned above, ubiquities of both Group 1 and Group 2 reproductive parts decreased over time, but these taxa did not disappear completely (see Table 181). Perhaps, given the diversification of wood use along with the increased evenness of food taxa in the Middle Formative period, people were broadening their plant selections in order to help preserve the local ecosystem.

Landform Use

By comparing the plants identified on the modern landscape and in the archaeobotanical record, we can see that the Mescal Wash inhabitants utilized plants from many different landforms (Table 182; see Table 173). The 21 taxa listed in Table 173 fall into two categories. The first set of plants are those found in only one location, whereas the second set are found on multiple landforms. The large number of widely distributed plants shows the richness of the area as a whole. People at Mescal Wash could have easily utilized many different plant resources without having to travel long distances. An exception was ironwood wood, which was acquired by making trips to much lower elevations.

Table 182. Potential Habitats of Plants Found in the Archaeobotanical Samples but Not Observed in the Modern Landscape Study Area

Common Name	Taxon	Bare Ground	Upland Terraces	Slopes	Floodplains/ Riparian	Cultivated
Barrel cactus–type	*Ferocactus*-type			X	X	
Carpetweed-type	*Mollugo verticillata*–type	X	X	X	X	
Corn/maize	*Zea mays*					X
Cotton-type	*Gossypium*-type					X
Ironwood-type	*Olneya*-type				X	
Juniper-type	*Juniperus*-type		X	X		
Knotweed-type	*Polygonum-type*	X	X			
Palo verde–type	*Cercidium*-type		X	X	X	
Pine-type	*Pinus*-type		X			
Purslane-type	*Portulaca*-type	X	X	X	X	
Reed-type	*Phragmites*-type				X	
Silk-tassel–type	*Garrya*-type			X	X	
Sotol-type	*Dasylirion*-type			X		
Walnut-type	*Juglans*-type				X	
Yucca, banana yucca–type	*Yucca*, *Yucca baccata*–type		X	X	X	

Sources: Kearney and Peebles (1960); efloras.org (2010).

Ancient and Modern Landscape

The fourth and final aspect of Question 2 concerns the similarities and differences between the ancient and the current landscape at Mescal Wash. Plant taxa present in the archaeobotanical record but not found during the modern landscape study are listed in Table 182. When taken together, the list of plant remains from the excavations shows a varied prehistoric environment generally similar to the environment today. It appears that the area (i.e., Cienega Creek) was wetter in prehistoric times than it was in 2001, because many of the prehistoric taxa not found in the modern study are plants that grow in riparian habitats (see Table 182). Although Cienega Creek was dry at the collection stops when we visited them, the water table was higher during prehistory. During most of the nineteenth century, the Cienega Creek basin was still a broad, grassy valley with a perennial stream along its axis (Huckell 1995:20). Areas of ponded water were surrounded by lush patches of riparian vegetation, the *cienegas* that gave the valley its name. Today, even in dry months, bedrock formations often force water to the surface in an area just northwest of the confluence with Mescal Wash (Pima Association of Governments 2003:11).

The ancient environment also had different agricultural areas and mixes of disturbance weeds. Cotton seeds and corn kernels in the archaeobotanical assemblages suggest that there were fields in the vicinity of the Mescal Wash site, likely on the Cienega Creek floodplain. These fields, along with middens and other disturbed areas on the site itself, would have provided good habitat for plants that favor churned up ground, such as carelessweed, melon-loco, and carpetweed.

Question 3: Seasonality

The array of archaeobotanical seeds and nonreproductive plant tissues overwhelmingly indicate site use during the summer and fall months (see Table 174). Of the fruits and seeds available only during portions of the year, the vast majority were available in the summer and fall. People could have lived at the site in the winter and spring months by subsisting on stored agricultural and wild-plant products. Indeed, numerous storage pits at the site were already in use by the Late Archaic period. For comparison, many of the archaeobotanical plants found at Mescal Wash also were found at Snaketown, a known permanent settlement. For example, prickly pear, cholla, squash, goosefoot, tansy mustard, mesquite seeds, and grass family grains were common at both sites (Bohrer 1970). One difference is that the Snaketown assemblage contained spring season fruits such as cocklebur (*Xanthium*) seeds and summer fruits, such as saguaro (*Carnegiea*) (Bohrer 1970:414). In summary, people were definitely at Mescal Wash in the summer and fall. However, the evidence is inconclusive as to whether the site was occupied during the winter and spring. When seasonality was compared by time period, the same overall patterns held.

Question 4: Interlocus Variation

All but one of the analyzed flotation samples came from Loci A, C, and D (see Table 169). We found that the basic suite of plants used in each locus was the same, although the relative ubiquity varied (Table 183). We will first discuss the spatial variation of reproductive taxa and then the spatial variation of woody and vegetative taxa.

Interlocus Variation in Reproductive Taxa

Across each locus, the top-ranked reproductive taxa by ubiquity were consistently corn/maize, melon-loco, cheno-ams, hedgehog cactus, prickly pear, and cholla, although there was some variation between the loci (see Table 183), notably in the amount of corn/maize. Corn/maize cupules had ubiquities of 84, 74, and 45 percent in Loci A, D, and C, respectively. Despite the low ubiquity in Locus C, corn/maize cupules were the most-prevalent reproductive taxa in all three loci. In addition to the spatial patterning of corn/maize ubiquity, the loci commonly differed in the lower-ubiquity seeds, such as squash, tansy mustard, and thin-shelled-type nuts (which probably represent pine and oak), and yucca. For example, squash-type rind fragments had a higher ubiquity in Locus A than in Locus D, and mesquite seeds were only recovered in Locus D but not in other loci. Yucca seeds were found only in Locus D, whereas yucca tissue was only found in a flotation sample from Locus C. On the other hand, grass family grains, stems, and stem segments were evenly distributed among the loci, varying between 4 and 9 percent ubiquity for grains and 25 and 36 percent ubiquity for stems and stem pieces. Monocotyledon fibrovascular bundle fragments, which probably include agave fibers charred in roasting, were present at Loci A, C, and D with percent ubiquity ranging from 16–32.

When the reproductive taxa assemblages from each locus were compared with simulated random assemblages using DIVERS, Locus C stood out from the others. Locus C had lower richness than would be expected for its sample size, whereas the other loci were within the 90 percent confidence interval (Figure 147). When evenness was considered, the three loci assemblages were all within the expected range by sample size, but it is possible that the comparatively large seed counts from Locus D weighted the results (Figure 148). In case the results were skewed by

Table 183. Ubiquity of Taxa from the Flotation Samples, by Locus

Common Name	Taxon	Parts	Ubiquity (%)				
			Locus A (n = 17)	Locus B (n = 1)	Locus C (n = 22)	Locus D (n = 69)	All Loci (n = 109)
	Group 1 Fruits (Weedy/Annual)						
Carpetweed-type	*Mollugo verticillata*-type	seed	—	100	—	—	1
Cheno-am	cheno-am	utricle, embryo, fragment	41	—	36	71	59
Goosefoot family–type	Chenopodiaceae-type	utricle	6	—	—	—	1
Melon-loco-type	*Apodanthera*-type	seed coat fragment	47	—	36	77	63
Purslane-type	*Portulaca*-type	seed	—	—	—	4	3
Squash family–type	Cucurbitaceae-type	rind fragment	6	—	9	7	7
		seed	—	—	4	—	1
Squash-type	*Cucurbita*-type	rind fragment	12	—	—	7	6
Tansy mustard–type	*Descurainia*-type	seed	—	—	—	1	1
	Group 2 Fruits (Nonweedy/Perennial)						
Barrel cactus–type	*Ferocactus*-type	seed	—	—	—	1	1
Cactus-type	*Opuntia*-type	embryo, seed, fragment	—	—	18	12	11
California poppy–type	*Eschscholzia*-type	seed	—	—	4	—	1
Hedgehog cactus–type	*Echinocereus*-type	seed, fragment	18	—	14	20	18
Juniper-type	*Juniperus*-type	seed, fragment	—	—	—	3	2
Knotweed/canaigre-type	*Polygonum/Rumex*-type	achene, fragment	—	—	4	12	8
Legume family–type	Fabaceae-type	seed	—	—	—	1	1
Mesquite-type	*Prosopis*-type	seed, fragment	—	—	—	7	5
Saltbush-type	*Atriplex*-type	utricle	—	—	—	3	2
Thick-shelled-type nuts		nutshell fragment	—	—	—	1	1
Thin-shelled-type nuts		nutshell fragment	6	—	—	13	9
Unknown shell-type nuts		nutshell fragment	—	—	4	1	2
Yucca, banana yucca–type	*Yucca*, *Yucca baccata*-type	seed, fragment	—	—	—	6	4
	Mixed Group Fruits						
Grass family–type	Poaceae-type	caryopsis	6	—	4	9	7
Spurge family–type	Euphorbiaceae-type	seed	—	—	—	1	1
Sunflower family–type	Asteraceae-type	achene	—	—	4	—	1
Unknown		bud	—	—	4	1	2
		disseminule, fragment	18	—	18	33	28
		embryo	—	—	—	3	2
		reproductive part	6	—	—	—	1
		seed, seed coat, fragment	29	—	18	22	22
	Domesticated/Likely Managed Crops						
Agave-type	*Agave*-type	fibrovascular bundle fragment	6	—	—	—	1
Corn/maize	*Zea mays*	cupule, fragment	82	—	45	75	70

continued on next page

Common Name	Taxon	Parts	Ubiquity (%)				
			Locus A (n = 17)	Locus B (n = 1)	Locus C (n = 22)	Locus D (n = 69)	All Loci (n = 109)
		kernel, embryo, fragment	12	—	4	6	6
Cotton-type	*Gossypium*-type	seed	—	—	4	—	1
	Woods and Vegetative Parts						
Black spherical-type		disseminule	6	100	—	3	4
Burrobush-type	*Hymenoclea*-type	twig, wood	6	—	4	6	6
Catclaw	*Acacia*-type	wood	24	—	27	19	21
Catclaw/mesquite-type	*Acacia/Prosopis*-type	wood	12	—	4	1	4
Cottonwood/willow-type	*Populus/Salix*-type	wood	18	—	—	1	4
Creosote bush–type	*Larrea*-type	wood	6	—	4	1	3
Dicotyledon-type		knot, twig, wood	70	—	50	61	60
Diffuse-porous-type		wood	12	—	4	4	6
Grass family–type	Poaceae-type	stem, stem segment fragment	35	—	36	25	28
Juniper-type	*Juniperus*-type	wood	18	—	23	23	22
Legume family–type	Fabaceae-type	bark, wood	47	—	82	58	61
Mesquite-type	*Prosopis*-type	knot, twig, wood	88	—	82	88	86
Monocotyledon-type		fibrovascular bundle fragment	24	—	32	16	20
Monocotyledon-type		stem, stem segment fragment	76	—	50	22	36
Monocotyledon-type		tissue fragment	29	—	32	20	24
Mycorrhizal fungus	*Cenococcum*-type	sclerotium	6	100	4	—	3
Palo verde/mesquite–type	*Cercidium/Prosopis*-type	wood	—	—	4	1	1
Palo verde–type	*Cercidium*-type	wood	—	—	—	—	1
Pine-type	*Pinus*-type	wood	12	—	9	1	5
Reed-type	*Phragmites*-type	stem, stem segment fragment	18	—	4	—	4
Ring-porous-type		bark, wood	12	—	9	7	8
Saltbush-type	*Atriplex*-type	wood, twig	29	—	14	22	21
Silk tassel–type	*Garrya*-type	wood	—	—	4	1	2
Sotol-type	*Dasylirion*-type	tissue fragment	—	—	—	1	1
Termite-type		fecal pellet, fragment	—	—	—	3	2
Walnut-type	*Juglans*-type	wood	6	—	—	3	3
Yucca-type	*Yucca*-type	tissue fragment	—	—	4	3	3
Unknown		bark, knot, twig, wood	41	—	41	38	39
		epidermis fragment	6	—	—	4	4
		fecal pellet	—	—	—	1	1
		fruit	—	—	—	1	1
		plant tissue fragment	70	100	45	61	60
		stem fragment	6	—	4	4	5
		unknown	59	—	36	75	64

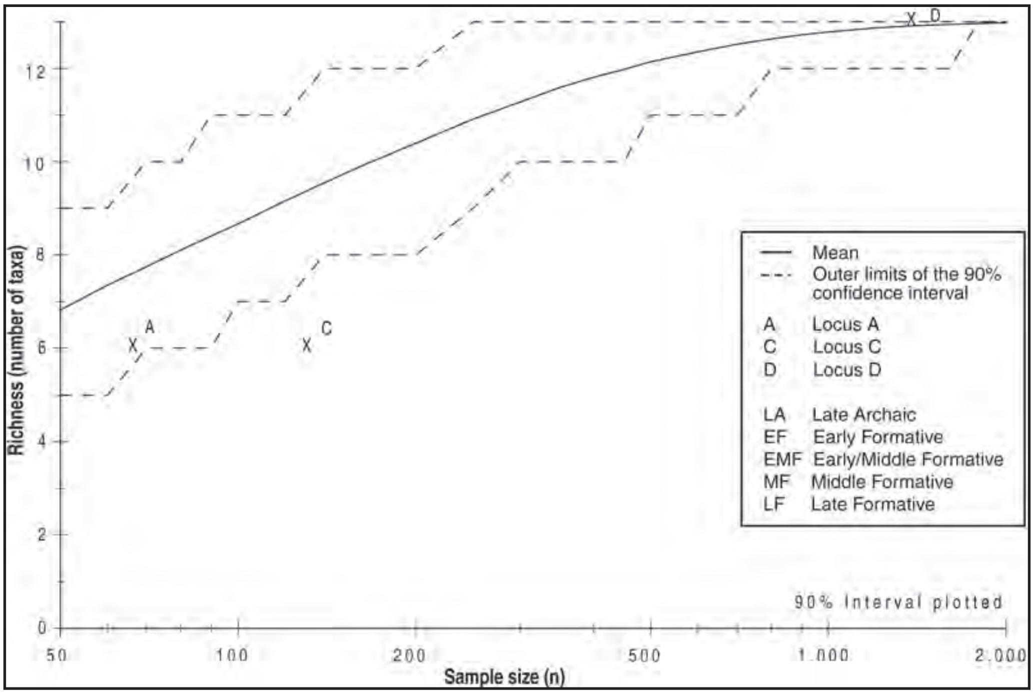


Figure 147. Diversity of Mescal Wash site reproductive taxa, by locus. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall.

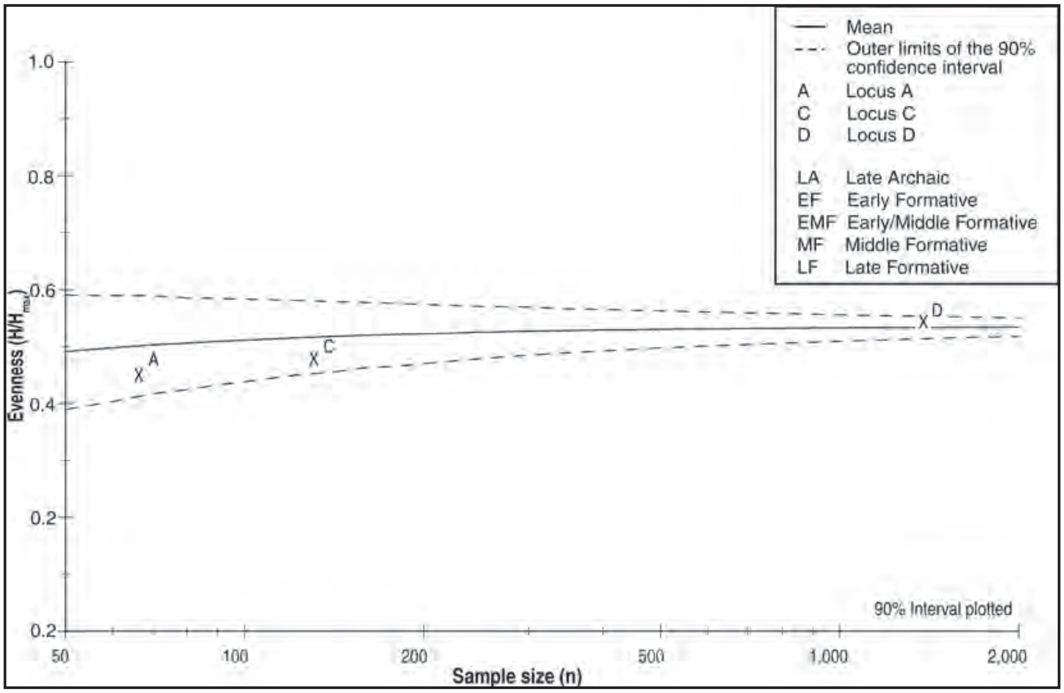


Figure 148. Evenness of reproductive taxa, by locus. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall. Evenness (H/H_{max}) is based on the Shannon index, which measures how evenly the members of population are distributed among possible categories of membership.

the inclusion of the large number of samples from Locus D, we also compared the richness of seed taxa from Locus A and Locus C apart from Locus D. Locus A and Locus C both had 6 reproductive taxa, as compared to the 13 taxa found in Locus D. Comparing only Locus A and Locus C did not greatly change the results. Locus C was still quite low compared to the simulated assemblages, although in the second trial, the lower 5 percent confidence interval line intersected the Locus C richness value. Thus, it seems that fewer plants were used in Locus C than in Loci A and D, although the inhabitants did not concentrate on any particular plant.

Interlocus Variation in Nonreproductive and Wood Taxa

Just as we asked whether reproductive taxa (which probably represent food use) varied between the loci, we also asked whether the nonreproductive and wood taxa (which probably represent fuel, tool, and construction materials) varied between the loci. We found that people in all three loci used the same nonreproductive and wood taxa (see Table 183). Grass family stems and other types of monocotyledon tissue, along with mesquite, catclaw, and saltbush, were highly ranked in terms of ubiquity. Of the wood taxa, only mesquite is abundant in the area today. Sparse catclaw was found at Stop No. 4 (a steep slope on the south side of Mescal Wash), and sparse saltbush was found at Stop No. 2 (the bottomlands of Mescal Wash). Thus, it seems that catclaw and saltbush were more widely available in the area prehistorically than today.

The inhabitants of each site locus seem to have collectively used the same group of plants, although the relative amounts of the basic taxa differed (see Table 183). When we compared the complements of nonreproductive and wood taxa from each locus with simulated random assemblages in DIVERS, the results for each locus were quite different. The number of plant taxa at Locus A was within expected ranges, whereas the evenness of use was slightly higher than the 90 percent confidence interval for the sample size (Figures 149 and 150). At Locus C, there were fewer nonreproductive and wood taxa than would be expected, based on the sample size. The site's inhabitants concentrated only on a few of the taxa that were used, resulting in lower evenness than would be expected, based on the sample size. Because Loci A and C were roughly contemporaneous, this suggests that different wood and vegetative part strategies were used in each area. In Locus A, there appears to have been no preference, or the use of preferred taxa was somehow restricted or conserved. In Locus C, some plant taxa appear to have been clearly preferred over others. People in Locus D used fewer nonreproductive and wood taxa than would be expected 95 percent of the time. Locus D had proportionally more evenness

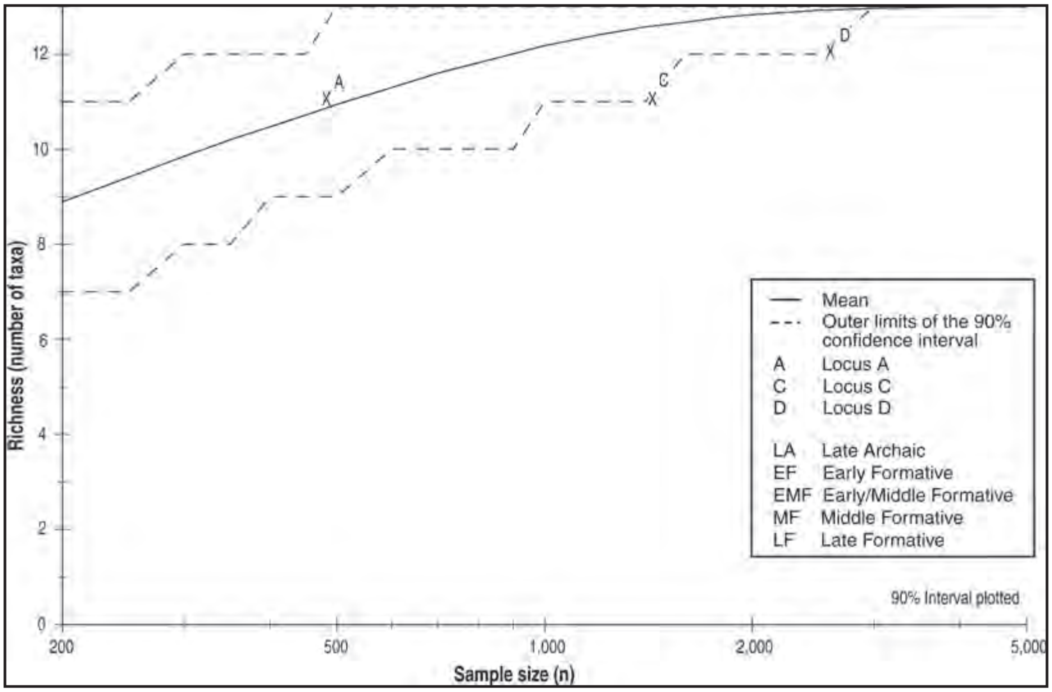


Figure 149. Richness of nonreproductive taxa and woods, by locus. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall.

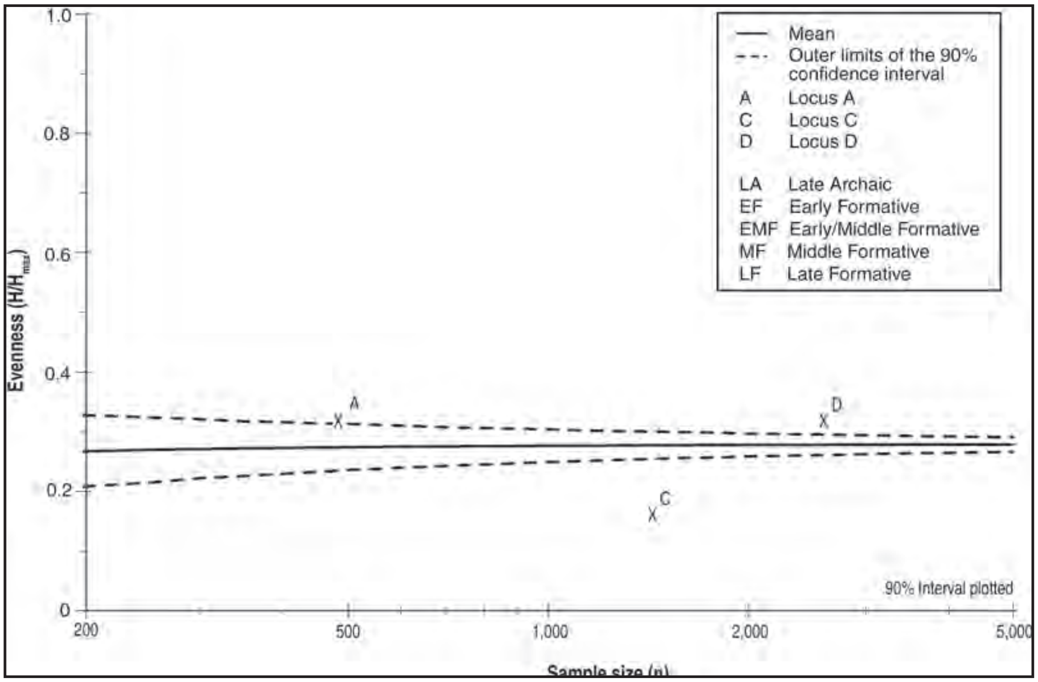


Figure 150. Evenness of nonreproductive taxa and woods, by locus. Note that sample size is represented on a logarithmic scale. The 90 percent confidence interval represents the boundaries of the area where 90 percent of the simulated assemblages fall. Evenness (H/H_{max}) is based on the Shannon index, which measures how evenly the members of population are distributed among possible categories of membership.

than expected, based on sample size, than Locus C. This may be accounted for by changes in wood and vegetative part use through time, as Locus D had a longer occupation history than the other loci, including Locus C.

Question 5: Differences by Feature Type

Did different feature types contain different plant remains? The flotation samples from Mescal Wash came from various types of features, although some of these types were only represented by one sample (see Table 171). In this section, we will look at plant remains from the various intra- and extramural pit features, ignoring the few samples from structure fill. Nonthermal bell-shaped pits—likely used as storage facilities—were the most-sampled feature type. Also well sampled were bell-shaped roasting pits and other roasting pit types including *hornos* (large pits greater than 1 m in diameter, ethnographically used for communal agave roasting), rock-lined roasting pits, and “basic” roasting pits (less-formally prepared, of varying sizes and shapes and possibly used on the household level rather than community level). For more information on the various feature types, the reader is referred to Chapter 1, this volume.

When we consider plant use by feature type, the principal plant types remain the same, but some small patterns emerge that would have been invisible when grouping samples by time or by locus. The most-common reproductive taxa in the overall archaeobotanical assemblage were corn/maize, apodanthera, and hedgehog cactus (see Table 176). For the purposes of examining feature uses, if one temporarily considers these principal taxa as “background noise” of everyday life, some other reproductive taxa appear to be linked to specific feature use (see Table 180), including thin-shelled nutshells and prickly pear and cholla. Pieces of thin-shelled nutshell probably represent oak and pine nutshell discarded into trash pits or fires. The nutshell in the thermal features could also represent nut roasting or nutshell from a boiling pot that foamed over while extracting nut oils. Similarly, some prickly pear and cholla seeds were found in structure hearths, possibly as a result of people singing off the spines on the prickly pear and cholla fruit.

We will now look at the plant remains per the most-common feature types, starting with nonthermal features, followed by thermal features.

Nonthermal Features

Bell-Shaped Pits

Twenty-one flotation samples were chosen for analysis from nonthermal bell-shaped pits, 19 of which were from Locus D (see Table 172). Reproductive taxa such as apodanthera-type seed coat fragments, cheno-ams, and corn/maize cupules were common (see Table 180). Hedgehog cactus–type seeds, juniper-type seeds, prickly pear– and cholla-type seeds, grass family grains, thin-shelled nutshells, yucca seeds, and corn/maize kernels were present in moderate amounts. Other taxa were present in rare amounts, present in only one sample from this feature type (Feature 2157). Because bell-shaped pits were likely used for storage but ultimately also for trash disposal, the high richness of taxa present in bell-shaped pits is probably owing to the accumulated debris left from daily activities being swept up and deposited into the pits. The grass family grain ubiquity was highest in bell-shaped pits, when nonthermal contexts are considered. Based on ethnographic records, grass stems were used to line storage pits, but because these grains are charred, they probably were modified elsewhere before being deposited into the bell-shaped pits.

The wood and vegetative taxa from the bell-shaped pits are very similar to the overall site collection. This also is most likely a reflection of their use as trash receptacles. Mesquite was the most common wood, followed by saltbush and catclaw (see Table 180). Grass family and monocotyledon stem fragments, along with juniper-type wood, were present in moderate amounts.

Basin-Shaped Pits

Nine flotation samples were analyzed from basin-shaped nonthermal pits in Loci A, C, and D (see Table 171). The few reproductive plant taxa found were the most-common plants overall (apodanthera, corn/maize, and cactus [*Opuntia*]); very few minor taxa were found at all. Mesquite was the dominant wood taxon, followed by juniper, saltbush, and catclaw (see Table 180). Overall, the basin-shaped pits are very similar in archaeobotanical terms to the bell-shaped pits. Judging by the rarity of reproductive taxa, it may be that the refuse dumped into the basin-shaped pits was not from food-production activities. Although the sample size is smaller than that of the bell-shaped pits, it should still have been large enough to capture some of the variation in taxa.

Cylindrical Pits

Nonthermal cylindrical pits were represented by four flotation samples from Loci A, C, and D. Only the top reproductive taxa from the overall site (corn/maize cupules, apodanthera, cheno-ams, and squash-type rind fragments) were found in the samples (see Table 180). Similarly, the most-common woods and vegetative taxa in the cylindrical-pit samples were also the most-common taxa overall (mesquite, saltbush, monocotyledon stem fragments, and catclaw, in descending order). The low incidence of reproductive plant taxa in the features suggests that cylindrical pits were not associated with food production.

Structure Floors

Seven flotation samples from Loci A and D structure floors were analyzed to inform on activities within the houses. Along with those from bell-shaped pits, the structure floor samples were the most diverse of the nonthermal contexts. Alongside the usual top reproductive taxa, many rare taxa with a ubiquity of one or two samples were recovered, including saltbush, tansy mustard, and juniper seeds, a grass family grain, and knotweed/canaigre achenes (see Table 180). Given these infrequent recovery rates, these taxa were not important food sources, but they are helpful in understanding the ancient plant landscape.

The woods and vegetative parts from the structure floors inform on indoor activities as well (see Table 180). Agave and monocotyledon fibrovascular bundle fragments and yucca tissue fragments likely represent the use of plant fibers for cordage and other household purposes. Taxa such as cottonwood/willow (*Populus/Salix*) wood, reed stem fragments, and grass family stem fragments may represent construction materials (see Table 174). Mesquite, catclaw, and juniper were common in the structure floor contexts, as they were in other contexts. These could represent either firewood or construction materials.

Thermal Features

Hornos

Four flotation samples were examined from three *hornos* excavated in Loci A, C, and D. Although we did not find plant remains specifically identified as agave, it is clear that the *hornos* were used for specialized roasting purposes. Although the overall taxa richness was low, there was a comparatively high ubiquity (50 percent) of monocotyledon-type fibrovascular bundle fragments in the samples (see Table 180). This monocotyledon fiber ubiquity was the highest of all the feature types at Mescal Wash. As we described earlier in this report, it can be difficult to distinguish among the members of Agavaceae, which include agave, sotol, beargrass, and yucca. The heads of the first three plants have been recorded in the ethnobotanical literature as having been roasted in large pits. The plants being roasted in the Mescal Wash *hornos* could represent any of these three. One grass family grain was found in the samples, along with grass family stem fragments (see Table 177). These may have been added to the *hornos* as a lining material. The diversity of woods in the *hornos* was low; this could be owing to the small sample size, but it could also reflect the specialized use of the feature.

Mesquite, saltbush, and catclaw were the most-common woods in *horno* contexts. Because *hornos* may have served communal purposes, the firing of an *horno* would have required advanced planning, including the stockpiling of wood. In this way, diversity of taxa would be lower, because it does not reflect a cumulative assemblage of wood gathering over a longer time.

Bell-Shaped Roasting Pits

Bell-shaped roasting pits generally date to the earlier portions of the occupation, and all analyzed samples from this feature type came from Locus D. In total, we examined flotation samples from eight bell-shaped roasting pits. It is unclear whether they were former bell-shaped nonthermal pits that were reused for roasting or were originally dug to be roasting pits. Bell-shaped roasting pits appear to have been used for preparing a broad variety of plants (see Table 180). Sotol tissue found in one pit probably represents roasting of the heads. Yucca seeds represent potential fruit roasting in the bell-shaped pits. Monocotyledon tissue, stem fragments, and fibrovascular bundle fragments may be related to agave, beargrass, sotol, and yucca. Another possible use could have been for roasting mesquite pods. Mesquite seeds had a 38 percent ubiquity in bell-shaped roasting pits contexts, the highest of any feature type. Castetter (1935:44) has reported that the mesquite beans were pit-roasted by the Pima for making pinole.

The vegetative and wood parts found in the bell-shaped roasting pits represent a large number of plants as well. Mesquite, saltbush, and juniper were common, but rarer taxa such as burrobush and creosote bush were also present (see Table 180). Grass family stem segments were present in 25 percent of the features, which may represent grasses used to line the sides of the roasting pits or may have been left over from lining of the pits if they were used for storage.

Basic Roasting Pits

Eighteen flotation samples were analyzed from as many basic roasting pits in Loci A, C, and D. The reproductive taxa found in the roasting-pit samples include the typical top seeds and fruits (melon-loco seed coat fragments, cheno-ams, and corn/maize cupules). These plants were found in slightly lower ubiquity when compared with structure hearth contexts, which suggest that they were probably not used for everyday food preparation. Corn/maize kernels were found in two basic roasting pits but not in any other thermal feature type, suggesting that the roasting pits may have been used for roasting corn/maize. Additionally, one feature contained mesquite seeds, which may indicate bean roasting similar to the bell-shaped roasting pits. We did not find any grass family grains in the basic roasting pits.

Woods and vegetative taxa in basic roasting pits were slightly less diverse than noted for the bell-shaped roasting pits and the structure hearths; we did not find the lower-ubiquity taxa in these roasting pits. Instead, mesquite, catclaw, and juniper were the dominant wood types. Monocotyledon-type fibrovascular bundle fragments, stem fragments, and grass family stem fragments were present at ubiquity levels similar to other thermal feature types. Roasting-pit-type features may have been used for roasting of agave or other monocots, but the case is not as clear for basic roasting pits as for bell-shaped roasting pits and *hornos*.

Rock-Lined Roasting Pits

Seven flotation samples were analyzed from seven rock-lined roasting pits in Loci C and D, with the majority from Locus D (see Table 171). The reproductive taxa have low richness (see Table 180). Corn/maize cupules, apodanthera, and cheno-ams had the highest richness values, with moderate amounts of prickly pear– and cholla-type seeds and knotweed/canaigre achenes. Squash-type rind fragments and spurge family (Euphorbiaceae) seeds appeared in one sample each. Prickly pear and cholla seeds have a higher ubiquity in rock-lined roasting pit samples than in other thermal feature types, thus it is possible that people were roasting cholla buds in some of the pits. When woods and vegetative parts from rock-lined roasting pits are considered, the usually dominant taxa (catclaw, saltbush, juniper, and mesquite) were present but without many of the lower-ubiquity woods. Pine-type wood was found in one sample, though. Monocotyledon tissues, such as fibrovascular bundles and stem fragments, were present in the rock-lined roasting pit samples but at lower ubiquity levels than other types of roasting pits.

Structure Hearths

Eighteen structure hearth samples from Loci A, C, and D yielded a moderate variety of reproductive plant taxa. Corn/maize cupules, melon-loco seed coat fragments, and cheno-am seeds were most common, with a complement of rarer seeds present in very low ubiquity, such as squash seed and rind fragments, California poppy (*Eschscholzia*) and cactus seeds, and a single grass family grain. Although the features were probably used for food preparation, the richness of individual plant species is lower in structure hearths than in the bell-shaped pits. This may be owing to the cumulative effect of multiple trash dumpings into a bell-shaped pit, whereas a structure hearth may only contain the remains of uses since the last cleaning.

Unlike the reproductive taxa, structure hearths had a diverse array of woods and vegetative parts. Mesquite, juniper, and catclaw were common woods (see Table 180). Similar to structure floor contexts, there was a comparatively high ubiquity of monocotyledon stem, tissue, and fibrovascular bundle fragments, along with grass family stem fragments. These probably represent construction and fiber usages.

Conclusions

We analyzed 112 flotation samples (light fractions) and over 200 macrobotanical specimens from the Mescal Wash site. The people at Mescal Wash consistently supported themselves with a diet of corn/maize, cheno-ams, melon-loco seeds, cactus (prickly pear, cholla, hedgehog cactus, and barrel cactus [*Ferocactus*]), squash, and thin-shelled nuts. In addition, we found grass family grains, which indicated that they were utilizing wild cereals for food, in particular during the Late Archaic period. There is indirect evidence based on preserved charred fibers and direct evidence from seeds that they also utilized members of Agavaceae for food, including agave, sotol, beargrass, and yucca. Over time, the mix of plants changed, although none of these new plants played a large role in the diet. Fewer types of plants were used during the Late Archaic and Late Formative periods than in other periods. Relative amounts of Group 1 (annual/weedy) and Group 2 (perennial) plants varied through time but not in any consistent way that would suggest food stress. Over time, however, the Mescal Wash site residents tended to eat more Group 2 plants, such as cacti and nuts. For their fuel and construction needs, the people of Mescal Wash focused on a few main types of wood and nonreproductive taxa. Over time, they consistently used mesquite, saltbush, grass family, and monocotyledon tissues such as agave and yucca.

Besides the overall patterns of plant use, there are several highlights worth mentioning. The first is the high ubiquity of corn/maize in the Late Archaic period samples. Corn/maize cupules were found in all Late Archaic period flotation samples, indicating that even at this early stage of domestication, maize was fully integrated into the Mescal Wash cuisine.

Also conspicuous is the sparseness of securely identified agave remains from the site. The low ubiquity of agave and its sister plants sotol, beargrass, and yucca is surprising given the common presence of agave and yucca near the site today. One factor that may account for this is the conservative approach taken in identifying tissues potentially belonging to Agavaceae, only labeling them as agave or sotol if they met specific identification criteria. Because of this, there is a high probability many of the specimens currently identified as monocotyledon belong to these other taxa. The high ubiquity of monocotyledon remains in flotation samples from *hornos* confirms that these features were used for the roasting of Agavaceae members. Bell-shaped roasting pits had the clearest evidence for roasting of Agavaceae, with both yucca seeds and sotol tissue identified.

Solving the mystery of the CCSCs is a major accomplishment of this analysis. Until now, archaeobotanists have been unsuccessful in identifying similar fragments. We believe that the fragments found at Mescal Wash and other sites are consistent with the morphological characteristics of melon-loco seeds. We came to this conclusion after measuring seed coats collected from melon-loco plants growing on the backfilled site surface. Still, we are unsure why these seeds appear in such high ubiquity in the Mescal Wash samples. Normally, if other plant taxa appeared with such high ubiquity, we would suggest that the plant was an important economic resource. Yet, melon-loco plants have a particularly bitter taste, which would hardly make them desirable as a food source, at least if they were used like other squashes. But as discussed above, their seeds are high in protein and fat, and ethnographically they are roasted and eaten in Mexico. If the seeds are indeed such a good source of nutrition, their ubiquity in the Mescal Wash samples is less surprising.

Another important facet of our analysis pertains to the grass family remains. We documented grass remains from several different feature types across the site and described the grains according to several morphological attributes. Although we were unable to identify any of them to species level, our descriptions should contribute to reaching this goal in the future. The key to identifying them will be to find corresponding morphological measurements on grains from known grasses. We also conducted a modern landscape study to identify plants that might have been available to site residents. The ancient plant community was similar to what is found today, with the notable exception that the higher water table in Cienega Creek promoted a greater diversity of riparian taxa such as noted in the archaeobotanical record. Woods such as cottonwood/willow found in the site's samples were not found during the modern plant study. Cotton seeds found in the flotation samples are another indicator of wetter conditions, as this plant requires copious amounts of water. Based on the plant remains, we can say that Mescal Wash was definitely inhabited in the summer and fall, likely inhabited during the spring, and possibly inhabited during the winter.

Finally, we looked at sustainability and whether there was any evidence of plant resource depletion. Given the site's longevity and use by various different groups of people, the greater site location may have been a common or shared area for resource use. Sometimes common areas are exploited to the point that the resources are damaged, as notoriously described in Hardin's (1968) "tragedy of the commons." However, we did not find evidence for resource depletion at Mescal Wash. The data from the flotation samples do not show an increase of shrubby taxa in any particular time period that would indicate deforestation. There may have even been a wider complement of trees and shrubs on the landscape than exists today, based on the common presence of catclaw wood in the samples. During the Middle Formative periods, when the population was at its peak, the archaeobotanical data show that although the people at Mescal Wash widened the number of plant taxa that they used, they still had the same types of plants available to them as in other periods. As a common area, Mescal Wash appears to have been used in a sustainable manner over its entire lifespan.

CHAPTER 10

Pollen Analysis

Susan J. Smith

The Mescal Wash site has preserved an archaeological record of what Vanderpot and Altschul (2007) called a persistent place. Over the course of the nearly 3,000-year history of human presence at Mescal Wash from approximately 1300 B.C. to A.D. 1450 (see Chapter 2, this volume), it was used by many generations of travelers and residential farmers. A major draw of the site was the presence of water for agriculture and wildlife, as well as a patchwork of overlapping ecosystems that supported diverse native botanical resources (see Chapter 9 and Appendix 9.A, this volume).

The Mescal Wash pollen sample set consisted of 52 archaeological samples from 24 structures and 11 extramural features (Table 184) excavated in three loci (Loci A, C, and D) that span four chronological periods (Table 185). Another 8 samples were analyzed from offsite alluvial and *cienega* deposits along Cienega Creek and Mescal Wash to help address questions about the site's paleoenvironment (discussed further by Homburg and Pearthree in Volume 3).

Archaeopalynology is an imprecise discipline because of the uncertain source of any recovered pollen no matter how protected the context. Experimental data show that each harvested plant species registers differentially in the archaeological record and that there is a component of "other" pollen types that attach to gathered materials (Geib and Smith 2008). These other taxa represent the atmospheric pollen rain and vegetation at collecting sites and can be more abundant in samples than pollen from harvested plants. In this analysis, a select suite of pollen types is interpreted to represent economic resources. The occurrence and abundance of these economic taxa are examined for temporal patterns that might relate to changes in resources or processing technologies and contextual patterns that might inform on how space was used. The results from the *cienega* profiles are interpreted for any environmental signals and are presented in a separate section.

Methods

Subsamples (20 cc) were collected from the 60 sediment samples and, prior to processing, a known concentration (25,084 grains) of club moss spores (*Lycopodium*) was added to monitor degradation from the extraction procedure and to enable pollen-concentration calculations. The samples were then processed by the method recommended by Smith (1998) with the addition of timed decants as described below.

The samples were pretreated with hydrochloric acid (10 percent solution) to dissolve caliche and sieved through a 180-µm-mesh stainless steel screen to remove coarse material (rocks, roots, charcoal, etc.). The fine fractions were mixed with 20 ml of warm sodium hexametaphosphate (less than 2 percent solution) and 1,000 ml of hot distilled water and then allowed to settle for 8 hours. After 8 hours, the muddy liquids were decanted. The timed decants were repeated using only distilled water until liquids were clear after the 8-hour settling time. The technique is an efficient, nontoxic method to remove clay-sized organic and inorganic particles and concentrate pollen. After the settling cycles, samples were soaked overnight in hydrofluoric acid (49 percent solution), followed by a density separation in lithium polytungstate (1.9 specific gravity) and acetolysis, which reduces plant lignin and other organic materials. The recovered residues were rinsed in alcohol, transferred to one dram vials, and stored in glycerol.

Pollen assemblages were identified by counting transects on microscope slides at 400× magnification to a 200-grain sum, if possible, followed by scanning the entire slide at 100× magnification to record additional taxa. Aggregates (clumps of the same pollen type) were counted as 1 grain per occurrence, and the taxon and size (number of grains in a clump) were tallied separately. Numerous large

Table 184. Distribution of Archaeological Pollen Samples, by Locus and Context

Context	Locus A (Middle Formative Period)		Locus C (Middle Formative Period)		Locus D (Late Archaic/Late Formative Period)		Total No. of Samples
	No. of Structures or Features	No. of Samples	No. of Structures or Features	No. of Samples	No. of Structures or Features	No. of Samples	
				Structures			
Pole-and-brush structures	—	—	—	—	3	4	4
Pit structures	3	5	6	15	9	10	30
Adobe structures	—	—	—	—	3	7	7
				Extramural Features			
Hearths	—	—	1	1	—	—	1
Bell-shaped pits	—	—	—	—	7	7	7
Non–bell-shaped pit	—	—	1	2	1	1	3
Total	3	5	8	18	20	29	52

Table 185. Number of Dated Features at Mescal Wash with Analyzed Pollen Samples

Context, by Locus	Late Archaic Period	Late Archaic/Early Formative Period	Early Formative/Middle Formative Period	Middle Formative Period	Late Formative Period
A					
Pit structures	—	—	—	3	—
C					
Pit structures	—	—	—	6	—
D					
Pole-and-brush structures	—	3	—	—	—
Pit structures	—	—	7	2	—
Adobe structures	—	—	—	—	3
Extramural bell-shaped pits	4	1	—	—	—
Number of features	4	4	7	11	3

aggregates in protected archaeological contexts can reflect immature flowers and plant processing (Gish 1991) and also indicate local onsite plants, because aggregates are less easily transported than single grains.

Pollen identifications were made to the lowest taxonomic level possible based on published keys (Kapp et al. 2000; Moore et al. 1991) and the Laboratory of Paleoecology pollen reference collection at Northern Arizona University. Sunflower family pollen was differentiated into six distinct types: sunflower family (high-spine Asteraceae), ragweed/bursage (low-spine *Ambrosia*), sagebrush (*Artemisia*), a long-spine type that may represent sunflower (cf. *Helianthus*), an unknown composite with broad spines, and chicory tribe (Liguliflorae). The chicory type represents genera such as wild lettuce (*Lactuca*) and dandelion (*Taraxacum*). Three types of cactus pollen were identified: cholla, prickly pear, and cactus family. The cactus family type encompasses saguaro (*Carnegiea*), hedgehog cactus (*Echinocereus*), barrel cactus (*Ferocactus*), and other cacti.

Three numerical measures were calculated from the data: pollen percentages, taxa richness, and pollen concentration. Pollen percentages represent the relative importance of each taxon in a sample ([pollen counted ÷ pollen sum] × 100) and taxa richness is the number of different pollen types identified per sample. Pollen concentrations estimate the absolute abundance or density of pollen contained in sample sediments. Concentrations are calculated by taking the ratio of the pollen count to the tracer count and multiplying by the initial tracer concentration. Dividing this result by the sample volume yields the number of pollen grains per cubic centimeter (gr/cc).

Analytical Methods

The sources of archaeological pollen, even when recovered from the most-protected contexts, consist of a mix of environmental pollen rain and pollen resulting from cultural activities. Thus, archaeological assemblages require interpretation to tease out the most-probable economic taxa. In this analysis, economic taxa are defined as cultigens and known wild-food staples, such as cacti and mesquite. However, simple presence or absence measures are not adequate to examine the abundant pollen types. For high-count pollen types, numerical filters were applied based on the average pollen concentration calculated from samples with significant counts. Samples with concentrations greater than the numerical filter were separated and analyzed for patterns by context and time.

Results

Fifty-six of the Mescal Wash samples produced significant counts ranging from 97–520 pollen grains. Four of the samples were evaluated sterile, which is defined as an assemblage containing too few pollen grains to represent a statistically significant pollen population. The sterile samples included PDs 5034 and 7420 from two pit-structure hearths (Features 4683 and 379, respectively), PD 10128 from the base of a pit structure storage pit (Feature 6129), and PD 10606 from an adobe-structure floor (Feature 10781). The sterile samples were excluded from the analysis except for calculations of ubiquity of economic taxa.

The pollen counts are documented in Appendix 10.A. The results from the archaeological samples are presented below followed by discussion of the *cienega* profiles.

Mescal Wash Archaeological Features

The archaeological samples are characterized by abundant pollen and diverse assemblages, which is attributed to the long cultural history and natural diversity of environments at Mescal Wash. The average pollen concentration from the 52 archaeological samples is 24,232 gr/cc (with a range 1,391–163,046 gr/cc) and the average taxa richness is 9.3 taxa per sample (with a range of 1–19 taxa per sample). Thirty-nine pollen types were identified (Table 186) and seven taxa produced aggregates (Table 187).

Crane's bill (*Erodium*) is present in 19 percent of the archaeological samples and may reflect mixing or contamination of subsurface sediments with historical-period pollen. Although there are native species, the introduced crane's bill (*Erodium cicutarium*) is widespread and common today across the U.S. Southwest.

Three cultigens were identified: maize, squash, and cotton. Maize was identified in 69 percent of the Mescal Wash samples and aggregates of maize pollen were documented in 25 percent of the samples. The highest counts of maize are from Feature 2160, a pit structure in Locus A, and three pit structures (Features 379, 995, and 6098) in Locus C. Squash was identified in only three samples—samples from two pit structures in Locus D (Features 3817 and 3869) and one hearth sample from Feature 6098 in Locus C. Five samples yielded cotton pollen and three of the five samples are from Middle Formative period Locus C features (Table 188). Because fewer samples were analyzed from Locus C than Locus D (see Table 184), the spatial distribution is notable and suggests possible cotton specialization in Locus C.

Four of the five samples with cotton pollen were from hearths (see Table 188), which indicates some cotton product was cooked or heated. Cotton seeds with their high oil content are a valuable food and some Mexican tribes ate the green bolls, which are reported to have a sweet flavor (Huckell 1993b:175–176). Cotton was also important in ceremony and ritual. It was often used as a symbol for clouds and rain, the fibers decorated ceremonial cigarettes, prayer sticks, masks, and other ceremonial items, and the Hopi placed cotton over the faces of deceased persons as a symbol of their transformation to clouds (see Huckell 1993b:177). Cotton is an insect-pollinated plant that produces small amounts of poorly dispersed pollen (McGregor 1976:172), and based on these limitations, it is unlikely that substantial amounts of cotton pollen would persist on seeds. Products such as green bolls or even cotton flowers may have been the materials processed in Mescal Wash hearths.

In addition to the three cultigens, the pollen data are interpreted to record several native food plants, especially cholla, prickly pear, general cactus family, mesquite, paloverde, and cattail. Cacti, mesquite, and paloverde were key resources valued by all of the southern desert cultures (Hodgson 2001). Cattail pollen is evidence for prehistoric *cienega* environments near the site, and the plant was also undoubtedly utilized. Every part of cattail is edible or useful for matting and textiles; even the pollen was used for food (Moerman 1998:572–576). Cattail was identified in four of the Mescal Wash samples: floor samples from structure Features 200, 6098, and 4729 and a sample from pit Feature 3876.

Table 186. Pollen Types Identified from Archaeological Contexts, Ecological and Cultural Significance, and Sample Ubiquity

Common Name	Taxon	Ubiquity (% of 52 Samples
	Cultigens	
Maize	*Zea*	69
Squash	*Cucurbita*	6
Cotton	*Gossypium*	10
	Native Desert Resources	
Mesquite	*Prosopis*	6
Prickly pear	*Platyopuntia*	48
Cholla	*Cylindropuntia*	44
Cactus family	Cactaceae (including saguaro [*Carnegiea*], hedgehog cactus [*Echinocereus*], and others)	15
Paloverde	*Cercidium*	19
Hackberry	*Celtis*	2
Ocotillo	*Fouquieria*	2
	Riparian	
Willow	*Salix*	2
Cattail	*Typha*	8
	Native Weeds, Herbs, Grasses, and Shrubs	
Cheno-am	Chenopodiaceae-*Amaranthus* (including saltbush [*Atriplex*], goosefoot [*Chenopodium*], amaranth [*Amaranthus*], and others)	100
Tidestromia	*Tidestromia*	21
Sunflower family	Asteraceae (including brittlebush [*Encelia*], desert broom [*Baccharis*], and others)	94
Long-spine sunflower type	cf. *Helianthus*	2
Ragweed/bursage	*Ambrosia*	64
Unknown sunflower type (Asteraceae) with broad-based spines		2
Grass family	Poaceae	77
Globemallow	*Sphaeralcea*	4
Spiderling	*Boerhavia*	56
Summer poppy	*Kallstroemia*	23
Mallow family	Malvaceae	4
Mustard family	Brassicaceae	12
Mint family	Lamiaceae (including chia [*Salvia*])	8
Buckwheat	*Eriogonum*	56
Spurge family	Euphorbiaceae	31
Evening primrose	Onagraceae	19
Pea family	Fabaceae	2
Indian wheat	*Plantago*	6
Thistle	cf. *Cirsium*	2
Chicory tribe	Liguliflorae (including wild lettuce [*Lactuca*], dandelion [*Taraxacum*], and others)	12
	Exotic	
Crane's bill	*Erodium*	19

Common Name	Taxon	Ubiquity (% of 52 Samples
	Extralocal–Regional Woodland Trees and Shrubs	
Pine	*Pinus*	56
Juniper	*Juniperus*	15
Oak	*Quercus*	4
Sagebrush	*Artemisia*	2
Mormon tea	*Ephedra*	4
Rose family	Rosaceae	6

Table 187. Ubiquity of Pollen Aggregate Taxa from Archaeological Samples

Common Name	Taxon	Ubiquity (% of 52 Samples)
Maize	*Zea*	25
Cactus family	Cactaceae	2
Grass family	Poaceae	4
Cheno-am	Chenopodiaceae-*Amaranthus*	75
Cheno-am aggregates (>50 grains)		15
Sunflower family	Asteraceae	14
Tidestromia	*Tidestromia*	4
Spiderling	*Boerhavia*	8

Table 188. Cotton Pollen in Mescal Wash Samples

Feature No., by Locus	Feature type	Context	Period
A			
2160	pit structure	floor sample	Middle Formative
C			
7195	extramural hearth	base of hearth	not determined
6098	pit structure	floor around recessed hearth	Middle Formative
6129	pit structure	base of hearth	Middle Formative
D			
4768	pit structure	base of hearth	Middle Formative

Other potential economic taxa represented in single samples include hackberry, ocotillo, willow, and the long-spine type sunflower (possible *Helianthus*). There are also low frequencies of taxa such as mint family, mustard family, and Indian wheat (*Plantago*), all of which are late winter and early spring annuals widely exploited for greens and seeds. Two additional pollen types are emphasized here as possible economic taxa: cheno-am and grass.

The most-abundant pollen type across all contexts is cheno-am. Single grain cheno-am percentages ranged from 44 to 90 percent of pollen sums (average 69 percent; n = 48 samples) and cheno-am aggregates are common; 38 of the 48 samples with counts (79 percent ubiquity) contained cheno-am aggregates, and 8 samples contained aggregates of greater than 50 grains. Such a strong signature suggests an ethnobotanical resource, but it is difficult to assess cultural use of cheno-am, especially in alluvial settings such as along Mescal Wash and Cienega Creek, where natural high percentages of cheno-am are typical (see Solomon et al. 1982). In this analysis, a cheno-am filter was defined as 19,000 gr/cc, which is the average concentration from the 48 samples with significant counts rounded to the nearest 1,000 grains. Samples with concentrations greater than the numerical filter were evaluated as high representation. A filter for cheno-am aggregates was also applied using 50 grains as a cut off for large aggregates.

Grasses are another pollen category for which it is difficult to differentiate between cultural and natural expressions in archaeological samples. Grasses were used for several practical products such as padding, packaging, tinder, thatch, and textiles, as well as the seeds for food (Doebley 1984; Moerman 1998). In this analysis, a numerical filter for grass pollen was defined as 600 gr/cc, which is the average grass concentration rounded to the nearest 100 grains (n = 48 archaeological samples with significant counts).

The suite of economic pollen taxa defined above were examined for contextual patterns using just the data from pit structures and extramural, nonthermal bell-shaped pits (Table 189), which were the most intensively sampled contexts. Fill samples from pit structures produced the highest frequencies of three of the key economic pollen types (maize, cholla, and prickly pear), and the highest representations of crane's bill and cheno-am pollen. This signature is interpreted as refuse dropped into abandoned house depressions and the action of sheetwash and wind reworking surface materials into the depressions. Pit-structure fill was apparently an optimal habitat for cheno-am weeds, and the disturbed soils may also have been susceptible to bioturbation, which might explain how exotic crane's bill became mixed into the fill. Structure floors and hearths preserved the strongest signal of cultural activities with the most

Table 189. Contextual Patterns from Pit Structures (Excludes Adobe and Pole-and-Brush Structures) and Extramural Bell-Shaped Pits

	Pit Structures				Bell-Shaped Pits
	Floor	Hearth	Storage Pit	Fill	
Number of samples	11	8	6	5	7
Average pollen concentration (gr/cc)[a]	17,840	14,987	17,102	28,772	46,404
Average taxa richness[a]	11.2	9.5	9.8	9.6	8.0
	% Ubiquity				
Squash	18	13	—	—	—
Maize	91	75	83	100	43
Maize pollen aggregates	55	13	—	60	29
Cholla	55	25	50	80	14
Prickly pear	64	38	50	80	29
Other cacti	27	—	—	—	14
Crane's bill	27	38	—	60	14
Other taxa (present in two or more samples)	cattail, paloverde	paloverde		mint family	
	% Ubiquity of Samples with High Cheno-Am and Grass Concentrations and Large Cheno-Am Aggregates				
Cheno-am concentrations (>19,000 gr/cc)	27	17	20	60	43
Cheno-am aggregates (>50 grains)	9	13	—	60	14
Grass concentrations (>600 gr/cc)	27	17	—	20	57

[a] Average pollen concentration and taxa richness excludes sterile samples.

diverse economic assemblages and overall higher taxa richness values. Concentrations of grass pollen are also notable in structure floor samples (see Table 189).

The pollen results from the bell-shaped pits indicate these features—tentatively interpreted as storage features—were used for a variety of food stuffs, but one interesting aspect is a link with grass pollen. Grass pollen concentration was greater than the project average in only 13 pollen samples, but 6 of the 12 samples were from extramural pits—4 bell-shaped pits and 1 non–bell-shaped, nonthermal pit (Feature 6143). This is a high expression, as there was only a total of 11 extramural features in the sample set, and this demonstrates an association between grasses and nonthermal pits. At Mescal Wash, grasses were probably used to layer and insulate foodstuffs in extramural storage pits and also possibly as wrapping material to steam foods during roasting in thermal pits.

Based on the contextual patterns interpreted from Table 189, structure floors are evaluated as the best context to compare the pollen results between loci and architectural house styles (Table 190). Pole-and-brush structures (including three with analyzed pollen samples) were the earliest houses, dating to the Late Archaic/Early Formative period, and adobe structures (including three with analyzed pollen samples) were the latest, occupied as late as approximately A.D. 1390 near the end of the Late Formative period (see Chapter 2, this volume). The adobe structures had raised floors and narrow, stepped entryways. Eleven of the 18 pit structures with analyzed pollen samples date to the Middle Formative period, and 7 structures, all from Locus D, date to the Early Formative–Middle Formative period.

Maize pollen is evident in the earliest, pole-and-brush structures (see Table 190), but farming was only part of the Late Archaic/Early Formative subsistence. Compared to all other house styles, pole-and-brush structure floor samples preserved the highest ubiquities for cholla, prickly pear, and other cacti. Clearly gathering and processing native cacti was an important part of Late Archaic/Early Formative subsistence at Mescal Wash.

The highest pollen concentrations from structure floor samples are in Locus D (see Table 190). If pollen concentration is a credible proxy for the amount of plant material

Table 190. Summary Pollen Data by Locus from Structure Floor Samples

	Pit Structures			Adobe Structures	Pole-and-Brush Structures
	Locus A	Locus C	Locus D	Locus D	Locus D
Feature numbers	200, 290, and 2160	379, 995, 6098, and 7461	784, 3869, and 4768	1575, 4729, and 4683	1815 and 1816
Number of floor samples	4	4	3	5	3
Average pollen concentrations (gr/cc)[a]	12,366	9,638	36,075	36,693[a]	18,123
Average taxa richness[a]	11.3	11.8	10.3	9.5	11.7
	% Ubiquity				
Cotton	25	25			
Squash			33		
Maize	75	100	100	40	67
Maize pollen aggregates	25	50	100	20	
Cholla	50	50	67	40	67
Prickly pear	75	50	67	20	100
Other cacti	50	25			67
Paloverde	25	25	33		
Mesquite		25			
	% Ubiquity of Samples with High Cheno-Am and Grass Concentrations and Large Cheno-Am Aggregates				
Cheno-am concentrations (>19,000 gr/cc)			100	40	33
Cheno-am aggregates (>50 grains)		25		20	33
Grass concentrations (>600 gr/cc)	25		67	20	

[a] Average pollen concentration and taxa richness excludes sterile samples.

associated and manipulated inside structures, then relative differences should relate to how long and/or how intensely features were utilized. The high concentrations are consistent with the archaeological evidence that Locus D was the most intensively occupied area.

The maximum average pollen concentration from floor samples is from the Late Formative adobe structures in Locus D, yet ubiquities of maize, cholla, and prickly pear are lowest from adobe structures (see Table 190). The minimum taxa richness between house styles is also from the adobe structures. The low richness and representation of economic pollen is perhaps related to the raised floors in adobe structures, which might have been regularly swept, compared to earlier pit structures. Alternatively, food processing may have been focused outside the houses.

Cienega Wash Profiles

Cienegas are unique desert wetlands that form along low gradient sections of drainages with high groundwater tables. Depending on local hydrologic conditions, the wetlands are combinations of episodically flooded meadows, marshes, and slow-flowing pools with emergent aquatic vegetation. Before Euroamerican settlement, *cienegas* were relatively common in southeastern Arizona (see Hendrickson and Minckley 1985). Lenses of black, organic-rich clay and silty sediment exposed in the washes near Mescal Wash site are the remains of fossil *cienegas* (see Homburg and Pearthree, Volume 3). Eight pollen samples were analyzed from two profiles through these deposits, Profile 6 in Mescal Wash and Profile 7 in Cienega Creek, and the results are presented in this section.

The development and growth of desert *cienegas* in the U.S. Southwest is not well understood. *Cienega* surfaces may remain stable for long periods and then rapidly aggrade. For example, at Los Ojitos Cienega in southeastern Arizona, 68 cm of organic matter accumulated over a period of 5 years (Minckley and Brunelle 2007:428). Minckley and Brunelle (2007) modeled *cienega* growth as a response to increased flooding and terrestrial sediment input from sheetwash. The deposits can also apparently be scoured by floods following drought periods that diminish protective vegetative cover.

The pollen spectra recovered from the samples analyzed here are evaluated to record a sensitive and local record of vegetation similar to paleoecological studies of bog deposits, as opposed to the smoothed regional perspective of pollen preserved in lake sediments (Berglund 1986). Most of the *cienega* samples are from levels with radiocarbon dates derived from burned grass stems (Table 191) (see also Homburg and Pearthree, Volume 3). The dates span from A.D 1000 to the 1900s, but most of the pollen samples are in levels that date between A.D. 1200 and 1400.

Table 191. Pollen Concentration Data Rounded to Nearest 10 Grains from *Cienega* Profile Samples and Average Concentration from Five Structure Fill Samples

PD No., by Context	Depth (cm)	Soil Horizon	Soil Texture	Radiocarbon Dates (A.D.)[a]	Sample Concentration (gr/cc)	Cultigens	Pine (gr/cc)	Cheno-Am (gr/cc)	Grass (gr/cc)
Structure fill (n = 5)					28,800	maize	<2	22,090	250
Profile 6 (southeast bank of Mescal Wash)									
10859	42–52	2Ab	silty loam	1476–1947	38,530		360	22,220	2,510
10862	72–79	2Ab	silty loam		36,720		790	21,010	3,300
10866	125–135	4A	silty loam	1412–1638	78,420		2,200	48,610	4,390
10871	235–245	6Ab	silty loam	1269–1420	47,080	maize, cotton	160	24,930	1,730
Profile 7 (north bank of Cienega Creek)									
10934	25–35	2Ab1	sandy loam		15,920	maize	860	6,140	2,320
10938	76–87	2Ab4	silty loam	1304–1474	16,250		—	8,850	700
10940	194–203	5Acb	sandy loam	1062–1378	3,920		100	1,200	340
10942	310	6Acb2	loam	1276–1420 A.D.[b]	6,460		30	2,780	270

Key: PD = provenience designation.

[a] Radiocarbon dates are listed as years A.D. at 2σ standard deviation.

[b] Date range based on charcoal from 290–300 cm.

The presence of charred grass stems in several of the soil horizons suggests that before historical-period fire suppression, the *cienegas* were grassy meadows that burned regularly. The presence of the Mescal Wash farming community raises the question of whether these meadows were deliberately burned during the dry season to manage plant and animal resources. Prehistoric firing of *cienegas* in southern Arizona was interpreted by Davis et al. (2002) from their study of pollen and charcoal spectra in the deposits of six *cienegas*.

The pollen results from the Mescal Wash and Cienega Creek samples are summarized in Table 191 from the perspective of pollen concentrations, which are selected over percentages as a more sensitive parameter of local conditions. Using concentrations emphasizes a major contrast between the two profiles—Mescal Wash Profile 6 is characterized by exponentially higher pollen concentrations than Profile 7 from Cienega Creek. This may reflect the trunk-stream status of Mescal Wash with a greater area of alluvial substrates for high pollen-producing taxa, such as cheno-am, which thrive in flood-disturbed sediment. Differences in sediment texture between profiles is another control on pollen abundance. Profile 7 sediments are sandier than Profile 6, which indicates higher-energy water flows in Cienega Creek. Pollen assemblages in sandy alluvial sediments are characterized by lower pollen concentrations (Adams et al. 2002:41). The contrast between the two profiles confirms that the pollen records are specific to the profile locations.

Fill samples analyzed from Mescal Wash structures are included in Table 191 as an approximate analog for a local terrestrial signal, although one influenced by cultural activities. Pine, cheno-am, and grass are emphasized as the three taxa with the greatest contrast between mixed cultural/natural structure fill and *cienega* sediments. Pine is particularly high in the *cienega* samples and essentially negligible from house fill. The pine source is interpreted as pollen blown in from local mountain ranges that include the Whetstone, Santa Rita, and Empire Mountains, but another significant component is attributed to water-transported pollen originating from forests in headwater drainages.

A modern pollen study of canals in the Gila River floodplain near Sacaton, Arizona, demonstrated that the representation of conifer pollen in canals was an indicator of water-transported pollen from higher-elevation woodlands (Adams et al. 2002:52). Thus, high pine concentrations in the two profiles analyzed here might reflect periods when high water flows inundated cienega surfaces. The Mescal Wash archaeological samples preserved cattail and willow pollen, and in flotation samples, willow and bulrush (Scirpus) remains were recovered (see Chapter 9, this volume), which proves slow-flowing water was located near the site. However, no local riparian tree or aquatic pollen types were identified from any of the eight profile samples. This lack of water indicators and the contrast between low grass concentrations in structure fill and high concentrations in the cienega samples indicate grassy meadows bordered Mescal Wash and Cienega Creek. Favorable climatic conditions for cienega growth then might register as spikes in grass pollen.

In the above paragraph, a logical construct is defined to interpret wetter episodes favorable for *cienega* growth based on high pollen representation of pine and grass. The Mescal Wash *cienega* sample with the highest pine, cheno-am, and grass concentrations was Sample No. 10866 from Profile 6 at a depth of 125–135 cm (see Table 191) that dated to A.D. 1412–1638. Other samples with high concentrations of pine and grass indicative of wetter episodes favorable for *cienega* growth include Sample No. 10862 from Profile 6 at a depth of 72–79 cm and Sample Nos. 10934 and 10940 from Profile 7 at a depth of 25–35 and 194–203 cm, respectively. Sample No. 10940 was dated to A.D. 1062–1378.

Maize and cotton pollen were identified in Profile 6 at 235–245 cm, which is dated between A.D. 1269 and 1420 (Late Formative period). This indicates that people living in the Late Formative period adobe structures were farming the *cienegas*. In Profile 6 from Mescal Wash, there are no pollen data below the 235–245 cm sample, but there are samples dated from before the A.D. 1400s from Profile 7 from Cienega Creek, and none produced cultigen pollen. Apparently, the agricultural potential was better along Mescal Wash.

Maize pollen was documented in the top sample of Profile 7 from Cienega Creek, which is undated, but probably younger than A.D. 1400. The maize in this sample could be a contaminant from reworked site sediments washed into Cienega Creek but might also reflect later farming activities at the site or from upstream sites.

Conclusions

Farming blended with desert resources of cacti, agave, mesquite beans and pods, and paloverde beans and pods is a deeply embedded way of life that has sustained desert cultures in the U.S. Southwest for millennia. It is no surprise then to recover pollen evidence of farming and use of native cacti and desert trees in the Mescal Wash pollen samples that span the Late Archaic through the Late Formative period occupations. The identified cultigens are maize, squash, and cotton and the interpreted native food staples are prickly pear, cholla, other cacti, mesquite, paloverde, cattail, grasses, and weedy taxa, such as cheno-am, mustard family, and mint family, which were exploited for seeds and greens. Other potential resources identified from the pollen results include hackberry, ocotillo, willow, and sunflower.

The *cienega* environments along Mescal Wash and Cienega Creek included grassy meadows, and the best farm land was apparently within these meadows near the site, where maize and cotton were cultivated as late as A.D. 1300–1450 (Late Formative period). The pollen results from the *cienega* samples were also interpreted as indicating wetter intervals sometime after A.D. 1400 and perhaps another mesic event between A.D. 1060 and 1378, based on Profile 7 from Cienega Creek.

The archaeological pollen data from Mescal Wash were examined for contextual patterns, and the contexts that best preserved cultural signatures were pit-structure floor and hearth samples. Correlations between pollen types and contexts suggest grasses were integral to the operation of bell-shaped pits and that cattail was used on structure floors, perhaps as matting.

Evidence of cotton in the prehistoric U.S. Southwest conjures visions of weaving industries, but cotton may have been equally if not more important as a food resource. Cotton pollen in Mescal Wash samples corresponded with hearth samples, which suggests cooking. This is not the first archaeological example of a link between cotton and cooking features. Cotton pollen concentrated in *hornos* has been documented at two large pre-Classic communities (Grewe and Adamsville) in the Middle Gila Valley of southern Arizona (Smith 2010).

The archaeological pollen samples yielded notably high expressions of economic pollen in certain structures that might signal longer occupations or more-intense use. The structures with higher representations of economic taxa are the following: Feature 200 in Locus A; Features 995, 6098, and 7461 in Locus C; and a Late Archaic/Early Formative period pole-and-brush structure Feature 1816 in Locus D.

The Mescal Wash pollen results were also examined for temporal patterns. The greatest abundance of pollen and ubiquity of economic taxa is from features in Locus D, which contains the longest occupational history and the greatest density of structures. Two other temporal trends stand out. Late Archaic/Early Formative period people using the pole-and-brush structures may have grown less maize and harvested more cacti, compared to the site occupants from later periods. The second temporal trend is that cotton does not appear until the Middle Formative period. Cotton pollen was also concentrated in Locus C features and may reflect specialization by a few households.

CHAPTER 11

Mortuary Analysis

Christopher P. Garraty, Mitchell A. Keur, Joseph T. Hefner,
Lorrie Lincoln-Babb, and Penny Dufoe Minturn

SRI's 2000 and 2001 investigations at the Mescal Wash site resulted in the identification and excavation of 48 human burials (30 cremations and 18 inhumations) (Figure 151). Eight burials were excavated during Phase 1, and 40 were excavated during Phase 2. Based on the Phase 1 surface inspections, SRI divided the site into eight loci (A–H), but Phase 2 data recovery mainly focused on Loci A, C, and D, especially Locus D, which contained an extremely dense concentration of features and was a favored locus of habitation over a long span. It is therefore no surprise that more than half of the burial features (n = 27, or 56 percent) were exposed in Locus D. Most of the remaining features (n = 18, or 38 percent) were excavated in Locus C. Two burials were excavated in Locus E, and 1 was removed from Locus A.

The burials were excavated in strict accordance with the project Burial Memorandum of Agreement (A.R.S. §41-844, Case No. 00-21), which stipulated that SRI conduct a good-faith effort to locate and remove any burial potentially affected by construction activities within the project's area of direct impact (ADI). During Phase 2, extensive backhoe stripping, hand and mechanical excavation, and probing of features not slated for excavation ensured that all burials were indeed identified and excavated. Stripping focused on the areas in each locus where the excavations had exposed subsurface features and where burials would be expected. In these areas, all cultural deposits were removed until sterile sediments were reached. Not each entire locus portion within the project ADI was stripped, because large areas were solely surface manifestations of cultural materials. Probing was done for 37 nonthermal pits in Locus D. It consisted of removing multiple shovelfuls of fill from each pit until its bottom was reached, carefully inspecting the removed sediment for human remains. As required by the burial agreement, all bioarchaeological analyses were performed in the field; no photographs were taken, and no samples were kept for analysis. Drawings of the burials were made in compliance with the burial agreement. Ceramic vessels, stone censers, and other grave goods were drawn in the field. For several vessels, permission was obtained from the Tohono O'odham Nation to make additional drawings in the SRI laboratory before repatriation.

Detailed descriptions and a summary table of the burial features are presented in Appendix C of Volume 1 in this series. This chapter does not describe individual burial features but, rather, discusses the results of various contextual and osteological analyses. Our goal is to infer mortuary practices and how they changed over time and among contemporaneous communities at Mescal Wash. Where possible, we compare our results with the results of burial excavations in the northern portion of Locus A by WestLand Resources, Inc., in 2008 (Buckles, Klimas, and Deaver 2010) and with those of EcoPlan Associates, Inc. (EcoPlan), who excavated a cemetery in the northern portion of Locus B (Heilman et al. 2010; Neuzil 2009b). Various contributors were responsible for this effort. In accordance with the aforementioned burial agreement, physical anthropologists Lorrie Lincoln-Babb and Penny Dufoe Minturn recorded various osteological and contextual attributes of the burials and skeletal remains during fieldwork. In 2010, Mitchell Keur and Joseph Hefner analyzed the osteological data recorded by Lincoln-Babb and Minturn and prepared the osteological section of this chapter. Christopher Garraty's efforts focused on analyzing the contexts and archaeological patterning of the burial features and on writing and compiling the results of the analyses.

This chapter includes various topical sections. In the first section, we present a brief overview of the site's occupation sequence and how our mortuary analysis will contribute to the research themes defined by Altschul et al. (2000). In the second section, we describe the burial-feature record and discuss the modes of interment (inhumation and primary and secondary cremation), including the various

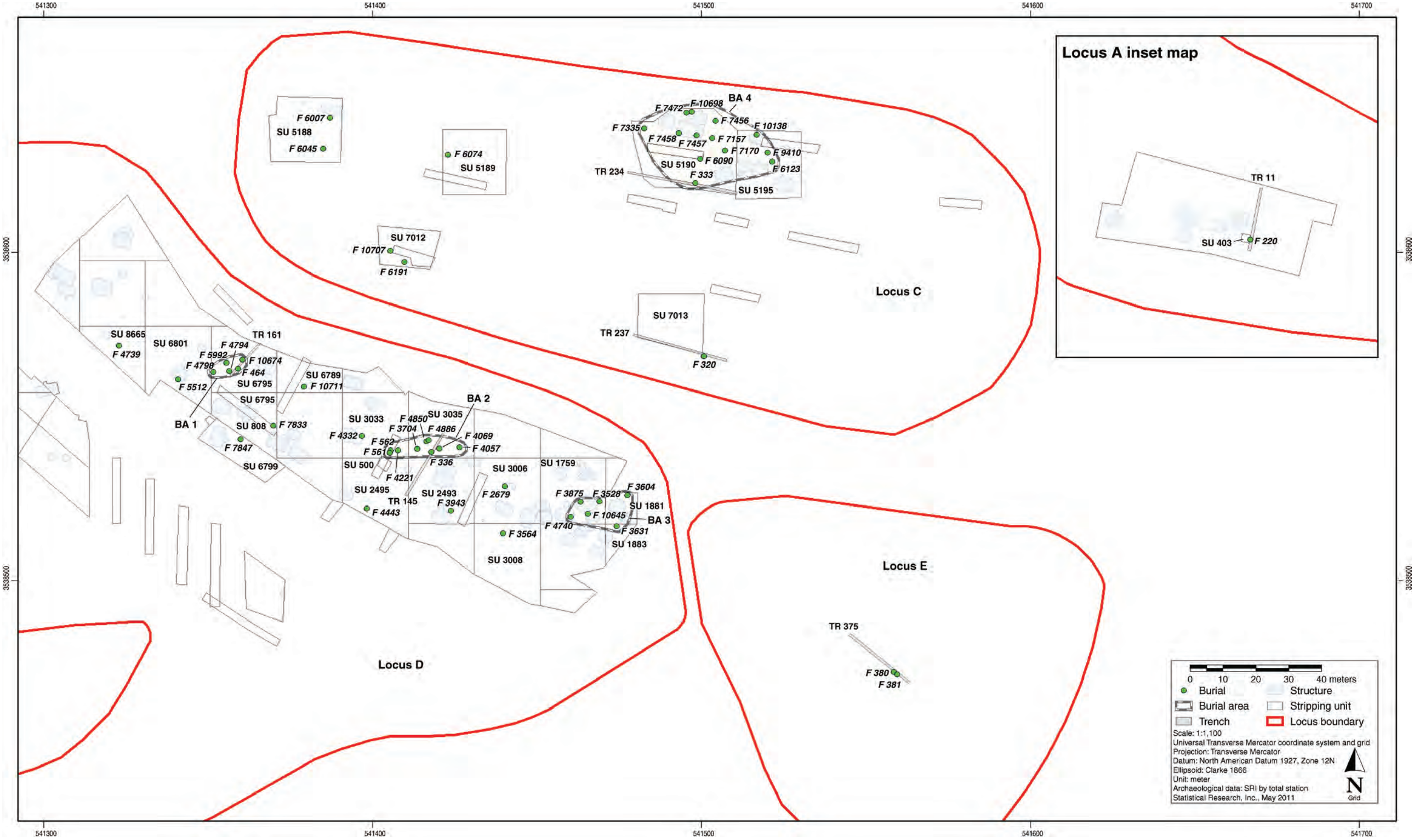


Figure 151. Map of Mescal Wash showing the locations of the excavated burial features (green dots) (see Figure 2 for entire boundaries for each site).

mortuary practices involved in cremation and inhumation events. The third section presents the results of the osteological analyses, including studies of age, sex, paleodemography, and pathologies. In the fourth and fifth sections, we discuss patterning in the mortuary evidence, including relationships among the modes of interment, the presence/absence and types of burial offerings, and the demographic attributes (age and sex). The two subsequent sections focus, respectively, on the temporal and spatial distributions of the burials, including identification of possible discrete burial areas. The final section summarizes the results and discusses their implications for the research themes.

Mescal Wash: Background and Research Themes

Site Background and Occupation Sequence

Mescal Wash was a residential locus (possibly seasonal) that was continually occupied over a long span but most intensively during the Middle Formative period (ca. A.D. 750–1150). The site is situated between the Tucson Basin and the San Pedro Valley in a "frontier zone" between the Hohokam and the Mogollon, as well as other cultural regions (Altschul et al. 2000). Its frontier location is best evidenced by the complex mix of painted-pottery types that are associated with different cultural traditions scattered throughout the southern deserts, including the Hohokam (Tucson and Phoenix Basin variants), Mogollon (Dragoon, San Simon, Mimbres, and San Carlos types), and Trincheras traditions (see Chapter 3, this volume). The site is also situated along a former *cienega* in an ecotone between the Sonoran Desert and the Chihuahuan grasslands that offered access to a diverse array of economic resources (Vanderpot 2001:18) and likely drew pre-Hispanic period people to the area over many centuries, resulting in a sustained period of reuse and reoccupation (see Chapter 1, this volume).

Archaeomagnetic and radiocarbon dates, temporally diagnostic pottery, and a wide range of projectile point styles indicate a long span of prehistoric period occupation at Mescal Wash, from the Late Archaic through Late Formative periods (see Chapter 2, this volume), but the majority of features were assigned to the Middle Formative period (ca. A.D. 750–1150). This 450-year span can be subdivided into two shorter periods: the Middle Formative A period (ca. A.D. 750–950) and the Middle Formative B period (ca. A.D. 950–1150), which roughly correspond to the Colonial and Sedentary periods in the Hohokam sequence. Generally, the bulk of the features excavated in Locus D were assigned to the Middle Formative A period, and most of the features in Loci A and C were assigned to the Middle Formative B period. A small number of features (mostly in Locus D) were assigned to the Early Formative (ca. A.D. 1–750) and Late Formative (ca. A.D. 1150–1450) periods, but we suspect that probably all or most of the human burials were interred during the Middle Formative period (see chronological discussion, below).

Research Themes and Contribution of the Mortuary Analysis

As noted, the Mescal Wash site is situated on a frontier between the Hohokam and Mogollon "regional communities" (Altschul et al. 2000:13–14). The abundance and diversity of painted sherds associated with different regional decorated-pottery traditions have underscored the extent of interaction or affiliation with populations throughout the southern deserts. Garraty and Heckman's (see Chapter 3, this volume) analysis of painted-pottery sherds further suggests that social or economic interactions with different regional communities varied over time and among contemporaneous groups residing in different areas of the site. These areas may have housed extended kin groups or social affines that separately and independently maintained social ties with different regional communities (possibly their homelands) and communicated their extralocal ties through display of visually distinctive painted-pottery vessels (see Chapter 3, this volume).

What remains unclear are the root causes of these intrasite differences in painted-pottery styles. Do they indicate a direct movement of people into the site (migration), a movement of goods (exchange of pottery vessels), a movement of ideas (through social interaction and emulation), or some combination of factors? Garraty and Heckman argue that different groups or multihousehold groups within the site *deliberately* adopted and displayed painted-pottery types associated with specific regional communities, to express their social and political allegiances or alliances during public commensal feasts or ceremonies. They emphasize political machinations and competition among distinct kin groups or communities as a basis for intrasite competition. Their argument stresses a movement of ideas and, possibly, a movement of goods but not a movement of people, although the sherd data did not provide evidence sufficient to evaluate migration.

From this perspective, the spatial and temporal variability in mortuary practices provides a vital line of evidence for interpreting intrasite material-cultural diversity at Mescal Wash. For instance, a correspondence in variability between mortuary practices and painted-pottery or architectural styles might suggest movement of people who brought with them a whole suite of material culture and practices from their respective homelands. In contrast, consistency or similarity in mortuary practices among areas or loci with distinct painted-pottery and architectural styles implies shared mortuary customs; if this was the case at Mescal Wash, then the intrasite diversity of painted-pottery wares reflects a movement of pots (e.g., exchange) or a movement of ideas (e.g., local emulation) rather than a movement of people through migration. One goal of this chapter is to evaluate spatial and temporal variability in mortuary practices at Mescal Wash.

Burial Context: Form, Location, and Mode of Interment

Modes of Interment

The 48 burials excavated at Mescal Wash included a mix of inhumations, primary cremations, and secondary cremations (Table 192). Nearly two-thirds of the burial features were classified as cremations (n = 30, or 63 percent), the dominant mode of interment at Mescal Wash. The remainder (n = 18, or 37 percent) were classified as inhumations. Buckles, Klimas, and Deaver (2010) also observed mostly cremations (10 of 11 burials) during their excavations in Loci A and G, in the northern part of the site. This range of variation in the mode of interment is consistent with Middle Formative (pre-Classic) period burial practices throughout the Hohokam region. For example, the pre-Classic period site of Snaketown, in the middle Gila River valley, also included a mix of primary cremations, secondary cremations, and inhumations (Haury 1976:164–166).

In the following sections, we separately discuss the cremation and inhumation features recovered at Mescal Wash. Note that, in this chapter, we only include illustrations of selected burial features to exemplify specific patterns or attributes; most of the burial illustrations are not included. For illustrations of *all* burial features excavated during SRI's testing and data recovery at Marsh Station, we refer readers to Chapters 4, 6, 7, and 8 in Volume 1 of this series.

Cremations

Detailed Classification

Broadly speaking, the cremations can be divided into primary and secondary deposits (see Table 192). Most of the cremation features (n = 30, or 87 percent) were secondary deposits in which the human remains were cremated in separate locations and subsequently gathered and interred in a pit—sometimes placed within a burial vessel (urn) prior to interment. Four cremations (13 percent) were classified as primary cremations. A primary cremation is a mortuary context in which the cremated remains were interred in the location in which they were incinerated. At Mescal Wash, some or all of these features may have functioned as multiple-use crematoria, where the human remains were incinerated and then gleaned and interred in secondary locations. Some scholars (e.g., Motsinger 1993:217) have distinguished features as one or the other "type" of primary-cremation location, but these features at Mescal Wash frequently included bone fragments from incomplete gleaning episodes, which obscure the distinction between primary cremations and crematoria. Moreover, in several cases, cremated remains were interred in a subfloor pit beneath the incineration area or crematorium. In light of the presence of bone fragments (sometimes from multiple individuals) as well as subfloor burials in these features, we opted not to distinguish between primary cremation and crematoria and, instead, classified all such features as primary cremations.

Table 192. Summary of Burial Features Excavated in Mescal Wash

Mode of Interment	Locus A		Locus C		Locus D		Locus E		Total	
	Count	%	Count	%	Count	%	Count	%	Count	%
Inhumation	—		8	44.4	10	37.0	—		18	37.5
Primary cremation	—		—		4	14.8	—		4	8.3
Secondary pit cremation	1	100.0	6	33.3	10	37.0	2	100.0	19	39.6
Secondary pit cremation with capping vessel	—		1	5.6	1	3.7	—		2	4.2
Secondary urn cremation with inverted vessel	—		1	5.6	2	7.4	—		3	6.3
Secondary urn cremation with upright vessel	—		2	11.1	—		—		2	4.2
Total	1	100.0	18	100.0	27	100.0	2	100.0	48	100.0

On a more refined level, we categorized the secondary cremations based on the presence or absence of associated urns or capping vessels, as well as the positions of these relative to the cremated remains. To capture this range of variability, we devised four categories of secondary cremations, as shown in Table 192:

1. Secondary pit cremations (no urns or capping vessels),
2. Secondary pit cremations with capping vessels,
3. Secondary urn cremations with inverted vessels, and
4. Secondary urn cremations with upright vessels.

Buckles, Klimas, and Deaver (2010) also reported a mix of pit cremations and urn cremations with inverted and upright vessels among the nine cremations in Loci A and G, but they did not report pit cremations with capping vessels. In all, our finer distinctions assisted with our efforts to detect spatial and temporal trends in mortuary practices. We explain each of these categories below.

Secondary pit cremations (no urns or capping vessels) accounted for about three-quarters of the secondary cremations (73 percent, or 19 of 26) and 40 percent of all burial features (Table 193). Some or all of the secondary pit cremations may have been placed in baskets, cloth bags, or other perishable containers, but no such evidence was observable at the time of excavation. We classified two features as secondary pit cremations with capping vessels, which consisted of secondary pit cremations, each capped with an inverted vessel at the top of the pit, well above the incinerated human remains. In each of these features, the vessel appeared to have been deliberately placed in an inverted position at the opening of the burial pit, perhaps to mark the burial location—assuming the vessel bottom was visible on the ground surface at the time of interment (Figures 152 and 153). This category accounted for about 8 percent of secondary cremations and 4.1 percent of all burials.

Five burials were classified as secondary urn cremations (19 percent of secondary cremations and 10 percent of all burials), which we further subdivided based on whether the vessel was placed in an upright position (containing the remains) or an inverted position (placed directly over the remains) (Table 194). Secondary urn cremations with inverted vessels accounted for about 12 percent of the secondary cremations and 6.3 percent of all burials. In each of these features, the cremated remains appeared to have been placed in the base of the pit and subsequently covered with an inverted vessel prior to burial, as exemplified by Feature 4850 in Locus D (Figure 154). Two other features were classified as secondary urn cremations with upright vessels, which accounted for 8 percent of the secondary cremations and 4.2 percent of all burials. In each of these features, the cremated remains were placed inside an urn, which was then positioned at the bottom of a pit and buried. In one of these cases, Feature 6090 in Locus C, a second bowl was placed over the orifice of the urn as a lid (Figure 155).

Four features were classified as primary cremations, which accounted for 8.3 percent of the burial features (Table 195). These were shallow, subrectangular in plan, and oriented east-west, with straight or slightly sloping side walls and flat bases. The four primary cremations, all in Locus D, also contained one or more postholes or possible postholes, which probably supported wooden pyres. Features 3704 and 4221 in Locus D, for example, each contained three or four postholes in linear arrangements along the northern and southern boundaries of the feature (Figure 156). The quantities and densities of cremated bone varied among these features, suggesting different levels of gleaning after their final use.

Two of the four subrectangular primary-cremation features (Features 4069 and 4798 in Locus D) included subfloor pits containing denser and more-abundant cremated remains. Presumably, these subfeatures contained the remains of individuals that were cremated in situ and, after a period of cooling, were gleaned and interred within a subfloor pit in the base of the cremation area. Feature 4069 in Locus D contained a probable subfloor cremation burial (Subfeature 2) (Figure 157, upper left). Feature 4798 in Locus D also contained a likely subfloor cremation burial (Subfeature 1) (see Figure 157, lower right). Perhaps these subfloor pits contained the remains of the last individuals to have been incinerated in those primary-cremation areas. If so, their interments in the bases of these features may have signified the cessation of cremation activities in those loci.

Like Features 4069 and 4798, Feature 4794 in Locus D, which is classified as a secondary pit cremation, *might* have been a subfloor burial within a larger primary cremation that was not clearly discernible during excavation. The excavators of this feature noted several patches of burned soil in the feature vicinity, suggesting that it may have resembled the two primary cremations that contained subfloor pits with cremated remains (Figure 158). Moreover, it was located in the immediate vicinity of Feature 4798. A closely spaced group of primary cremations was present elsewhere in Locus D (Features 3704, 4069, and 4221, roughly 30–40 m to the east of Feature 4794), suggesting a possible clustering of features in this burial category, but we were unable to corroborate this possibility with certainty; therefore, we retained the classification of Feature 4794 as a secondary pit cremation.

Contexts and Placement of the Cremations

All of the primary cremations, and all but two of the secondary cremations, were recovered in extramural locations. Feature 3875, a secondary pit cremation, was classified as an intramural burial because it intruded into the fill of a

Table 193. Attributes of Secondary Pit Cremations (n = 21) at Mescal Wash

Feature	Locus	Diameter (cm)	Maximum Depth (cm)	Plan	Profile	Disturbance	Comments
220	A	indeterminate		indeterminate	indeterminate	Partially removed by backhoe during trenching; heavy rodent disturbance.	Most of the bone recovered in rodent burrow; no visible pit outline; no artifacts in fill; trench backdirt screened.
320[a]	C	ca. 100[b]	38	circular	funnel shaped, rounded based	Bisected by backhoe during trenching, heavy rodent disturbance.	Inverted bowl placed over mouth of pit, with cremated bone in base of pit, suggesting pit was filled with soil following interment of remains and then capped with an inverted plain ware bowl, possibly as location marker; polishing stone in fill.
380	E	33[b]	22	indeterminate	indeterminate	Bisected by backhoe during trenching.	Approximate dimensions inferred from intact portion of feature; less than 1 m from Feature 381; 2 sherds in fill.
381	E	24[b]	23	indeterminate	indeterminate	Bisected by backhoe during trenching; moderate rodent activity and heavy root disturbance from nearby mesquite tree.	Approximate dimensions inferred from intact portion of feature; less than 1 m from Feature 380; no artifacts in fill.
464	D	19	22	circular	slightly sloping walls, flat base	Heavy root disturbance.	1 sherd in fill.
561 [a]	D	29	13	circular	convex walls, flat base	Minor root disturbance.	Inverted bowl placed over mouth of pit, with cremated bone in base of pit, suggesting pit was filled with soil following interment of remains and then capped with an inverted red ware bowl, possibly as location marker; sherds in fill.
562	D	30	15	circular	straight walls, flat base	Minor root disturbance.	Sherds and flakes recovered in fill.
3604	D	130 (60)[c]	16[d]	circular	basin shaped, rounded profile	Backhoe partially truncated top of feature; moderate root and rodent disturbance.	Likely placed in a previously used extramural pit, as area with bones encompasses approximately 30% of pit volume; 2 offering vessels (Dragoon Red-on-brown); sherds also in fill.
3875	D	42	15	circular	straight sides; flat, rock-lined base	Moderate root disturbance.	Intrusive into structure Feature 3679; rock-lined base suggests formal burial pit; sherds and flakes in fill.
4739	D	40	24	circular	slightly sloping walls, flat base	None observed.	Cremated bone placed in previously used thermal pit (inferred from blackened walls and base); bone only recovered in upper portion of pit, suggesting infilling of thermal pit prior to reuse as burial pit; no artifacts in fill.

Feature	Locus	Diameter (cm)	Maximum Depth (cm)	Plan	Profile	Disturbance	Comments
4794	D	16	24	circular	straight walls, flat base	Minor root and rodent disturbance.	Patches of burned soil in vicinity may suggest primary cremation location; if so, Feature 4794 may be a subfeature in the base of a primary cremation area, but this possibility remains indeterminate (see text for details); small, burned shell fragment recovered near cremated remains was a possible mortuary offering.
5992	D	15[b]	4[d]	circular	straight walls, flat base	Backhoe truncated top of feature; minor root and rodent disturbance.	Burned soil in base; no artifacts in fill.
6045	C	30	8	circular	basin shaped, rounded profile	Minor root disturbance.	Rocks in fill suggest possible lining of base with rocks; no artifacts in fill.
6074	C	ca. 80	8[c]	circular	indeterminate	None observed.	Gray stain observed surrounding a small “pocket” containing the calcined bone (ca. 8 cm wide), which may be the burial pit; sherds and flakes in fill.
7335	C	60	22	circular	slightly sloping walls, flat base	Heavy rodent disturbance.	Sherds and flakes in fill.
7456	C	35	15	circular	straight walls, flat base	None observed.	Sherds and flakes in fill.
7847	D	35 × 20	17	oval	basin shaped, rounded profile	None observed.	Elongated oval shape with east-west orientation; no artifacts in fill.
10138	C	23[b]	41	circular	basin shaped, rounded profile	Minor root and rodent disturbance.	Recovered in wall trench of structure Feature 6129; hundreds of small shell beads (unburned) in fill; sherds also in fill; dimensions approximated, because of disturbance from wall construction.
10674	D	29	13	circular	straight walls, flat base	None observed.	No artifacts in fill.
10707	C	30	9	circular	slightly sloping walls, flat base	Moderate root disturbance; heavy rodent disturbance.	No artifacts in fill.
10711	D	26	13	circular	slightly sloping walls, flat base	Minor root and rodent disturbance.	No artifacts in fill.

[a] Classified as a secondary pit burial with capping vessel.

[b] Approximated, based on the intact portion of the feature.

[c] Approximate diameter of the area with calcined bone in parentheses.

[d] Uppermost portion removed by the backhoe during scraping.

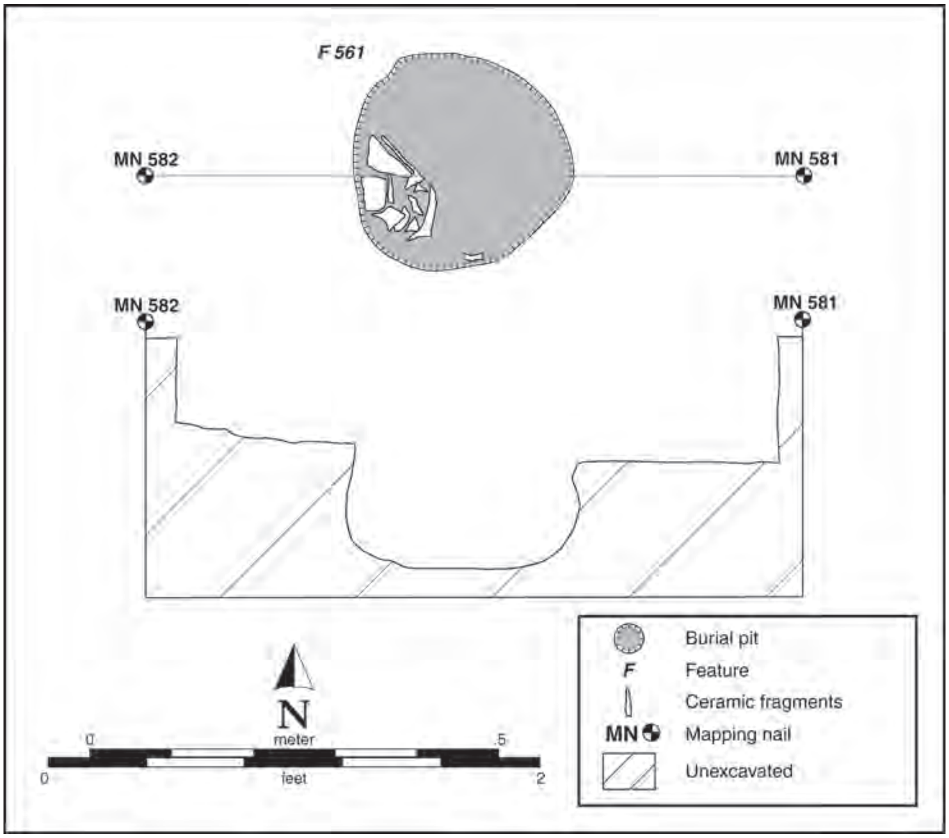


Figure 152. Plan view and cross section of Feature 561, a secondary pit cremation with capping vessel in Locus D.

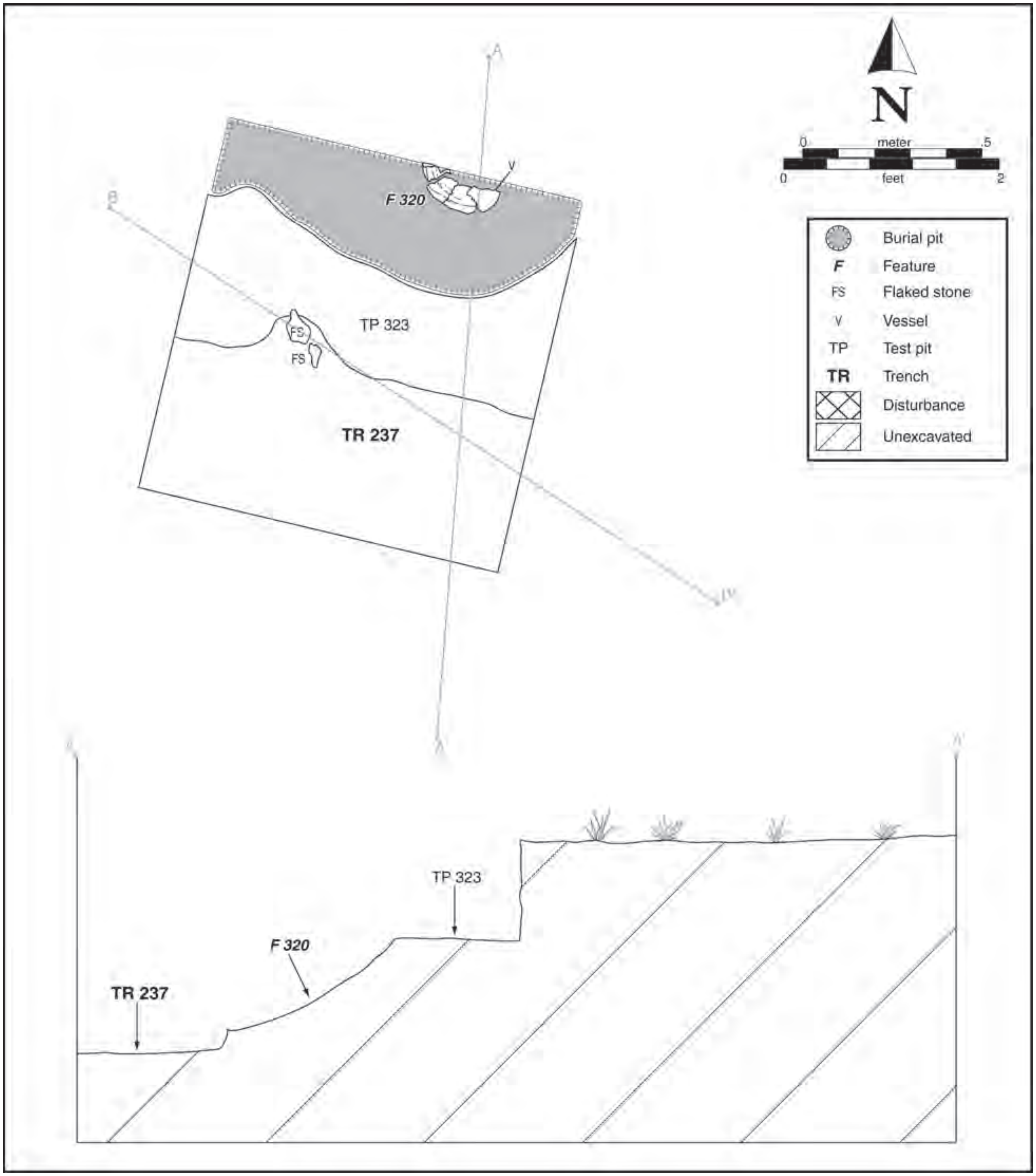


Figure 153. Plan view and cross section of Feature 320, a secondary pit cremation with capping vessel in Locus C.

Table 194. Attributes of Secondary Urn Cremations (n = 5) at Mescal Wash

Feature/ Locus	Diameter (cm)	Maximum Depth (cm)	Plan	Profile	Age	Sex	Urn Orientation	Urn Description	Disturbance	Comments
333/C	ca. 50[a]	22	oval/ circular	straight walls, flat base	adult	indeterminate	Inverted over remains in base of pit.	Sacaton Red-on-buff jar with Gila shoulder; neck removed, with reworked rim.	Partially removed by backhoe during trenching.	Pit outline difficult to define; no artifacts in fill.
4057/D	45 × 60	12	oval	straight walls, flat base	child	indeterminate	Inverted over remains in base of pit.	Type III plain ware jar (carinated).	Minor root and rodent disturbance; base of urn fragmented by backhoe.	Placed in south corner of pit, along with burned shell fragments; a few sherds and flakes in fill.
4850/D	35	19	circular	straight walls, flat base	adult	female	Inverted over remains in base of pit.	Type II plain ware jar with short neck (fragmented by backhoe).	Minor root and rodent disturbance; base of urn fragmented by backhoe.	No artifacts in fill; small pit barely wide enough for vessel; adjacent and connected to inhumation Feature 4886.
6090/C	21	10	circular	straight walls, flat base	young adult	indeterminate	Upright painted jar contained remains, in base of pit, capped with plain ware bowl.	Rincon Red-on-brown jar with neck removed (reworked rim) and Gila shoulder (container); Type III plain ware bowl (lid).	Base of capping vessel fragmented by backhoe.	No artifacts in fill; small pit barely wide enough for vessel; remains inside vessel were not subjected to analysis.
7472/C	30	10	circular	straight walls, flat base	indeterminate	indeterminate	Upright painted jar contained remains, in base of pit.	Dragoon Red-on-brown jar (elaborated).	Rim of vessel (and any possible lid) removed by backhoe.	No artifacts in fill.

[a] Approximated, based on the intact portion of the feature.

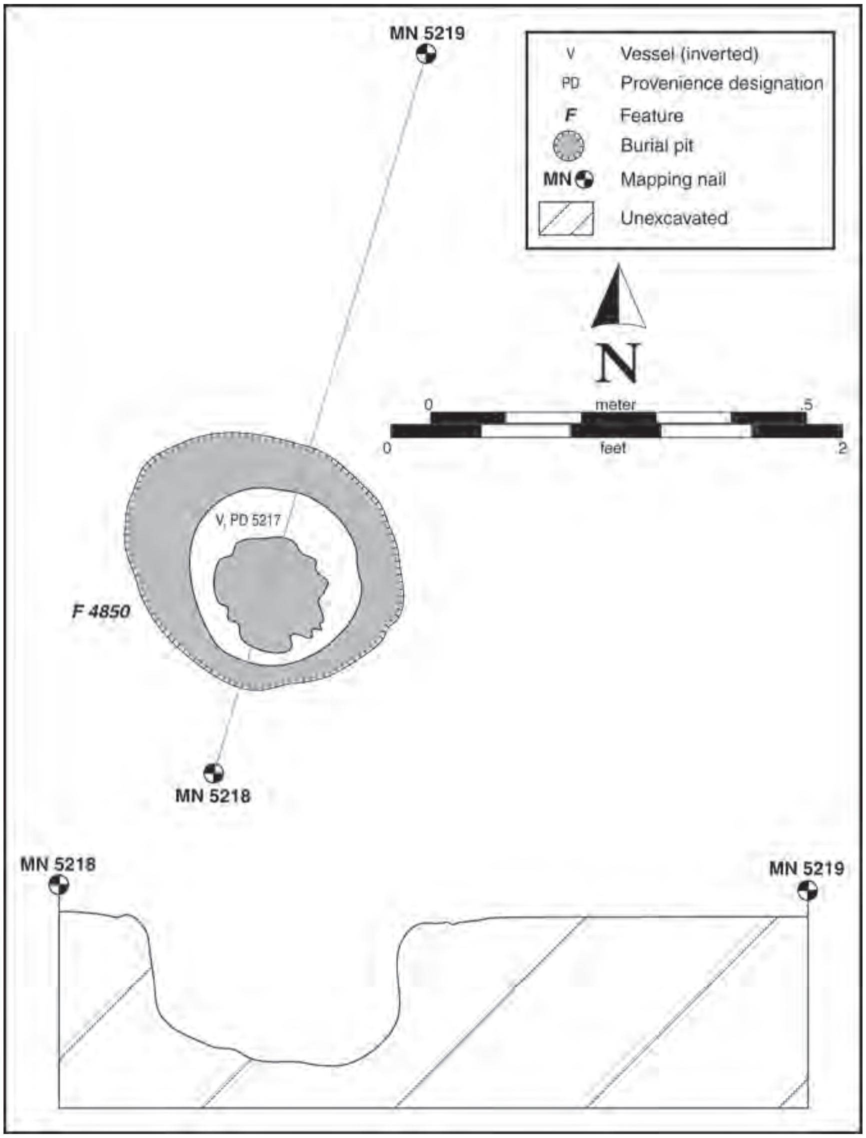


Figure 154. Plan view and cross section of Feature 4850, a secondary urn cremation with a vessel inverted over the cremated human remains in Locus D.

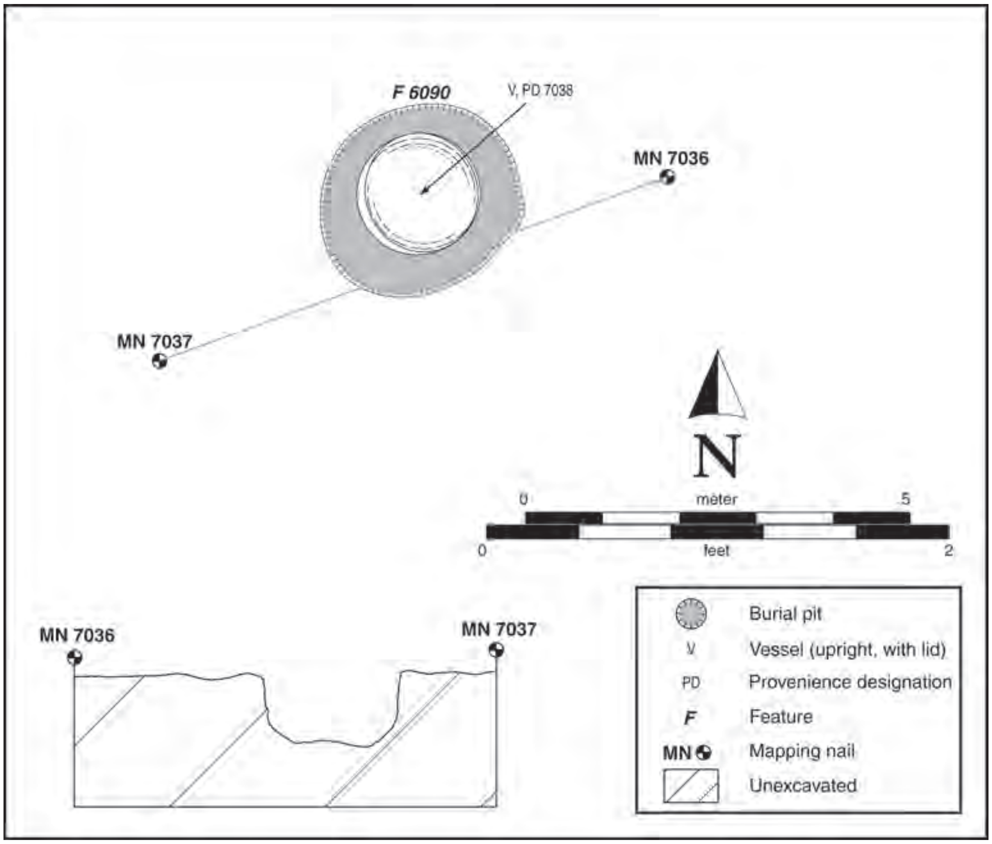


Figure 155. Plan view and cross section of Feature 6090, a secondary urn cremation with an upright vessel in Locus C. The upright vessel contained the cremated human remains and was covered with a lid.

Table 195. Attributes of Primary Cremations (n = 4) at Mescal Wash

Feature	Locus	Length (cm)	Width (cm)	Depth (cm)	Pit Shape	Age/ Sex	Subfeatures	Disturbance	Burial Goods	Comments
3704	D	170	80	8	subrectangular, sloping sides, flat base	indeterminate	7 postholes (ca. 20–30 cm in diameter); 1 in each corner and 3 midway between them on long edges; wood charcoal recovered in 1 posthole.	moderate rodent disturbance	none	Nearly completely gleaned (very few cremated bones); few sherds and flakes in fill.
4069	D	162	74	8	subrectangular, sloping sides	adult bones, sex indeterminate	1 posthole (14 cm in diameter); a shallow subfloor pit (ca. 40 cm in diameter) in the west end contained human bone associated with a carved-stone censer, a partial vessel, and a calcined awl (see Figure 157).	heavy root disturbance	ochre-stained, carved-stone censer; partial Type III plain ware vessel; calcined awl	Fill of main feature mostly gleaned (few scattered bone fragments), but with dense cremated bone in the subfloor pit (Subfeature 2); occipital bone found on floor on east side of feature suggests eastern orientation of the body during the cremation event; sherds and flakes in fill.
4221	D	223	89	21	subrectangular, sloping sides	adult, sex indeterminate	6 postholes (12–18 cm in diameter) and 1 possible posthole, including 3 along the north wall and 3 (possibly 4) along the south wall; a possible subfloor pit in the center of the floor was determined to be a probable rodent burrow.	heavy root disturbance	fragmented Type II plain ware jar and bowl	Incompletely gleaned (scattered cremated remains in fill); several plain ware sherds were warped, suggesting in situ thermal exposure; sherds and flakes in fill.
4798	D	150[a]	80	10	subrectangular, sloping sides	indeterminate	Two subfloor pits; 1 pit (ca. 30 cm in diameter) near southeastern corner was ca. 50 cm deep and cylindrical with calcined bone (Subfeature 1); a shallow, basin-shaped pit (23 cm in diameter) near the northeastern corner may have been a posthole (Subfeature 2).	backhoe removed west side of burned area	none	Western portion of feature partially removed by backhoe; fill of main feature mostly gleaned (few scattered bone fragments).

[a] Includes only the intact portion of the feature.

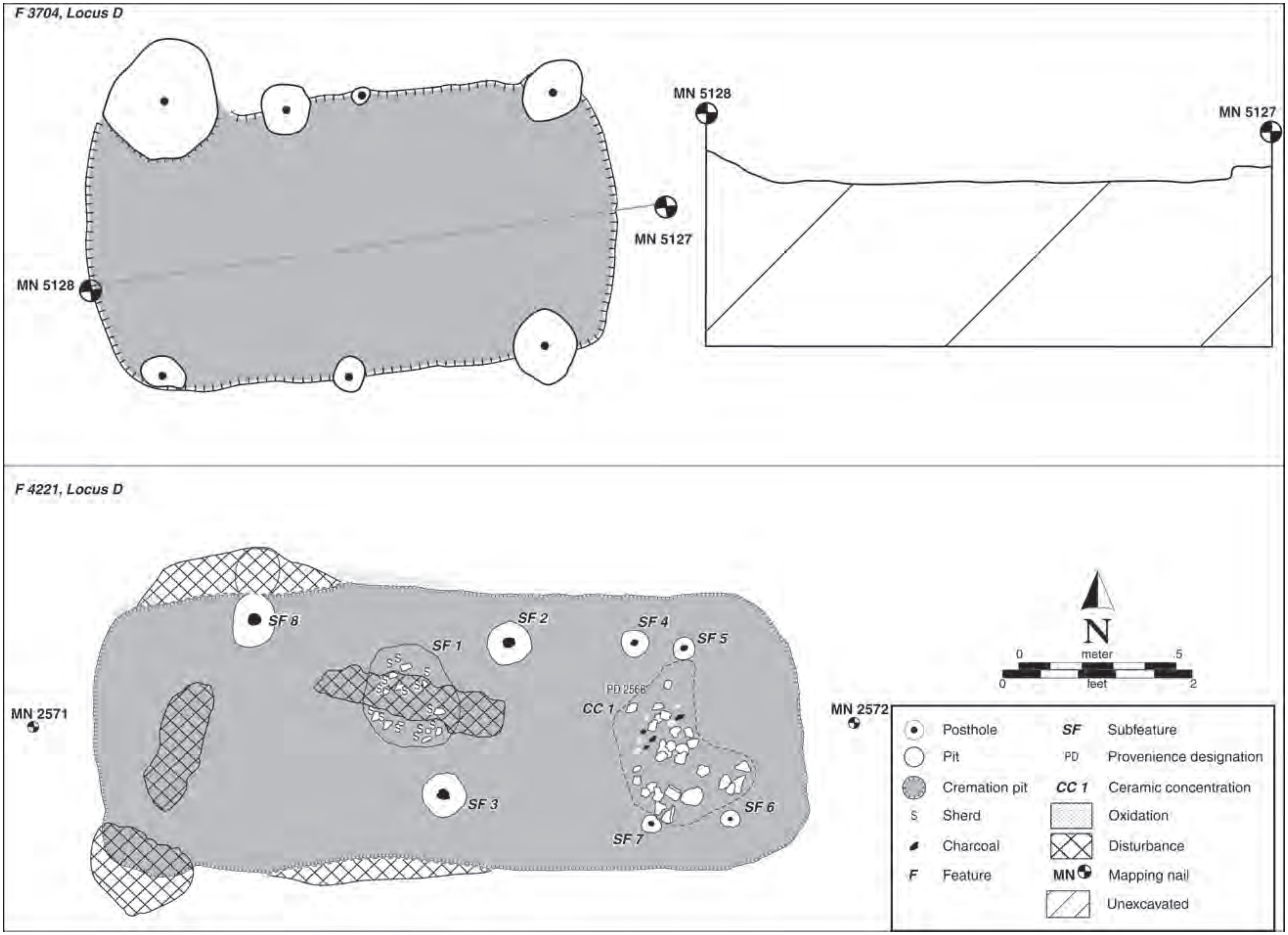


Figure 156. Plan views and cross sections of Features 3704 and 4221, primary cremations in Locus D. Note the lines of postholes on the northern and southern edges of both features.

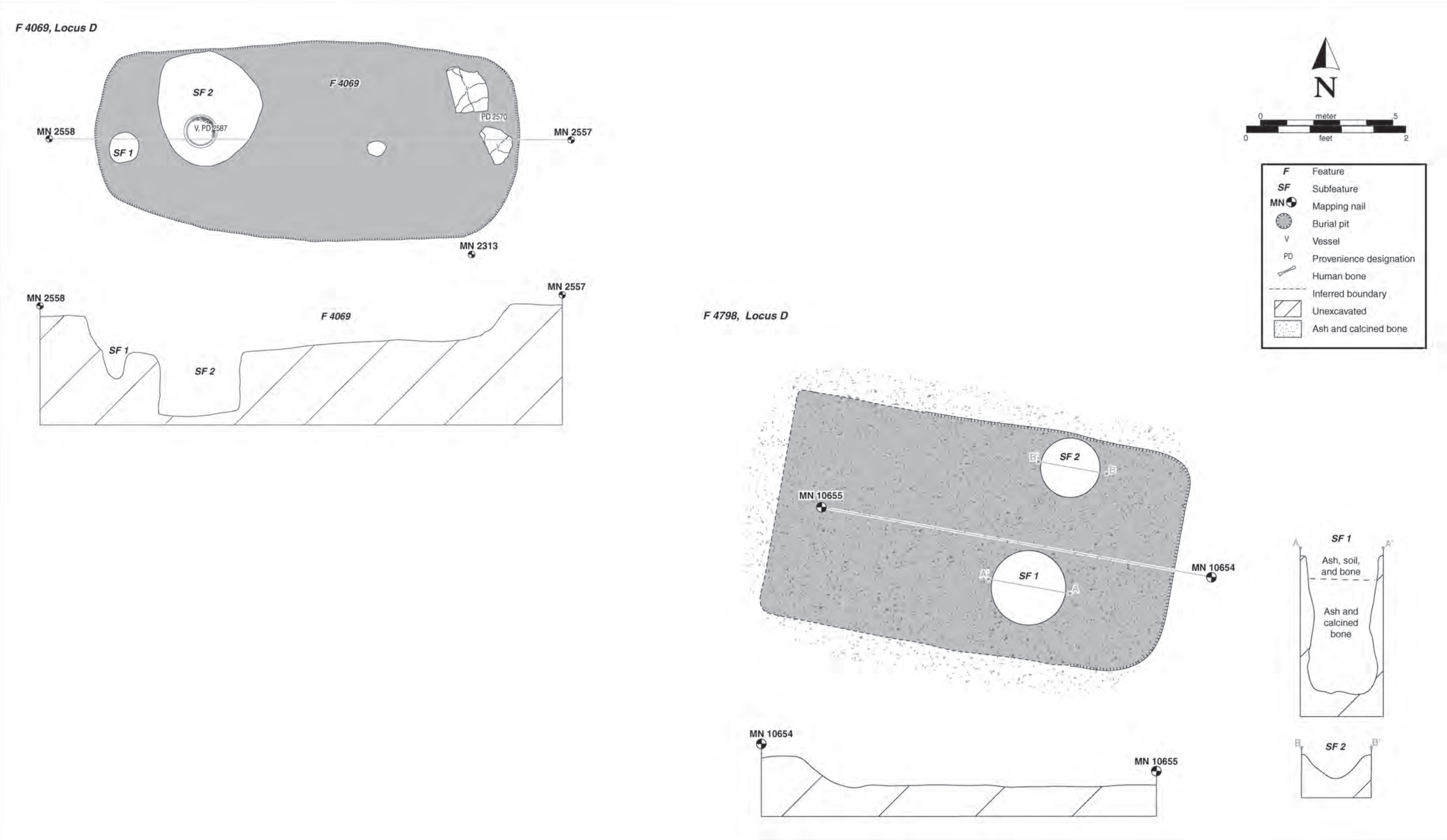


Figure 157. Plan views and cross sections of Features 4069 and 4798, primary cremations in Locus D that contained likely subfloor burial pits.

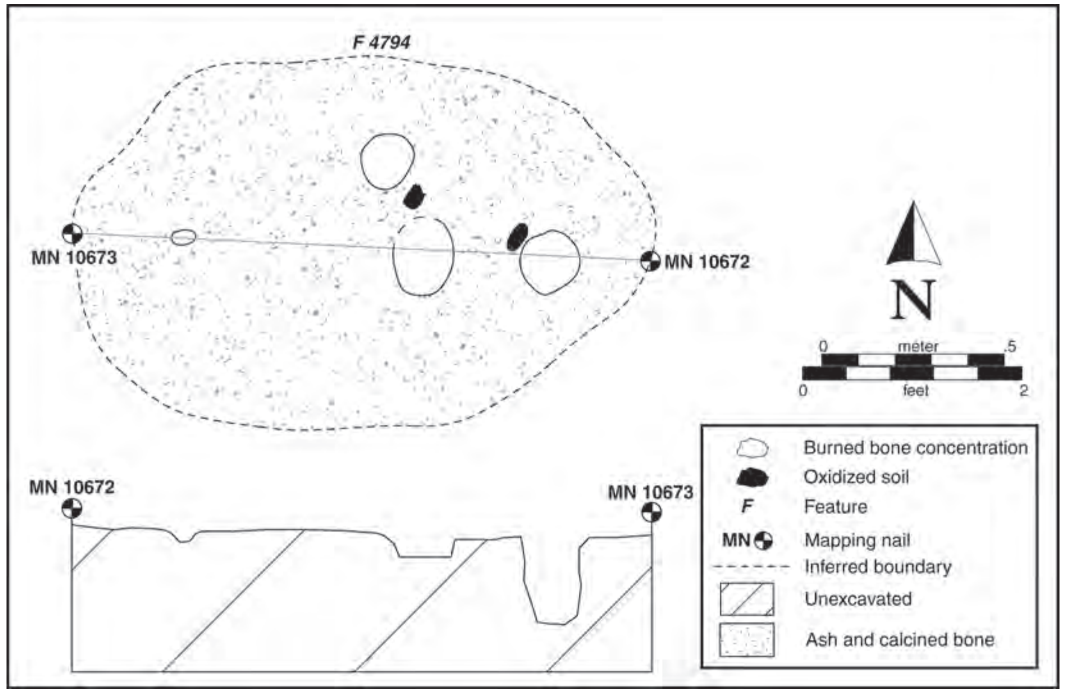


Figure 158. Plan view and cross section of Feature 4794, a secondary pit cremation in Locus D that might have been a subfloor burial beneath an unrecognized primary cremation.

previously abandoned structure in Locus D (Feature 3679). As explained below, intramural burial practices might have provided a means for kin groups or lineages to claim future use rights of lands in and near their abandoned houses (Lincoln-Babb et al. 2010). In this case, it is unclear whether the cremation was intentionally interred in an intramural location. A second possible intramural secondary pit cremation was Feature 10138, which was found in the base of a wall trench of a structure (Feature 6129) in Locus C (extending into the caliche). As with the previously mentioned burial, it was unclear whether the intramural placement of this burial was intentional; it is possible that the wall trench was constructed over a preexisting (and formerly extramural) cremation. If it was intentional, the cremation clearly would not have been visible to observers and likely would not have been intended as a form of land claim. Perhaps the cremated individual was interred in the wall trench during some sort of dedication ceremony for the structure.

The burial pits containing the secondary cremations were generally ovoid or subrectangular in plan, with mostly flat bases and straight or slightly sloping side walls. Cremation-burial pits were normally shallow and were likely dug for the sole purpose of containing the cremated remains (or the cremation urn), as well as any associated offerings. The pits were typically only dug to depths adequate to cover the remains (or urns) beneath a cover of soil. One secondary and possibly intramural cremation in Locus D, Feature 3875 (see above), was situated in a partly rock-lined pit. The rock-lined pit and intramural location could have indicated a culturally specific mortuary practice or a form of special treatment for the interred individual. Another secondary pit cremation in Locus C (Feature 6045) also appeared to have been placed in a rock-lined pit, but in an extramural context. On the whole, the relatively consistent shapes and sizes of the cremation-burial pits suggest formal burial practices likely associated with formalized and well-established mortuary ceremonies.

Two possible exceptions were secondary cremations in Locus D (Features 3604 and 4739) that appeared to have been interred in reused extramural pits that had previously been used for domestic activities. In Feature 3604, the human remains (age and sex indeterminate) were likely placed in a nonthermal pit, possibly a former storage pit, that far exceeded the size required for containing those remains (Figure 159). Feature 3604 also contained probable burial offerings (two decorated vessels), undermining the argument that it was an informal or expedient burial. Feature 4739, which contained the remains of an infant, contained human remains placed in a former thermal pit that probably had previously been used for cooking and roasting. It is unclear why these two cremations were placed in reused domestic pits. These features also may evidence a culturally specific form of mortuary treatment.

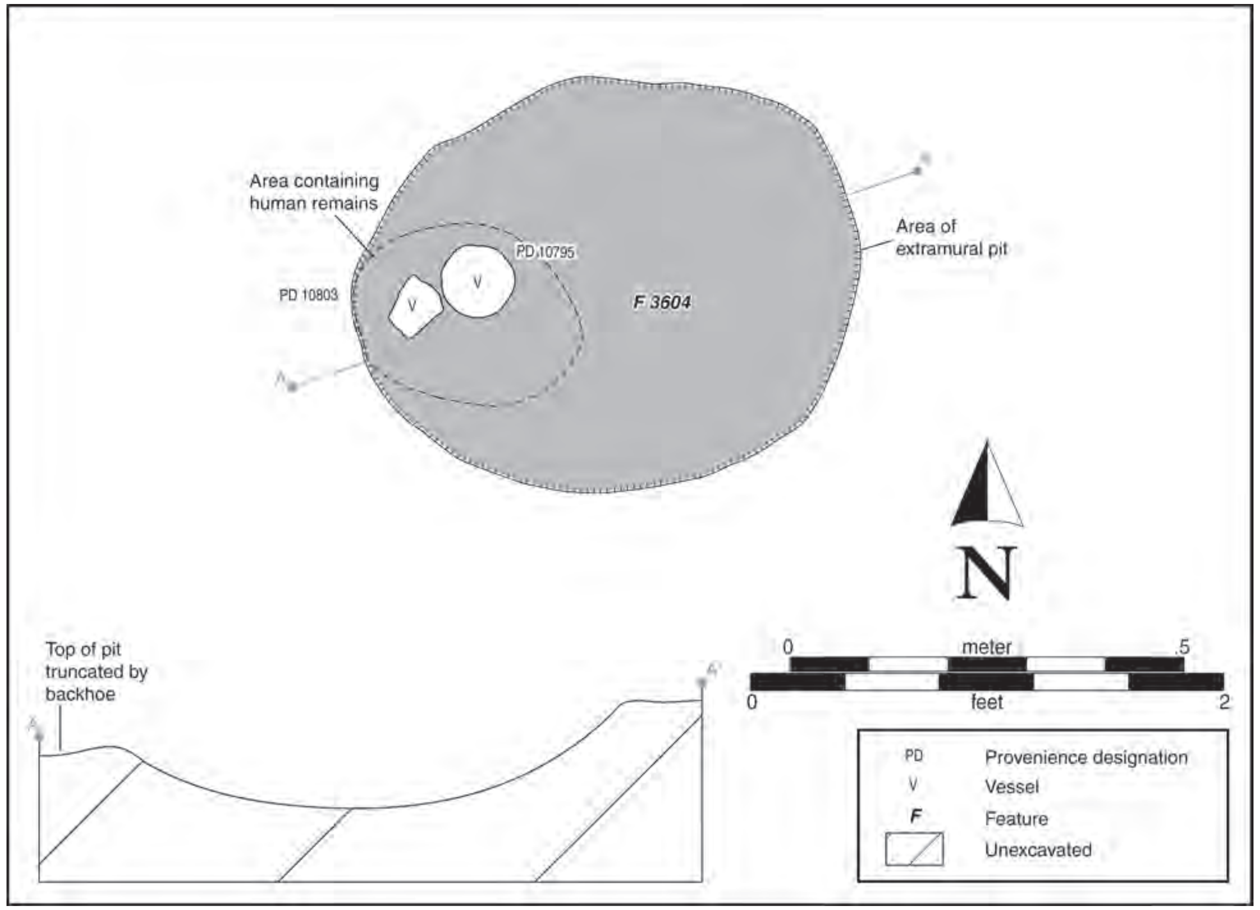


Figure 159. Plan view and cross section of Feature 3604, a secondary pit cremation in Locus D in which cremated remains appeared to have been placed in a reused extramural pit.

Inhumations

Eighteen inhumations were excavated at Mescal Wash; which accounted for 38 percent of the burial features (Table 196). Most of the inhumations (15 of 18) were probably primary interments. Five inhumations could not be confidently classified as either primary or secondary interments. These features consisted of disarticulated or incomplete skeletal elements with no direct evidence of secondary interment (e.g., bundling of bones). More likely, their incompleteness and disarticulation reflects translocation and removal of bone elements as a result of rodent activity or other postdepositional disturbances. For instance, 1 partial neonate skeleton in Locus C (Feature 10698) was found within a rodent burrow; the skeletal remains may have derived from a nearby structure (Feature 7461).

Excluding one indeterminate case, 12 inhumations appeared to have been interred in extramural contexts, and five probably were interred in intramural contexts. The 12 extramural inhumations included 1 case (Feature 4740 in Locus D) in which an extramural burial appeared to have been intruded on during subsequent construction of a structure. Among the five intramural inhumations, two (Feature 5512 in Locus D and Feature 9410 in Locus C) were interred in pits that originated in the fill of abandoned structures, and both pits extended through the structure floors. Members of the kin groups that resided in these structures may have intentionally placed these burials in abandoned structures as a means of communicating and legitimizing claims to those locations and their surrounding lands. This is plausible, given the extensive reuse of house locations, as evidenced by the frequent superimposition of multiple structures (especially in Locus D) (see Chapter 7, Volume 1), suggesting continual reuse of those structure locations and lands by the same kin groups or lineages. Without doubt, frequent reoccupation of the same locations required some means of communicating land claims following episodes of temporary abandonment. The burial of deceased relatives in abandoned houses may have facilitated communication and social legitimization of those land claims (see Lincoln-Babb et al. 2010).

Table 196. Attributes of Inhumations at Mescal Wash

Feature/ Locus	Length (cm)	Width (cm)	Depth (cm)	Body Position	Body Layout	Head Orientation	Pit Shape	Age	Sex	Disturbance	Burial Artifacts	Comments
336/D	180	45	41	extended	supine	east	subrectangular plan and profile	adult	female	Backhoe removed most of cranium and torso during trenching; moderate root and rodent disturbance.	*Olivella* shell near right tibia.	Sherds and flakes in fill; small, clay ball in rodent burrow; fragment from a Type II plain ware vessel may have been interred with burial.
2679/D	95[a]	53[a]	34	extended	supine	east	subrectangular plan and profile	adult	female	Moderate root and rodent disturbance; later construction of structure removed head and torso.	None.	Abundant sherds and flakes in fill, likely related to structure.
3528/D	42[b]	26[b]	37	indeterminate	indeterminate	east	subrectangular plan and profile	infant (ca. 1 year)	indeterminate	Heavy rodent disturbance, removed most of body.	None.	Most of body removed by rodent activity; sherds in fill.
3564/D	200[b]	60[b]	13	extended	supine	southeast	not visible	adult (30–40 years)	male	Moderate root and rodent disturbance.	Dragoon Red-on-brown bowl (elaborated) situated left of skull.	Sherds and flakes in fill; possible Empire projectile point (Archaic period) in fill near left hand may have been interred at the time of the burial.
3631/D	ND	ND	ND	ND	ND	ND	ND	indeterminate	indeterminate	ND	plain ware bowl	Field notes indicate the presence of a plain ware bowl of indeterminate type, but the vessel attributes were not recorded. The bowl was presumably interred with the human remains as a mortuary offering.
3943/D	50	40	15	indeterminate (possibly flexed)	seated	indeterminate	circular plan, indeterminate profile	child	indeterminate	Heavy rodent disturbance.	None.	Only skull, upper arms, and several ribs were recovered; remainder of body removed by rodent activity; burial appears to be intrusive into an earlier pit.
4740/D	90	55	55[a]	tightly flexed	on right side	east	oval plan; sloping walls; flat, rock-lined base	adult (50+ years)	male	Moderate root disturbance; later construction of structure removed portion of skeleton.	None.	Found beneath intramural pit in Feature 3545; sherds and faunal bone in fill.
4886/D	180	55	43	extended	supine, propped up	east	subrectangular plan and profile, small alcove at feet	adult (45+ years)	male	Minor rodent disturbance.	Two bone awls near right hand.	Adjacent and connected to cremation Feature 4850; no artifacts in fill.
5512/D	75	53	57	semiflexed	seated, head on left side	northwest	oval plan, sloping walls, flat base	adult (35–45 years)	male	Moderate root disturbance; backhoe disturbed right side of cranium during stripping.	One bone awl beneath left foot; small cobbles deliberately placed on portions of skeleton.	Large neckless-jar fragment in fill likely related to structure; sherds, flakes, and faunal bone in fill.
6007/C	190	47	15	extended	supine, head on right side	east	subrectangular plan and profile	adult (45–55 years)	male	Moderate root and rodent disturbance; backhoe disturbed left side of cranium during stripping.	None.	Sherds, flakes, and faunal bone in fill.
6123/C	117	30	12	extended	supine	southwest	subrectangular plan, sloping base, possible informal pit	child	indeterminate	Moderate root disturbance.	None.	No artifacts in fill; may be an informal burial pit with little preparation.
6191/C	175[a]	50[a]	12	extended	supine	east	indistinct in plan, sloping base, possible informal pit	adult	female	Moderate root disturbance; backhoe removed a portion of the torso during stripping.	None.	Sherds, flakes, and faunal bone in fill; may be an informal burial pit with little or no pit preparation.
7170/C	78[c]	66[c]	44	indeterminate (disarticulated)	indeterminate (disarticulated)	northeast	circular plan, subrectangular profile, likely reused extramural pit	infant (ca. 1 year)	indeterminate	Heavy rodent disturbance; bones scattered within pit.	Shell disk beads; shell ring or pendant near long bone.	Bones found in large pit, likely a reused extramural pit; sherds and flakes in fill.
7457/C	170[b]	55[b]	15	semiflexed	head and torso angled to the left	south	head level with floor of structure, shallow depression below torso may be burial pit	adult (50–65 years)	male	None observed.	None.	No obvious burial pit (pit outline was inferred), indicating a possible informal burial; body could have been placed on floor of structure or in slight depression (expedient burial pit?); nearby inhumation Feature 7458 also found on floor level of Feature 6098; ashy soil and charcoal, likely residue from structure fire; sherds, flakes, and faunal bone in fill.
7458/C	68[b]	48[b]	16	indeterminate (disarticulated)	indeterminate (disarticulated)	southeast	head level with floor of structure, with possible informal subfloor pit	child (2–4 years)	indeterminate	Disarticulation likely from prehistoric period disturbance.	None.	No obvious burial pit (pit outline was inferred); possible informal burial or secondary burial (partial cranium, tibia, fibula, and rib cage only); body might have been placed on floor of structure; nearby inhumation Feature 7457 also found on floor of Feature 6098; ashy soil and charcoal, likely residue from structure fire; sherds, flakes, and faunal bone in fill.

Feature/ Locus	Length (cm)	Width (cm)	Depth (cm)	Body Position	Body Layout	Head Orientation	Pit Shape	Age	Sex	Disturbance	Burial Artifacts	Comments
7833/D	130[b]	40[b]	19	extended	supine	east	head level with floor of structure; either informal burial pit or placed on floor	child (6–7 years)	indeterminate	Moderate root and rodent disturbance.	None.	No visible burial pit; sherds, faunal bone, and flakes in fill; may have been placed on floor of structure Feature 834, but body layout suggests more-formal arrangement.
9410/C	140	60	23	semiflexed	supine	south	oval plan, sloping base	adult (25–35 years)	male	Heavy rodent disturbance.	None.	Sherds, shell, and faunal bone in fill; burial pit barely large enough to contain body; burial position (flexed with arms folded over torso) suggests probable formal burial, although burial pit does not appear to have been formally prepared.
10645/D	95	60	24	fully flexed	supine, tilted left	east	circular plan, indeterminate profile, rock-lined pit	adult	male	Moderate root and rodent disturbance; later thermal pit partially disturbed portion of burial pit.	Overturned metate over skull; cobbles placed in base of pit and over portions of the body; possible ochre staining.	Flakes in fill; crystal in fill may have been associated with burial.
10698/C	80	38	20	indeterminate (disarticulated)	indeterminate (disarticulated)	indeterminate	not visible	neonate	indeterminate	Neonate bones found in rodent burrow.	None.	Neonate may have been buried in structure or left on floor but removed and translocated to wall by rodent; incomplete remains.
11441/D	ND	ND	ND	ND	ND	ND	indeterminate	infant	indeterminate	ND	None.	Infant burial found in base of posthole Subfeature 10 in structure Feature 3868.

[a] Includes only the intact portion of the feature.
[b] Inferred, based on the extent of skeletal remains.
[c] Dimensions of the larger pit in which human remains were recovered.
Key: ND = no data.

Three other inhumations classified as intramural interments (Features 7457 and 7458 in Locus C and Feature 7833 in Locus D) were found in the fill of structures, but with indistinct pit outlines. In all three cases, the remains were at the same elevations as the structure floors, suggesting that they were not subfloor burials. In such cases, it is difficult to discern whether the pits originated within the fill of their associated structures or the bodies were placed on the floors of these structures at the time of, or soon after, their abandonment. Notably, Features 7457 and 7458—an elderly-adult-male inhumation and a child inhumation, respectively—were found on the floor of the same structure (Feature 6098), which appeared to have been burned at the time of abandonment. These individuals may have been left on the floor immediately before the structure was set on fire, possibly as part of a formal mortuary ceremony or as an informal means of rapidly disposing of the dead during an unplanned abandonment, but the bone remains exhibited no evidence of having been subjected to intense fire and heat, suggesting possible interment subsequent to the structure fire. The structure (Feature 834) containing inhumation Feature 7833, a child inhumation in Locus D, did not appear to have been burned.

Most of the inhumations (at least 12, possibly 14) appeared to have been formal burials in which the bodies were placed in formally prepared burial pits. Burial-pit shapes ranged from ovoid to subrectangular in plan, with flat to sloping floors and straight to slightly sloping side walls. One inhumation containing the remains of an adult male (Feature 4886 in Locus D) included an alcove near the individual's feet, suggesting formal preparation of the pit. Two other burials in Locus D containing remains of adult males were placed in rock-lined pits (Features 4740 and 10645), also suggesting formal preparation.

Two inhumations in Locus C containing the remains of a child and an adult female (Features 6123 and 6191, respectively) appeared to have been interred in shallow pits with poorly prepared and uneven (sloping) bases, possibly suggesting informal and expedient burials rather than formal grave preparation (Figure 160). It is possible that these individuals were interred rapidly in shallow and poorly prepared pits under conditions of duress or during rapid abandonment. An infant inhumation in Locus C (Feature 7170) appeared to have been interred in a reused nonthermal pit. The reuse of pits previously used for domestic functions may indicate informal or expedient burial practices, as explained above, but the presence of probable offerings (shell beads) in this feature undermines that interpretation.

Variability in Modes of Interment among the Loci

In this section, we discuss the analysis of differences in the distributions of burial types among the site loci (see Table 192). The numbers of burials excavated in Loci A and E were too small for inclusion in this analysis. We therefore focus exclusively on the larger samples in Loci C and D. In Locus D, secondary cremations (n = 13) slightly outnumber inhumations (n = 10) a ratio of 1.3 secondary cremations per inhumation. In Locus C as well, secondary cremations (n = 10) were slightly more frequent than inhumations (n = 8)—a ratio of 1.25 secondary cremations to 1 inhumation. A contingency-table significance test of the frequencies of inhumations and cremations in Loci C and D (2-by-2 table) suggested no significant difference between these loci (chi-square test, with Yates correction: chi square = 0.07, *df* = 1, *p* = .80; Fisher's exact test: *p* = .60).

Variability was also evident among the various categories of cremations. In Locus D, secondary pit burials (with and without capping vessels) outnumbered secondary urn burials by 5.5 to 1. In Locus C, the ratio was much lower—2.3 to 1. The raw frequencies of secondary urn burials was roughly even in the two loci (3 in Locus C and 2 in Locus D) but proportionally more frequent in Locus C. Most of the features in Locus C postdated those in Locus D, suggesting a possible chronological trend in mortuary practices. Primary cremations were recorded in Locus D (n = 4) but not in Locus C (n = 1). However, given the frequencies of secondary cremations in both loci, we have no reason to believe that the residents of Locus C used primary-cremation areas (crematoria) any less frequently than did the residents in Locus D. Perhaps the residents of Locus C used crematoria located in nearby Locus D or in areas disturbed by road construction.

Indeed, cremation areas tend to be located away from structures and other domestic features within settlements, in dedicated extramural locations This is evidenced by Burial Areas 1 and 2, discussed below and also by the cremation area found by EcoPlan in Locus B (Neuzil 2009b). We suspect that cremation areas used by the residents of Locus C have been obliterated by road construction.

Osteological Analyses

Analytical Methods

The osteological and bioarchaeological analyses were performed according to *Standards for Data Collection from Human Skeletal Remains* (Buikstra and Ubelaker 1994), as well as the procedures outlined by Turner et al. (1991). The kind and amount of biological data collected from the human burials were largely controlled by each type of burial feature under consideration. Burial features at Marsh Station fell into two general categories: inhumations and cremations. For inhumations, characteristics of each burial pit and the position and layout of the body within

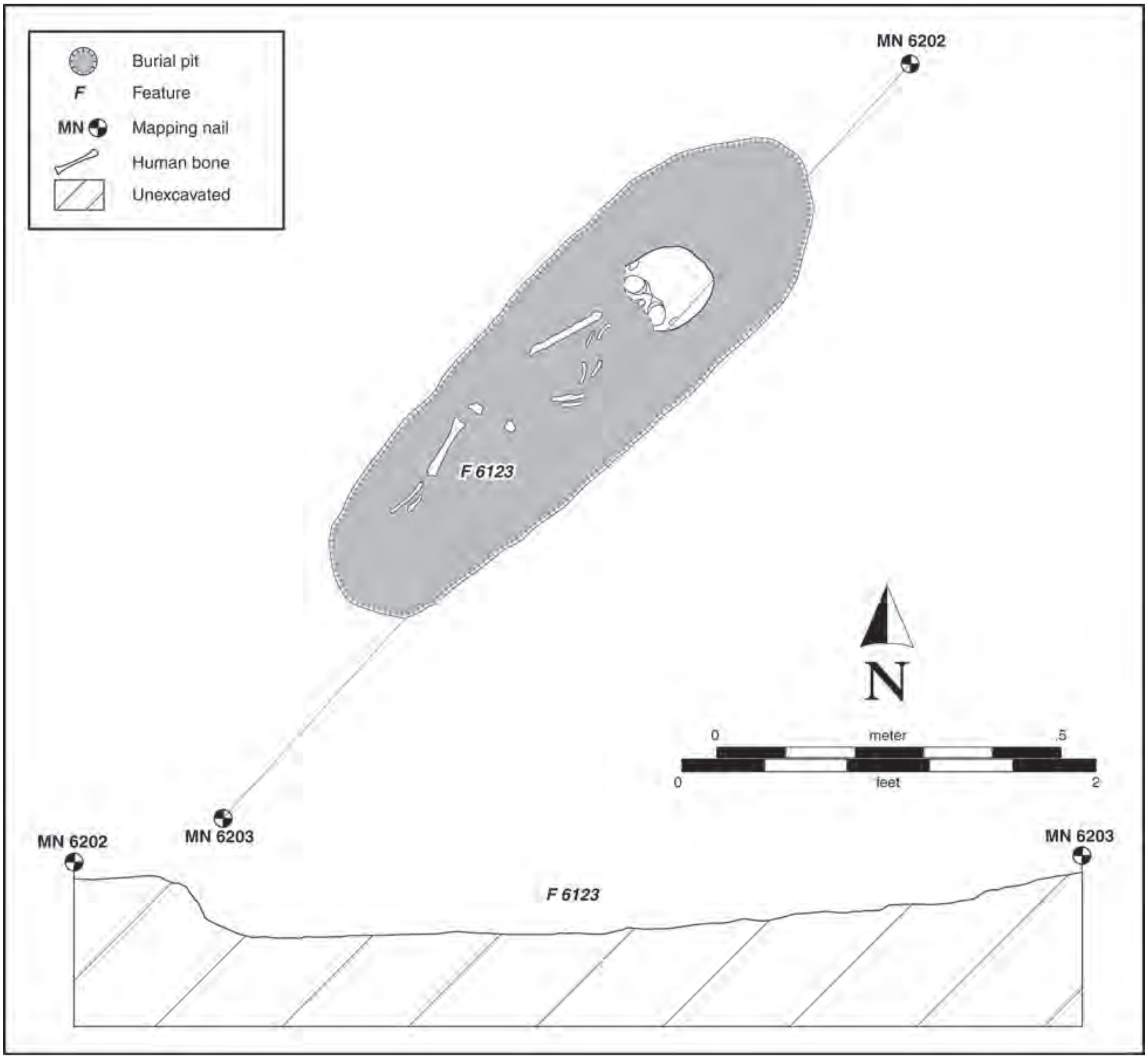


Figure 160. Plan view and profile of Feature 6123, a possible informal inhumation in Locus C.

the pit were recorded prior to any skeletal observations. In many cases, taphonomic forces had obliterated several attributes, such as head location and the position of the arms and legs. Nevertheless, these attributes were recorded, if investigators could make reasonable inferences based on the remaining skeletal elements.

Following observations of each inhumation context, an inventory of skeletal elements and teeth was recorded. A homunculus was used to visually indicate the skeletal elements that were recovered and the completeness of the skeletal remains. Available metric and nonmetric traits were assessed in the field to determine the age and sex of an individual, as detailed in the report by Buikstra and Ubelaker (1994). The presence or absence of pathological conditions was noted, and a brief description of the individual attributes was written for each feature. Any teeth associated with the interred individuals were similarly inventoried and assessed for developmental indicators, in juveniles, or for stages of enamel wear, in adults. Dental pathology and morphological characteristics were also recorded.

Cremated remains presented greater challenges to the investigators in the field (Lincoln-Babb and Minturn). As with inhumations, basic contextual attributes (primary versus secondary cremation, presence of a pit or vessel, etc.) were recorded before observations of the skeletal materials.

All identifiable skeletal elements were inventoried. In some instances, identifiable elements were diagnostic for age and sex determination following Buikstra and Ubelaker (1994). Typically, elements could only be placed into broad categories representing regions of the body (cranial, teeth, or long bones). Among these body regions, the cremated remains were separated into two levels of incineration: complete (calcined) and incomplete (blackened or charred). Then, the weight of cremated material for each body region and each level of incineration was recorded, in grams.

Demographic Characteristics

Among the 48 burials, age at death and/or sex could be inferred for 35 individuals and are listed in Table 197. Not surprisingly, all 13 individuals of indeterminate age and sex were recovered from cremation contexts. With cremations, thermal alteration of the bone and the substantially reduced amount of diagnostic skeletal material hindered the ability to draw conclusions related to age, sex, and other attributes. Nevertheless, several individuals recovered from cremation contexts retained skeletal material useful in determining their ages or sex. The mortuary context from which each individual was recovered is listed in Table 197.

Age and sex data for each individual were collected in the field and were used to construct a demographic profile of the Mescal Wash skeletal sample. Most age assessments were based primarily on developmental and functional dentition (i.e., dental maturity and wear), but other age indicators were incorporated to refine the age estimations. For example, age for an adolescent (12–18 years) could be estimated using epiphyseal development and closure. Unfortunately, age estimation for the majority of adult individuals was only possible using functional dental age. Because these methods were not designed to provide precise and accurate estimations of age, broad age ranges (e.g., 18–99 years) were often assigned.

Sex was estimated using any available biological indicators. These included sexually dimorphic traits of the pelvis and cranium but also more-heuristic estimates of general robusticity and gracility. As with any biological criteria, extreme-trait values were easily assessed (e.g., a large sciatic notch indicated a female), but individuals displaying values between extremes (e.g., a moderate sciatic notch indicated indeterminate sex) were not as easily evaluated; therefore, a number of individuals were considered indeterminate. Also, during the cremation process, shrinkage and warping of skeletal elements occurs, further hindering sex assessments. Despite these hindrances, sex was estimated for nearly 40 percent of the 35 individuals with observable demographic attributes (male: n = 8; female: n = 6). As with any skeletal sample, juveniles (less than 15 years) were not assigned sex estimates, because sexually dimorphic traits are not yet fully developed in humans of these age groups.

Paleodemography

The various mortuary treatments encountered at Mescal Wash (i.e., primary inhumations, primary cremations, and secondary cremations) dictated adaptive levels of effort during archaeological excavations (see above), but every effort was made to fully recover all inhumations from the site, including individuals of all age classes. For example, fine-mesh screen was used to ensure the recovery of term and preterm infants—an age cohort typically difficult to detect during archaeological investigations. As we show, such considerations are important in paleodemography studies.

The age range of the individuals recovered from Mescal Wash was neonate (birth) to 50+ years. Tables 198 and 199 present the general demographic structure of the Mescal Wash sample appropriate for paleodemographic analyses. The paucity of information for some individuals did not permit their inclusion in the final demographic analysis, potentially leading to biases in the final sample. Two sources of bias should be carefully considered. First, juveniles (neonates to subadults) may have been underenumerated because of infanticide, age-specific mortuary treatment, or differential preservation between age classes. Second, skewed adult representation (underaging of older adults) may have biased the age distribution of a skeletal sample, partly because of census errors introduced by the age-determination methods incorporated during osteological analysis. Each of these biases is considered below.

No evidence of infanticide or differential preservation between age classes was detected. Yet no individuals between 7 and 14 years of age were identified. The reasons for this underenumeration (i.e., complete absence) are unclear. Although sampling error cannot be ruled out, an additional explanation for this discrepancy is possible seasonal habitation and patterns of site use leading to a slightly skewed demographic profile. As explained above, Altschul et al. (2000) noted that Mescal Wash was situated between the Tucson Basin and the San Pedro Valley, at a crossroads for diverse Hohokam and Mogollon groups. As noted above, Vanderpot and Altschul (2007:68) explained that the site may have been used by “a variety of groups, primarily as a campsite for travelers moving between the Santa Cruz River and San Pedro River Valleys” and remained in use for an extended period, although it was never incorporated into a larger, dominant culture. They suggested that the area was considered a “free-zone” shared by various groups from the broader region, as a communal resource (see Bayman [2007] for a similar argument about the Papaguería). This might explain the absence of adolescents and older adults: children and elderly individuals may have remained in the larger villages while producing adults and dependent neophytes visited Mescal Wash for resource procurement and other purposes. This hypothesis is further explored below.

A survivorship curve for the pooled (all age and sex classes) sample is presented in Figure 161. Because of

Table 197. Ages, Sex, and Recovery Contexts for 48 Individuals Subjected to Osteological Analysis

Feature	Sex	Age	Context
220	indeterminate	indeterminate	cremation
320	indeterminate	indeterminate	cremation
333	indeterminate	adult	cremation
336	female	adult	inhumation
380	indeterminate	adult	cremation
381	indeterminate	child	cremation
464	indeterminate	indeterminate	cremation
561	indeterminate	indeterminate	cremation
562	indeterminate	indeterminate	cremation
2679	female	adult	inhumation
3528	indeterminate	infant	inhumation
3564	male	middle adult	inhumation
3604	indeterminate	indeterminate	cremation
3704	indeterminate	indeterminate	cremation
3875	indeterminate	indeterminate	cremation
3943	indeterminate	child	inhumation
4057	indeterminate	child	cremation
4069	indeterminate	adult	cremation
4221	indeterminate	adult	cremation
4739	indeterminate	infant	cremation
4740	male	old adult	inhumation
4794	indeterminate	young adult	cremation
4798	indeterminate	indeterminate	cremation
4850	female	adult	cremation
4886	male	middle adult	inhumation
5512	male	middle adult	inhumation
5992	indeterminate	indeterminate	cremation
6007	male	middle adult	inhumation
6045	indeterminate	adult	cremation
6074	indeterminate	adult	cremation
6090	indeterminate	young adult	cremation
6123	indeterminate	child	inhumation
6191	female	adult	inhumation
7170	indeterminate	infant	inhumation
7335	female	adult	cremation
7456	indeterminate	adult	cremation
7457	male	old adult	inhumation
7458	indeterminate	child	inhumation
7472	indeterminate	indeterminate	cremation
7833	indeterminate	child	inhumation
7847	indeterminate	indeterminate	cremation
9410	male	young adult	inhumation
10138	female	adult	cremation

continued on next page

Feature	Sex	Age	Context
10645	male	adult	inhumation
10674	indeterminate	middle adult	cremation
10698	indeterminate	neonate	inhumation
10707	indeterminate	adult	cremation
10711	indeterminate	indeterminate	cremation

Table 198. Demographic Structure of the Mescal Wash Sample

Sex	Age Group							Total
	Infant and Neonate	Child	Young Adult	Middle Adult	Old Adult	Adult	Indeterminate	
Female	—	—	—	—	—	6	—	6
Indeterminate	4	6	2	1	—	11	1	25
Male	—	—	1	4	2	1	—	8
Total	4	6	3	5	2	18	1	39

Table 199. Frequencies and Ratios of Adult Male, Adult Female, and Juvenile Burials from Mescal Wash

Group	Count (n)	Percent	Ratio (Juveniles to Adults)
Female	6	25.0	1.7
Male	8	33.3	1.3
Juvenile	10	41.7	
Total	24	100.0	0.7

Note: Female to male ratio = 0.75.

the limited sample number of identified males and females, a separate hazard analysis separated by sex was not possible. The resulting curve is clearly a Class 2 curve, with the standard contrast of a nonindustrial population to the Class 1 curve of modern societies (Swedlund and Armelagos 1976). Hazard analysis using a maximum-likelihood-estimation method yielded a mean age at death of 18 years. Applying the human archetypal fertility curve (with the assumption of a stable and stationary population) produced a crude birthrate of 55 per 1,000 per year, a mean family size of 3.6, and a generation length of 26.6 years. These estimates are comparable to statistics for other sites whose inhabitants followed similar economic strategies and subsistence patterns during this period (see below). Interpretations of Figure 161 (survivorship) and Figure 162 (mortality hazard) suggest that the sample may have exhibited some of the abovementioned biases.

The low infant-mortality and high adult-mortality rates evident in our sample do not correspond to extant anthropological populations often used for comparison (Swedlund and Armelagos 1976) and may reflect underenumeration of infants and biases in adult age estimation. The possibly seasonal and migratory nature of the Mescal Wash habitation may also have factored into the observed demography of the individuals recovered during excavations. To test this hypothesis, our sample was compared to other archaeological samples from groups who practiced similar subsistence strategies. Recent excavation by EcoPlan (Neuzil 2009b) produced an additional 43 individuals with sufficient age and sex data for comparison to the skeletal remains excavated by SRI (Heilman et al. 2010). To test for sampling error, we compared the skeletal remains excavated by EcoPlan to SRI's sample and, subsequently, pooled them for analysis. Before discussion of that comparison, we will discuss the skeletal data excavated by SRI as compared to the skeletal sample from the Libben site.

The Libben site, a prehistoric ossuary located in Ottawa County, Ohio, was excavated in the late 1960s. Excavation results suggested that it was a perennial occupation site spanning 250–300 years, from approximately A.D. 800 to 1100 (Lovejoy et al. 1977), which corresponds to the Middle Formative period. A total of 1,327 individuals were recovered from the Libben site, and all age classes were

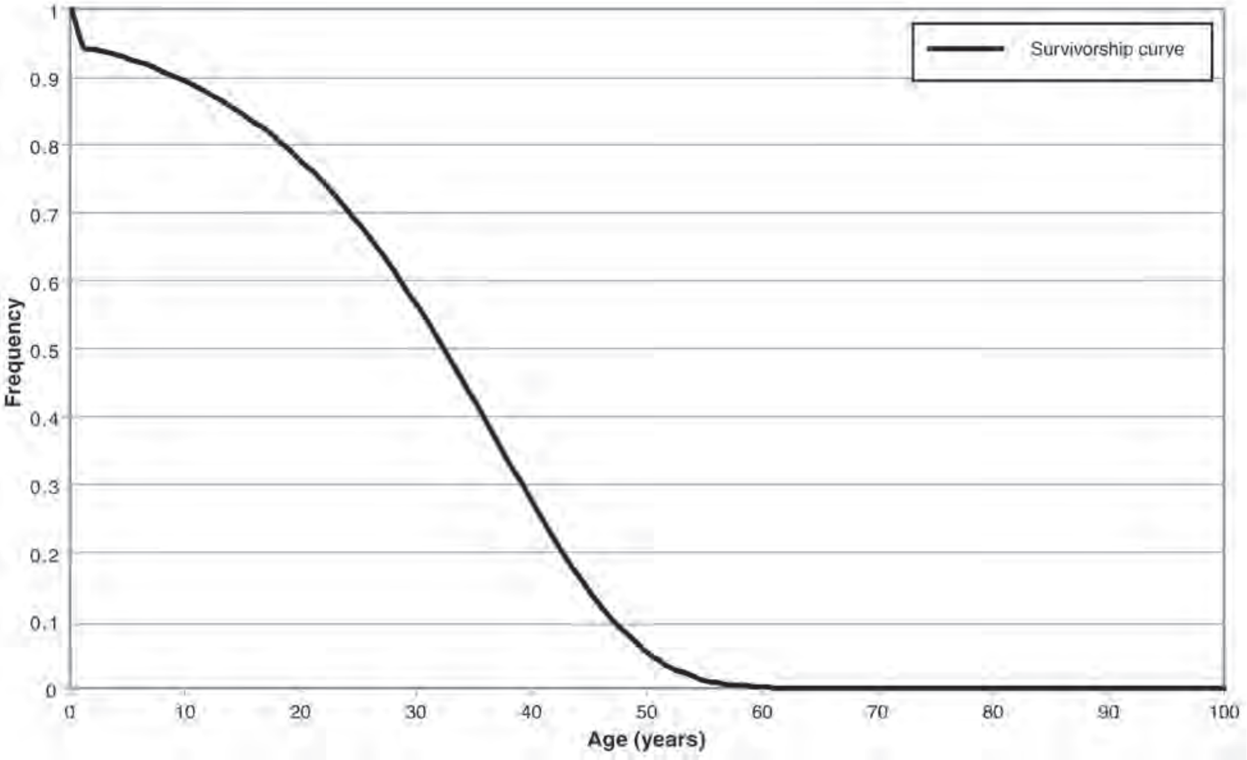


Figure 161. Survivorship curve for the pooled (all age and sex classes) sample.

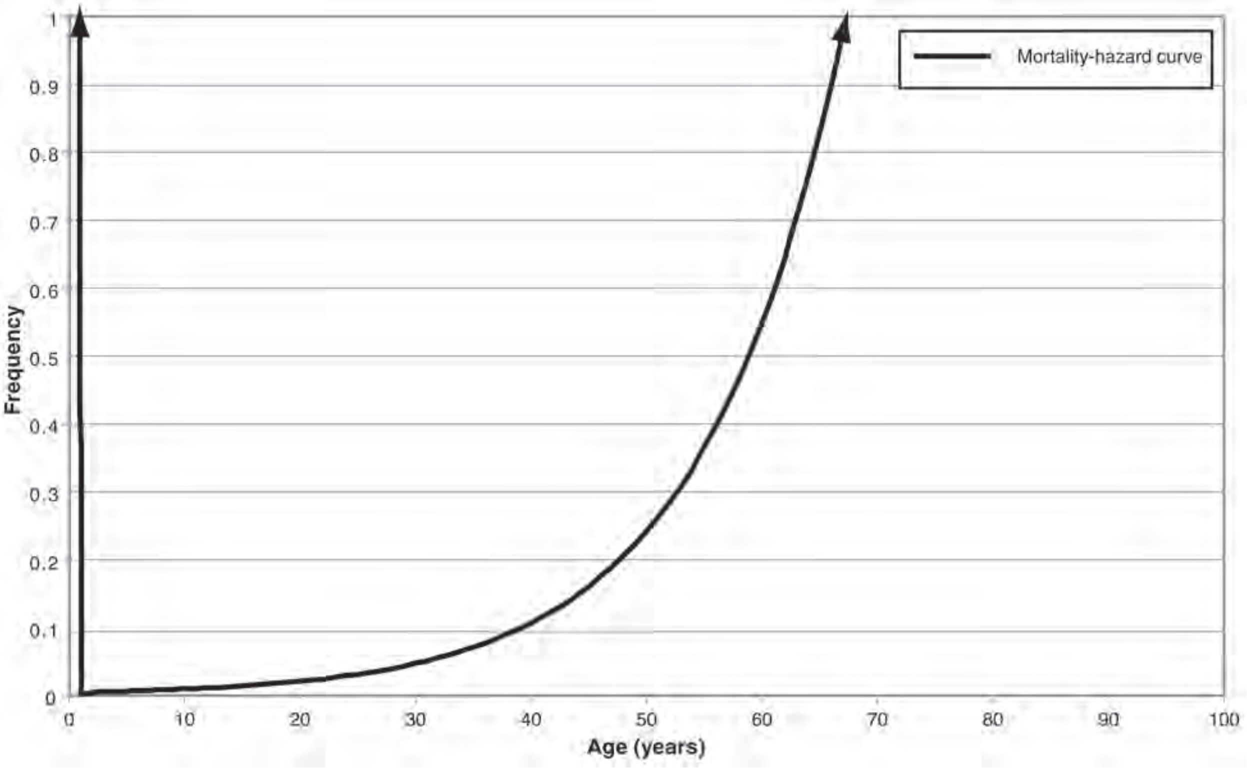


Figure 162. Mortality-hazard curve for the pooled (all age and sex classes) sample.

represented. The age range of the recovered burials was 16 weeks in utero to 70+ years. The composition of this burial population and the time period of the site were attractive attributes for comparison to our sample.

Figures 163 and 164 present survivorship and mortality-hazard curves comparing the Mescal Wash and Libben sites. The comparison of the survivorship and mortality hazards was facilitated using parameters (i.e., Siler) modeled with MLE (Holman 2000), a programming language for estimating parameters of likelihood models (Holman 2000:1). A four-parameter Siler model was fit to the full data sets from both the Mescal Wash and the Libben samples (Table 200). The fit of Siler competing-hazards models converged normally for both samples. The high number of infants relative to mid-aged juveniles (7–14 years) resulted in extreme values for infant mortality (parameters α_1 and β_1) (see Table 200), especially for the Mescal Wash sample, suggesting differences in subadult mortality between the sites. The survivorship plot (see Figure 163) illustrates the effect of underenumeration of mid-aged juveniles in the Mescal Wash sample. Both samples began with a relatively similar survivorship, but survivorship for the first decade of life in the Mescal Wash sample was unrealistically high, because no individuals between 7 and 14 years of age were present. The influence of unaged adults (18–99 years) resulted in an expanded standard deviation in the adult range of the Mescal Wash sample, flattening the adult age-at-death distribution. The differences observed between the Mescal Wash and Libben samples were significant ($\Lambda = 25.17$, $df = 4$, $p = .001$).

Although the individuals at the Mescal Wash and Libben sites practiced similar residential strategies (i.e., residence at both sites appeared to have been nonpermanent), differences in mortality and survivorship were evident. Of course, underenumeration of subadults in the Mescal Wash sample may explain the majority of these differences. Lovejoy et al. (1977) suggested that Libben was a perennially occupied site, but because Libben was an ossuary repeatedly used (secondary interment) by a single cultural group, it is unsurprising that all age ranges were present in that sample. A repeated but seasonal habitation by various members of different groups may provide a worthy, though strictly heuristic, explanation for these differences. In the absence of a permanent and formal governing system, multiple interments over long periods of time in a single location seem unlikely. Moreover, if no single group could lay claim to the area for an extended period of time ("free-zone"), mid-aged juveniles and older adults may have stayed in the larger "homeland" villages because the interval between visits to Mescal Wash would have involved, out of necessity, shorter durations.

EcoPlan excavated a total of five sites in the Mescal Wash site area (Neuzil 2009b), but only three of those sites yielded human remains (AZ EE:2:51 [ASM] [the Mescal Wash site],

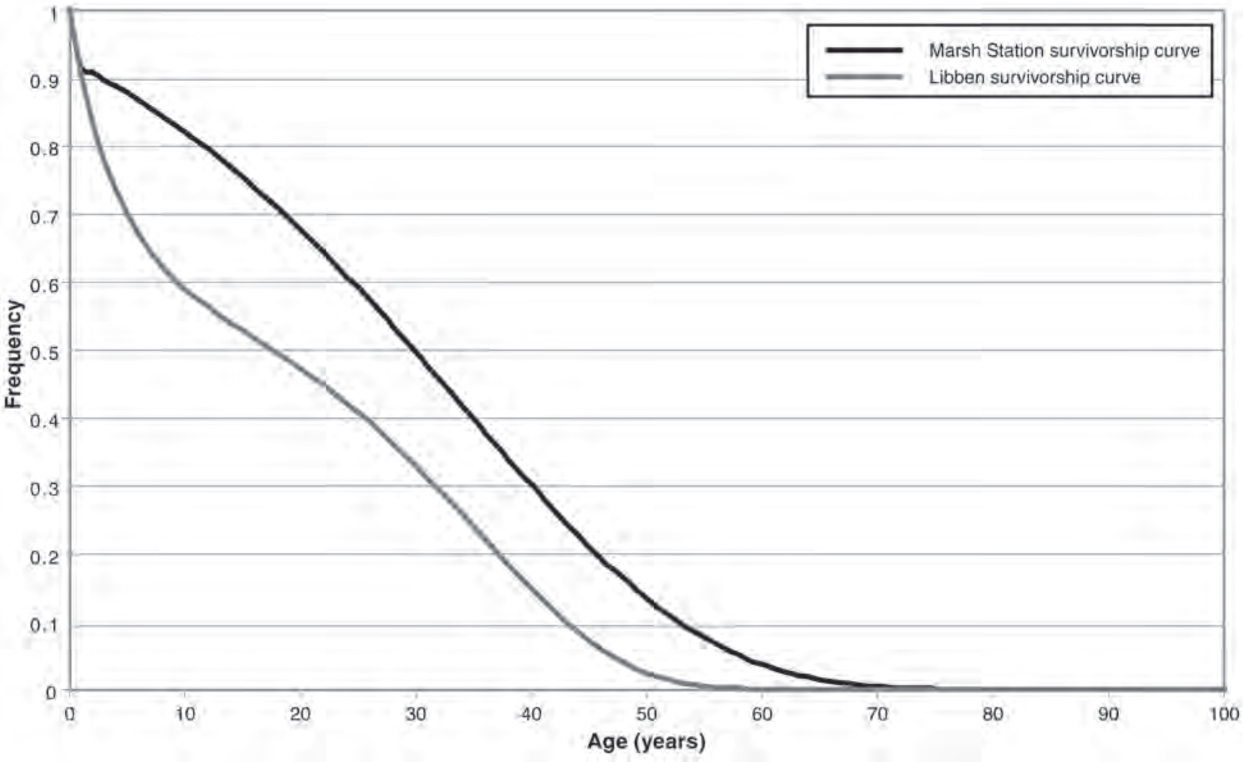


Figure 163. Comparative survivorship curves for the Mescal Wash and Libben sites.

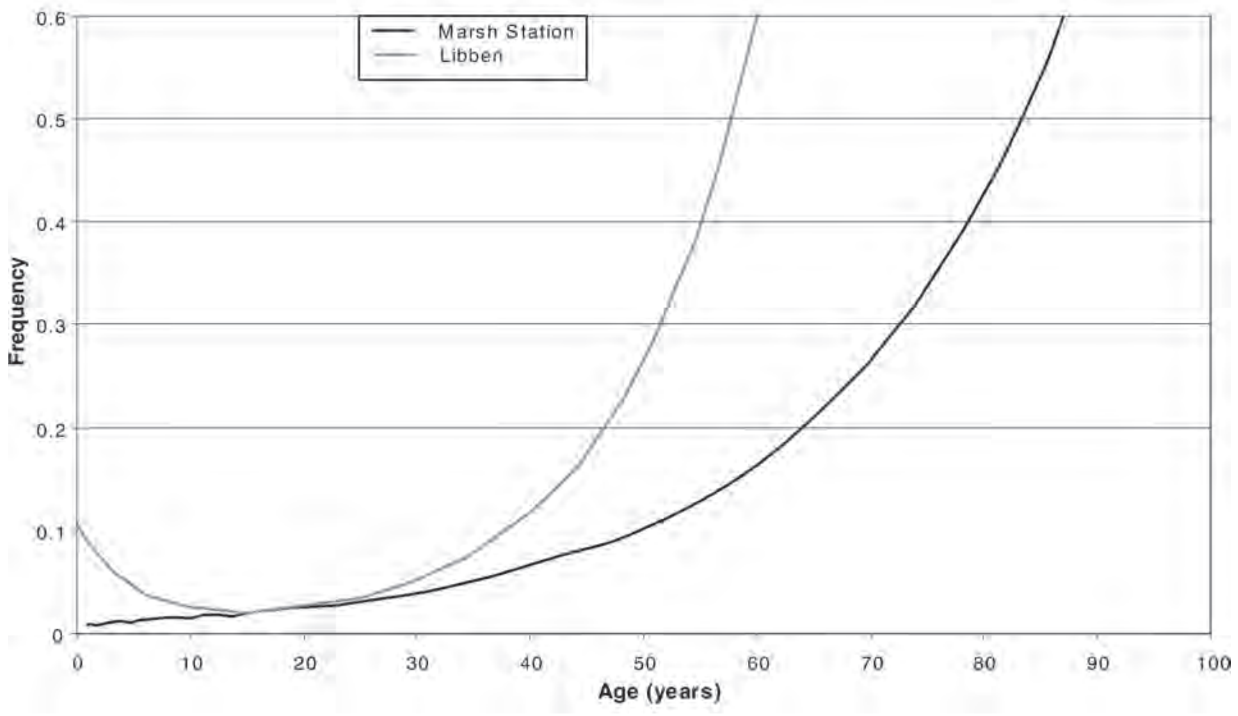


Figure 164. Comparative mortality-hazard curves for the Mescal Wash and Libben sites.

Table 200. Parameter Estimates of the Siler Age Model for the Mescal Wash and Libben Sites

Parameter	Marsh Station	Libben
α_1	0.905	0.103
β_1	3.909	0.192
α_2	0.000	0.000
α_3	0.028	0.004
β_3	0.028	0.082

AZ EE:2:437 [ASM], and AZ EE:2:438 [ASM]). Forty-three primary individuals (39 cremations and 4 inhumations) were recovered, the majority (n = 35) from the northern portion of Locus B at the Mescal Wash site, immediately north of the portion of the locus investigated by SRI. We compared the data sets using a Likelihood Ratio Test. The fit of the Siler models was not significantly different based on the Likelihood Ratio Test ($\Lambda = 1.47$, $p = .84$, $df = 4$). The similarity in the mortality patterns of these two data sets is interesting and suggests similar mortality hazards—an expected result, given their relative proximity. Also notable is the survivorship profile of the combined samples (Figure 165). The smoothing of the survivorship curve suggests that sampling bias and aging error may partially explain the distribution of deaths in the sample recovered by SRI, but that same smoothing could also have resulted from the necessarily large age ranges of the majority of the cremated individuals. More data from the area is necessary to better understand the nature of these distributions and their relationship.

Evidence of Pathology

Skeletal Pathology

Few pathological conditions were observed on individuals from our sample. Because of the condition of most sets of remains, especially those from cremated individuals, the majority of skeletal elements could not be evaluated for the presence or absence of pathological conditions. Therefore, the relatively small number of lesions represents a small universe of observable elements and does not necessarily suggest that the individuals recovered during SRI's excavations at Mescal Wash were in excellent health.

That said, skeletal pathology was noted on four individuals. The individual in Feature 3564 in Locus D, an inhumation of a middle-aged male, showed evidence of both active and healing porotic hyperostosis on the frontal and the occipital. Active and healing porotic hyperostosis was also

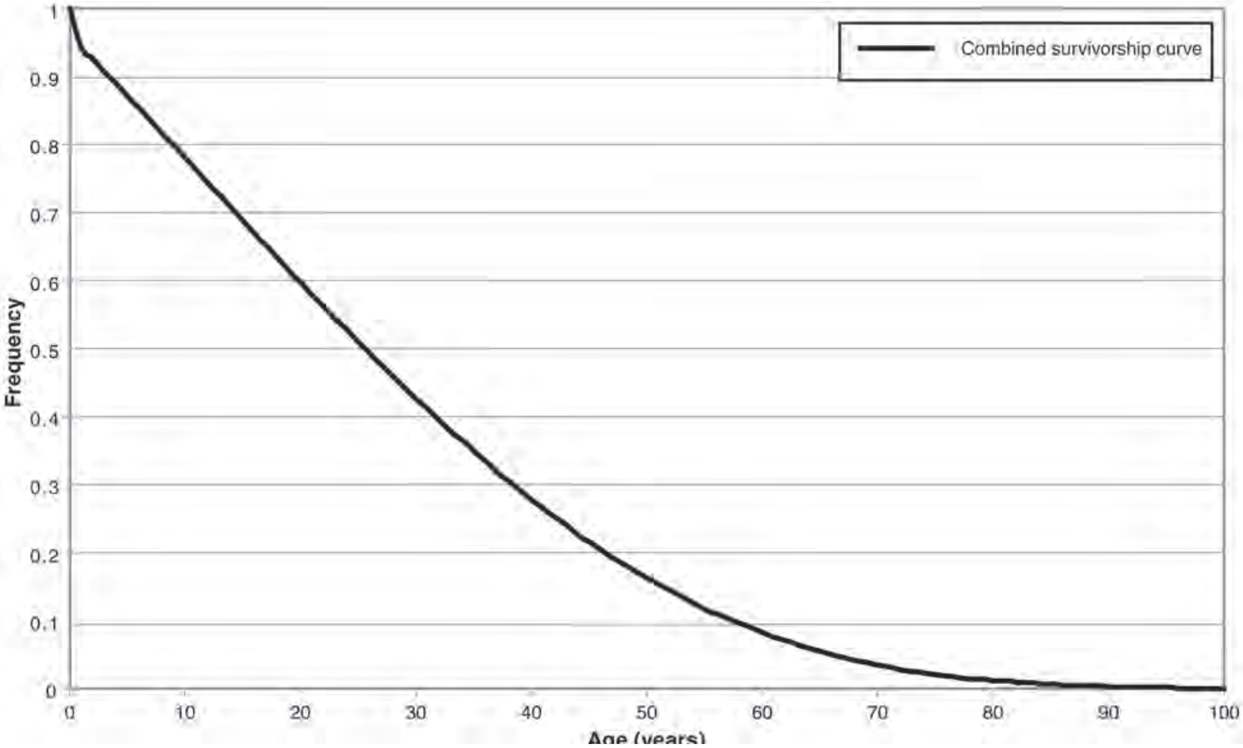


Figure 165. Survivorship curve for the combined Mescal Wash sample from excavations by Statistical Research, Inc., and EcoPlan Associates, Inc.

noted on the frontal, left parietal, and occipital of the individual in Feature 3943 in Locus D, an inhumation of a child of indeterminate sex. Mild porotic hyperostosis was noted on the occipital of the individual in Feature 4069 in Locus D, the primary cremation of an adult of indeterminate sex.

Porotic hyperostosis is characterized by a thickening of cranial bone, accompanied by pitting and porosity on the external surface (Mann and Murphy 1990:21–22). The cause of porotic hyperostosis is a metabolic disorder, such as Vitamin B12 deficiency (Walker et al. 2009). The frequency of porotic hyperostosis in a population has been used as a proxy for determining the overall health of a group as a whole. Although the presence of porotic hyperostosis in 3 of the 48 individuals in our sample is potentially meaningful, the *absence* of the condition in other individuals is largely unknowable, because of taphonomic influences. Put simply, too few individuals in the sample could be evaluated for presence/absence of the condition to draw firm conclusions about the population based on the appearance of the pathology in 3 individuals.

The individual in Feature 7457 in Locus C (inhumation of an old-adult male) exhibited sharp ridges on the anterior aspects of both tibiae. This condition, known as "saber shins," is associated with several disease processes, including treponemal infection, such as congenital or acquired syphilis; chronic periostitis, or a manifestation of Rickets (Vitamin D deficiency) (Mann and Murphy 1990:116). This inhumation consisted of more skeletal elements than those of many other individuals, and approximately two-thirds of the skeleton was present and in good preservation. Nevertheless, no other pathological lesions were noted on the skeleton of this individual; so, a precise diagnosis for the cause of the saber shins is not available.

Dental Pathology

Recovered teeth were evaluated for dental pathology and modification. Dental abscesses were associated with several molars of the aforementioned individual in Feature 7457. The condition known as saber shins is often caused by treponemal infection, and periodontal disease and dental abscessing result from bacterial infection, but it is unclear whether these two conditions were related in this individual. Indeed, the precise bacteria associated with dental abscessing remain unknown, and systemic infection is by no means a prerequisite for periodontal disease (Ortner 2003:593). Regardless of these caveats, it is a reasonable assertion that the individual in Feature 7457 possessed diminished health at the time of death.

Carious lesions (cavities) were noted on two molars and a premolar of the individual in Feature 4740 in Locus D (an old-adult-male inhumation). The two molars displayed both large and small occlusal caries, and the premolar showed small caries on several surfaces of the tooth. This maxillary left first premolar also exhibited chipping that was likely associated with the caries. Occlusal wear on this individual's teeth was extreme; at least 10 teeth were likely lost antemortem (i.e., before death).

Enamel chipping is a frequent finding in the teeth of individuals from the prehistoric period U.S. Southwest, largely a result of hunter-gatherer subsistence, as opposed to agriculture (Lincoln-Babb 1995, 2001). Chipping and breakage of back teeth (e.g., molars) is often the result of chewing or crushing nuts, small bones, or inclusions in processed foods. Chipping of incisors and other front teeth may also occur from mastication of hard foods, but is frequently the result of task activities that utilized the front teeth (Hawkey 1988). Three individuals exhibited enamel chipping. The individual in Feature 6007 in Locus C (a middle-adult-male inhumation) had chipping of both mandibular canines, as well as extensive occlusal wear on all teeth. The individual in Feature 7457 in Locus C showed chipping on both right canines and the lower left first premolar. Occlusal wear was also substantial on all teeth of this individual, including the four associated with abscesses described above. Finally, the individual in Feature 9410 in Locus C (a young-adult-male inhumation) exhibited chipping on the maxillary right first incisor and mandibular right second molar. Occlusal wear for this individual was not nearly as dramatic as that of the other individuals that exhibited enamel chipping. This characteristic is likely a product of age; the individual in Feature 9410 was a young adult, whereas the other individuals described were in the middle- and old-adult age ranges.

In sum, it is important to reiterate that the rarity of observed pathological conditions was substantially influenced by a dearth of observable bone elements. Thermal alteration of bone often obliterates characteristics of texture, size, and dimension critical to the identification of pathological conditions. Moreover, among the unburned individuals, skeletal completeness and preservation were compromised by taphonomic forces. Therefore, the true frequency and distribution of illness among the individuals recovered from our sample is not known.

Demographic Factors and Mode of Interment

Above, we presented overviews and rudimentary analyses of the contextual and osteological data from SRI's excavations at Mescal Wash. In this and following sections, we analyze the data in greater detail and, more specifically, explore relationships between the contextual and demographic variables. Here, for instance, we focus on the statistical relationship between the mode of interment and the age and sex of the interred individuals. In the next section, we analyze statistical relationships between the presence/absence and types of burial offerings and the various contextual and demographic variables described above. We employ contingency-table analyses to evaluate these statistical relationships.

As noted, the burial sample included a mix of cremations and inhumations. The disparity between cremations and inhumations warrants further examination, to explore possible causes for differential treatment. Why were some individuals subjected to cremations? And why were others inhumed? To explore these questions, a basic hypothetical assumption was made that the individuals recovered during the excavations were members of a single group and that differences in mortuary treatment were based on intrinsic factors of those individuals (i.e., age and/or sex). This assumption helped us to evaluate the hypothesis, put forward by Vanderpot and Altschul (2007), that the individuals from Mescal Wash migrated from multiple areas of the U.S. Southwest. If no universal characteristic can explain the differential mortuary treatment among individuals, then the evidence does not support the assertion that a single group is represented.

In light of the limited information available on a per-individual basis, few attributes offered an adequate empirical basis for comparison of differences in mode of interment. One individual attribute could be age. In our sample of skeletal remains, 35 individuals contained enough skeletal data to broadly distinguish between juvenile and adult. The others lacked sufficient observable elements to assign the individuals to even the broadest age categories. Of the 35 individuals for whom an age category was determined, 10 were juveniles (less than 18 years of age) and 25 were adults (18–99 years of age). These 35 individuals were distributed between inhumation (n = 18, or 51.4 percent) and cremation (n = 17, or 48.6 percent). Table 201 shows the distribution of these individuals by broadly defined age group (juvenile versus adult) and mode of interment.

A chi-square analysis (Yates corrected) revealed no significant relationship between mode of interment and age (chi-square = 1.03, *df* = 1, *p* = .31). A Fisher's exact test yielded a similar result (*p* = .26), suggesting no significant relationship between these two variables. This result is

Table 201. Distribution of Juveniles and Adults,by Inhumation and Cremation

Age	Inhumation	Cremation	Total
Juvenile	7	3	10
Adult	11	14	25
Total	18	17	35

Note: Chi-square = 1.03, *df* = 1, *p* = 0.31; Fisher's exact test: *p* = .26.

suspect because of the very small sample sizes (e.g., only 3 juvenile cremations), but even so, a heuristic examination of this distribution suggested that the decision whether to inhume or cremate individuals was not determined on the basis of age. This does not rule out the possibility that age was related to mode of interment. The analysis did not include a robust sample of individuals with finer age assessments sufficient to explore whether children of different ages (e.g., infant versus preteen) or adults of different ages (e.g., young adults versus the geriatric) were treated differently. Such detailed age information might indicate age-based differences in the mode of interment.

Mode of interment also could have been decided on the basis of the sex of the deceased individuals, but a cursory examination of this distribution does not support this argument. Again, the very small sample size of individuals identified by sex prevented a rigorous contingency-table analysis of this relationship. Furthermore, several biological and taphonomic factors inhibited an analysis along these lines. First, as sex cannot be reliably determined from juvenile remains, the sample was limited only to adult individuals (n = 25). Second, distinguishing between male and female skeletal remains often requires more and particular skeletal elements, a necessity frustrated by taphonomic forces, especially cremation. Therefore, of the 25 adult individuals, only 14 included diagnostic attributes sufficient to distinguish male from female. Unfortunately, the number of individuals meeting the criteria for a comparison of mortuary treatment by sex was inadequate to offer reliable analysis.

The different modes of interment practiced at Mescal Wash is striking, but the observable biological attributes of the individuals interred or cremated did not offer satisfactory data to infer a root cause. This is, of course, predicated on the assumption that the individuals recovered from Mescal Wash represented a single, cohesive group with a consistent pattern of mortuary behavior. As Vanderpot and Altschul (2007:68) pointed out, the site may have functioned as a nexus for groups from various areas of the Southwest. So, a possible explanation for the contrasting modes of interment relates to different mortuary practices in these groups' homelands. This "cultural variability" likely also contributed to some of the paleodemographic characteristics of Mescal Wash, which set it apart from similar sites, such as Libben. We explore this argument in more detail in the discussion below.

Burial Inclusions: Mortuary Offerings and Cremation Urns

The following sections focus on items that appear to have been deliberately interred with the human remains, as mortuary goods and offerings (Haury 1976:165–166). We first discuss our criteria for inferring mortuary offerings and analyze their distributions with respect to mode of interment, age, sex, and locus. We separately discuss the pottery vessels used as cremation urns in the final section.

Distribution of Mortuary Offerings

Identifying Mortuary Offerings

It is a challenge to distinguish between artifacts deliberately interred with human remains as offerings and those recovered in the burial-feature matrix as incidental inclusions (e.g., goods mixed in with fill soils) or as a result of postdepositional disturbance. The presence of, for example, shell jewelry or whole vessels in close proximity to the human remains can be confidently interpreted as deliberate mortuary inclusions, but postdepositional disturbances, such as postinterment construction or root and rodent activity, may move artifacts within the feature matrix, potentially removing goods from their association with human remains. In Mescal Wash, many burials were either intrusive into earlier features or intruded on by later ones, increasing the likelihood that unrelated artifacts penetrated the burial-feature matrix. Rodent and root disturbance was prevalent throughout the site and likely exacerbated subsurface mixing.

By the same token, sherds, debitage, or other fragmentary artifacts found within burial matrices are not usually interpreted as burial offerings, but some portion of these fill materials, in fact, may have been intentionally placed in the burial pits. Regarding the pre-Classic period burials at Snaketown, for example, Haury (1976:166) pointed out that broken vessel fragments may have been interred in some burials during the funerary ceremony but that such fragmented items may be perceived by archaeologists as unaffiliated with the burial event. He also noted that some offerings were "deposited in the pit after the bones had been well covered with earth" (Haury 1976:166), underscoring that some of the materials found in the burial fill—but not adjacent to the skeletal remains—may have been deliberately interred as burial offerings. To be sure, most of the sherds, debitage, faunal bone, or other mundane domestic debris recorded in the upper fill of the burials probably was not intentionally added as offerings, but we cannot rule out the possibility that some of these items were deliberately interred during the mortuary ceremony.

For these reasons, we separately list in Table 202 the artifacts interpreted as offerings and any artifacts found in the upper fill of the burial features. Where possible, we also note any intrusive nonburial features, to highlight the

Table 202. Mortuary Offerings and Possible Offerings (Excluding Burial Urns)

Feature	Locus	Mode of Interment	Likely Mortuary Goods (Directly Associated with the Human Remains)	Artifacts in the Upper Fill
220	A	secondary pit cremation	none	turquoise bead, sherds
320	C	secondary pit cremation	Type III plain ware bowl (capping vessel)	sherds, debitage, ground stone, glass fragments
336	D	inhumation	possible *Olivella*-shell bead; possible Type II plain ware vessel (form indeterminate)	sherds, debitage, shell specimen
380	E	secondary pit cremation	none	sherds
464	D	secondary pit cremation	none	sherds, debitage
561	D	secondary pit cremation	Type III red ware bowl (capping vessel)	sherds
562	D	secondary pit cremation	none	sherds, debitage
2679	D	inhumation	none	sherds, debitage (intruded on by later structure)
3528	D	inhumation	none	sherds (intrusive into earlier structure)
3564	D	inhumation	Dragoon Red-on-brown bowl (elaborated), possible Empire projectile point (Archaic period)	sherds, debitage
3604	D	secondary pit cremation	2 Dragoon Red-on-brown bowls (fine line)	sherds
3704	D	primary cremation	none	sherds, debitage (unburned)
3875	D	secondary pit cremation	none	sherds, debitage (intrusive into earlier structure)
3943	D	inhumation	none	sherds, debitage (adjacent to structure)
4057	D	secondary urn cremation	2 burned shell-bracelet fragments	sherds, debitage
4069	D	primary cremation	partial Type III bowl or jar (rim removed); ochre-stained and burned, carved-stone censer; calcined awl	hematite fragment, sherds, debitage
4221	D	primary cremation	Type II jar and bowl fragments (warped and blackened), sherds, flaked stone pieces	sherds, debitage, biface, bone awl (unburned)
4740	D	inhumation	none	sherds, faunal bone (intruded on by later structure)
4794	D	secondary pit cremation	small, burned shell fragment	none
4886	D	inhumation	2 bone awls in right hand	none
5512	D	inhumation	bone awl, medium-sized rocks placed on skeleton	sherds; faunal bone; debitage; large, worked jar fragment (intrusive into earlier structure)
6007	C	inhumation	none	sherds, faunal bone, debitage
6074	C	secondary pit cremation	none	sherds, debitage
6191	C	inhumation	none	sherds, faunal bone, debitage
7170	C	inhumation	shell beads, shell ring or pendant	sherds, debitage (probable reused pit)

continued on next page

Feature	Locus	Mode of Interment	Likely Mortuary Goods (Directly Associated with the Human Remains)	Artifacts in the Upper Fill
7335	C	secondary pit cremation	none	sherds, debitage
7456	C	secondary pit cremation	none	sherds, faunal bone
7457	C	inhumation	none	possible clay ball, 2 large sherds adjacent to body, sherds, faunal bone, debitage (body possibly left on floor of structure)
7458	C	inhumation	none	large sherd and rocks beneath body, sherds, faunal bone, debitage, burned wood (body possibly left on floor of structure)
7833	D	inhumation	none	sherds, faunal bone, debitage (intrusive into earlier structure)
9410	C	inhumation	none	sherds, faunal bone, shell (intrusive in earlier structure)
10138	C	secondary pit cremation	hundreds of perforated shell beads (probable necklace, unburned)	sherds (in structure-wall trench)
10645	D	inhumation	inverted metate placed over skull; small and medium-sized cobbles placed over a portion of the skeleton; another metate fragment was placed under the body; possible ochre staining	debitage, faunal bone, crystal, metate fragments (intruded on by later roasting pit)
10674	D	secondary pit cremation	burned awl	none

possibility of subsurface mixing. In all, 34 of the 48 burials (71 percent) included artifacts either in direct association with the skeletal remains or in the upper fill. Thirty-one percent of all burial features (15 of 48) contained artifacts interpreted as likely mortuary goods (i.e., in direct association with the burial remains). Generally, these materials were interpreted as mortuary offerings, based on their obtrusiveness (e.g., large vessels) or their proximity to human remains. These goods included pottery vessels or partial vessels, bone awls, shell bracelets and pendants, *Olivella* shell, shell beads (including a probable necklace), a carved-stone censer, a metate, and a possible Archaic period projectile point (possibly reclaimed and interred as an offering). In two features in Locus D, cobbles and pebbles appeared to have been deliberately placed over the skeletal remains (Features 5512 and 10645). The 13 burials in which no artifacts were recorded within the feature matrix are not listed in Table 202.

Additional materials recovered in the upper feature fill of some burials included artifacts commonly found in middens and trash deposits, such as sherds, debitage, and faunal bone—all items that are not normally interpreted as mortuary offerings. Other materials found in burial fill but not in direct proximity to human remains included shell, a turquoise bead, polishing stones, clay balls, hematite, and a crystal. Some or all of these items—including the sherds, debitage, and other debris—may have been deliberately interred with the human remains during the funerary ceremony but displaced or deliberately deposited in the burial fill. We are unable to corroborate this possibility; therefore, we do not include these goods in the discussion of the analysis of burial offerings below. Also, in the cases of Features 7457 and 4757, the inhumations were found on the floor of a structure (Feature 6098 in Locus C). Although artifacts were found in direct association with the skeletal remains, including large sherds and a clay ball, we have no reason to posit that they were deliberately interred with the skeletal remains.

In sum, we can confidently infer that at least one-third of the burials contained nonperishable offerings that we interpreted as having been deliberately interred with the human remains during the mortuary ceremony. Some of the artifacts recovered in the upper fill also may have been deliberately interred during the mortuary ceremony, but we are unable to corroborate this possibility. Additional goods made of perishable materials may also have been interred with the remains, such as foods, baskets, cloth, and other organic materials. Therefore, the percentage of burials with offerings among the 48 features is probably well above 31 percent.

Distribution of Burial Offerings by Mode of Interment

In this section, we discuss patterns of association detected between the presence/absence of burial offerings and the mode of interment. We merged the "secondary pit cremations with capping vessels" category with the large "secondary pit cremations" category, to avoid sampling vagaries. We also merged the two subcategories of secondary urn cremations into a single category and used a Fisher's exact probability test to evaluate relationships between variables.

Table 203 shows the distribution of burial goods by mode of interment. A Fisher's exact test (2-by-4 contingency table) yielded a probability of .82 that the observed distribution occurred by chance, indicating that burial goods were not significantly distributed among the four modes of interment. We cannot statistically infer that any one mode of interment was more frequently associated with burial goods, based on the marginal totals.

Also shown in Table 203 are the ratios of features with and without burial goods for each mode of interment. This means of quantifying the data suggested a slightly higher frequency of burial goods in the primary cremations than in the other burial modes. As noted above, the primary cremations in Mescal Wash were probably used as crematoria for multiple secondary interments. Therefore, various deceased individuals and associated offerings were probably incinerated in these locations. Although the cremation areas were gleaned prior to interment, gleaning episodes were typically incomplete, leaving behind burned bone and artifacts. Consequently, the likelihood of recovering burial goods in these contexts was probably higher than in other mortuary contexts, given that they likely were used on multiple occasions and incompletely gleaned. Along the same lines, the ratio of secondary cremations with burial goods was slightly lower than the ratios for inhumations or primary cremations. This trend probably resulted from the destruction of many goods in the crematory fire or the loss of goods from incomplete gleanings. It is unlikely that these slight differences reflected conscious efforts to more frequently inter burial offerings in inhumations than in secondary cremations.

Distribution of Burial Offerings by Age and Sex

In this section, we discuss the analysis of variability in the distribution of burial goods according to age and sex, again using a Fisher's exact probability test. The cremation and inhumations were merged for these analyses, to concentrate on the relationship between the presence/absence of offerings and these demographic attributes. We acknowledge that this analysis favored inhumations, as age and sex were inferred for a much higher proportion of inhumations than cremations (see discussion above).

Table 204 lists the distributions of burial goods (presence/absence) by age group for 33 features. A Fisher's exact test (2-by-3 contingency table) yielded a probability of .71 that the observed distribution occurred by chance, suggesting no statistically significant relationship between the age of an interred individual and the presence/absence of burial goods, given the sampling parameters. The ratios listed in Table 204 suggest that a slightly higher proportion of adult burials contained burial goods, but the small sample size of child and infant burials yielded unreliable ratios. Even if we combined the infant and child burials into a single subadult category, the ratio of adults with burial goods (0.71) would remain more than twice that for subadults (0.29). In all, a significant relationship cannot be established, because of the small sample sizes, but the ratios tentatively suggest a higher frequency of burial goods in adult burials. If we assume that the presence of buried goods is indicative of social rank or status, then this difference might suggest a system of achieved rather than ascribed status, but the presence of burial goods in one of the two infant burials undermines this interpretation. We also did not detect evidence of differences in the types of goods associated with adult and child/infant burials: the

Table 203. Counts and Ratios of Burials with and without Associated Goods, by Mode of Interment

Mode of Interment	Burial Goods Present	Burial Goods Absent	Total	Ratio of Present to Absent Burial Goods
Inhumation	6	12	18	0.50
Secondary pit cremation	6	15	21	0.40
Secondary urn cremation	1	4	5	0.25
Primary cremation	2	2	4	1.00
Total	15	32	48	0.45

Note: Fisher's exact test: *p* = .73.

Table 204. Counts and Ratios of Burials with and without Associated Goods, by Age Group of Interred Individuals

Age	Burial Goods Present	Burial Goods Absent	Total	Ratio of Present to Absent Burial Goods
Adult	10	14	24	0.71
Child	1	5	6	0.20
Infant	1	2	3	0.50
Total	12	21	33	0.57

Note: Fisher's exact test: *p* = .71.

two subadult burials with offerings contained pottery vessels and shell, both of which were also present among the adult burials.

Table 205 shows the distribution of burial goods according to the sex of the interred individuals, for 13 cases. A Fisher's exact test (2-by-2 contingency table) yielded a probability of 0.56 (two-tailed), again suggesting no statistically significant relationship between these variables, given the sampling parameters. The ratio evidence tentatively showed that slightly more male burials than female burials possessed burial goods, but this pattern will need to be corroborated using a larger sample of burials with inferred sex information. If valid, this trend could suggest higher frequencies of achieved status among the adult-male members of the community and perhaps a gender bias that socially valued male tasks over female tasks.

Also potentially meaningful were the types of goods associated with the male and female remains. Two adult-male inhumations in Locus D (Features 4886 and 5512) (Figure 166) were interred with one or two bone awls each, which might suggest vocations as woodworkers or leatherworkers prior to their deaths, assuming that bone awls were used in connection with one or both of these tasks. Another adult male was interred with a projectile point, possibly an Empire point dated to the Late Archaic period (Stevens and Sliva 2002). The burial also included a Dragoon-style vessel, suggesting a Middle Formative period interment; therefore, the possible Archaic period point may have been reclaimed and maintained by the individual as a token of social esteem and status. Perhaps it symbolized prowess in hunting or military pursuits. Two other adult-male inhumations in Locus D (Features 5512 and 10645) included cobbles or pebbles on top of portions of the skeletons, presumably placed on the bodies at the times of interment. The purpose of this practice is unknown, but one of the two features also included a metate fragment over the skull, which may reflect some ritual practice or religious custom enacted during the mortuary ceremony. Possible ochre stains also were observed in association with this same burial and also might have been disseminated as part of the mortuary-ceremonial performance. These two burials were not located in close proximity to one another and did not appear to be associated with a specific household or house group.

It is worth noting that one adult-female burial contained shell beads, likely fragments from shell jewelry, but none of the four adult-male burials with associated goods contained evident shell. It is possible that shell was symbolic of female attributes or was commonly used in female activities in the region, but our sample size was too small to reliably corroborate this hypothesis. Moreover, this hypothesis is not consistent with Bayman's (2002) argument that shell was used among the pre-Classic period Hohokam to express group membership or to perform symbolic rituals, which presumably applied equally to both men and women. But the symbolic meanings and uses of shell jewelry in the Mescal Wash area, in southeastern Arizona, may not be consistent with its uses and meanings in the Hohokam "heartland," in central and southern Arizona. Additional research and a larger sample will be needed to more firmly detect gender-based differences in mortuary treatment at Mescal Wash.

Distribution of Burial Offerings per Locus

In this section, we discuss the comparison of frequencies of burials with and without burial offerings in Loci C (n = 18) and D (n = 27) (Table 206). We exclude Loci A and E because they contained only one and two burial features, respectively. Unlike the previous analysis of burial-goods distributions, the relationship between locus and the presence/absence of burial goods (2-by-2 contingency table) was significant at the 0.10 level (Fisher's exact: p = 0.10 [two-tailed]). The ratio of burials with offerings was four times higher in Locus D (0.80 to 1) than in Locus C (0.20 to 1). As explained above, most of the dated features in Locus D were assigned to the Middle Formative A period, whereas most of analyzed features in Locus C dated to the Middle Formative B period (see Lengyel, Chapter 2, this

Table 205. Counts and Ratios of Burials with and without Associated Goods, by Sex of the Interred Individuals

Sex	Burial Goods Present	Burial Goods Absent	Total	Ratio of Present to Absent Burial Goods	Goods Included
Female	1	4	5	0.25	*Olivella*-shell beads, plain ware vessel
Male	4	4	8	1.00	3 bone awls, rocks placed on body (2), decorated vessel, projectile point, metate, ochre
Total	5	8	13	0.63	

Note: Fisher's exact test (two-tailed): *p* = .56.

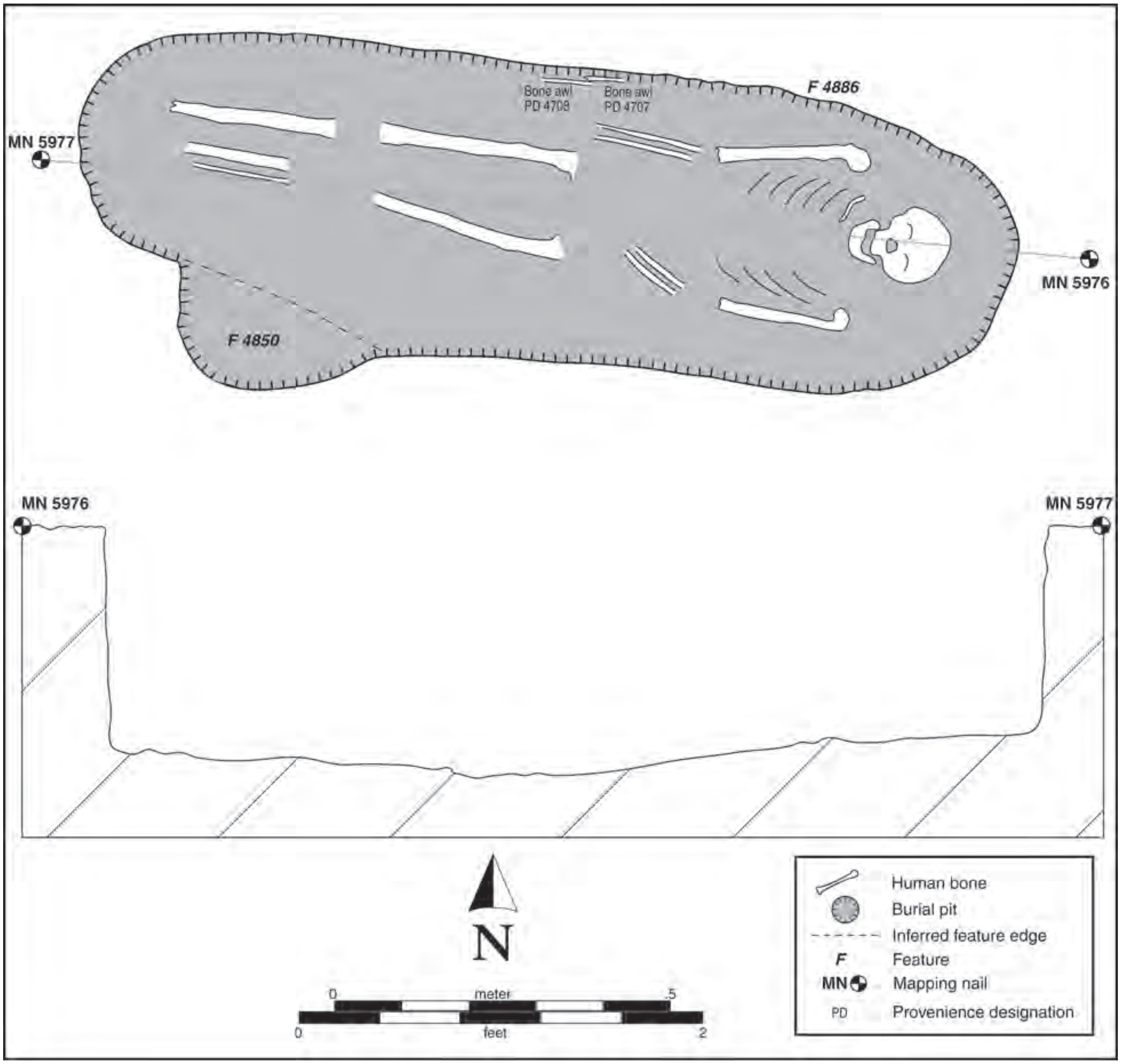


Figure 166. Plan view and cross section of Feature 4886, an inhumation in Locus C. Note the two bone awls near the right side of the body.

Table 206. Counts and Ratios of Burials with and without Associated Goods, by Locus

Locus	Burial Goods Present	Burial Goods Absent	Total	Ratio of Present to Absent Burial Goods
C	3	15	18	.20
D	12	15	27	.80
Total	15	30	45	.50

Note: Fisher's exact test: $p = .06$.

volume). The different frequencies of burial offerings in Loci C and D may reflect a diachronic trend.

The types of goods included as offerings also varied between the two loci. Among the 12 burials with offerings in Locus D, burial goods included undecorated pottery (3 burials, including capping vessels), bone awls (3 burials), shell jewelry (3 burials), decorated pottery (2 burials), cobbles/pebbles (2 burials), a carved-stone censer (1 burial), and a projectile point (1 burial). Several of these goods were recovered in primary cremations, including an elaborate carved-stone censer from Feature 4069 in Locus D (Figure 167). But as noted above, the primary cremations may have "overrepresented" the presence and range of burial goods, as a result of frequent reuse and incomplete gleaning episodes. Nevertheless, a wide variety of burial goods were evident in Locus D, even with the exclusion of primary cremations.

By contrast, in Locus C, two of the three burials with offerings contained shell jewelry, and a third contained only a capping vessel (plain ware) that may have been interred as a place marker rather than a mortuary offering. So, the wide range of goods present among the burials in Locus D was not present in Locus C, and shell jewelry may be the only nonperishable offerings recovered among the burials in Locus C. The smaller range of goods partially reflected the smaller sample size of burials in Locus C relative to Locus D, but we cannot rule out a more substantive interpretation. As noted, Bayman (2002) has argued that shell jewelry was used to express social affiliation among pre-Classic period Hohokam groups, and perhaps the focus on shell offerings in Locus C reflects a stronger focus on social identity during the Middle Formative B period compared to the earlier Middle Formative A period. This interpretation complements Garraty and Heckman's (see Chapter 3, this volume) argument that the very high ratios of decorated pottery from the Middle Formative B period suggest a heightened consciousness of identity and public expressions of social affiliation.

Cremation Urns

Five features were classified as secondary urn cremations (see Table 194). The cremation vessels are illustrated in Appendix 3.B. Each of the cremation urns was a jar, indicating a preference for large, globular-shaped vessels with relatively narrow orifices. Jars are generally larger and more voluminous than most bowls, and their narrower orifices offer better security against spillage or emptying of contents, although it is worth noting that none of the intact cremation jars exhibited high or substantial necks. The urn vessel in Feature 4057 had a carinated shape and no neck, and the jar used as an urn in Feature 4850 exhibited a minimal neck (ca. 1 cm in height). Features 333 and 6090 contained modified jars from which the necks were removed prior to interment; in both cases, the break at the neck-body juncture had been reworked to create a rounded rim tip. In Feature 7472, the entire upper portion of the jar had been removed during excavation, and it is not known whether the jar once possessed a high neck. Although the sample size was small, this evidence tentatively suggests a preference for placing cremated remains in jars with narrow orifices, but with very short necks or no necks, which may reflect a practical concern both for improved containment and protection (narrow orifice) and for facilitating placement of the cremated remains inside the container (absence of a long neck).

A focus on covering and protecting the remains was evidenced in the use of inverted vessels (Features 333, 4057, and 4850) and the placement of a lid over one of the two upright-urn burials (Feature 6090). An inverted plain ware bowl with a hemispherical shape and a rounded base was used as a lid for the upright cremation urn in Feature 6090. The second upright-urn cremation did not contain a lid and, therefore, was the only urn burial in which the cremated remains were interred without an apparent cover, although it is possible that the urn was covered with a perishable material (e.g., cloth or basketry).

Three of the five cremation urns (all in Locus C) had painted designs that could be linked to specific regional decorated-pottery traditions. The inverted vessel in Feature 333 was a Sacaton Red-on-buff jar with a Gila shoulder, associated with the Phoenix Basin tradition during the Middle Formative B period (Sedentary period). This buff ware type is consistent with the predominantly Middle Formative B period occupation in Locus C (see Lengyel, Chapter 2, this volume). Feature 6090 contained a Rincon Red-on-brown vessel, the Tucson Basin equivalent

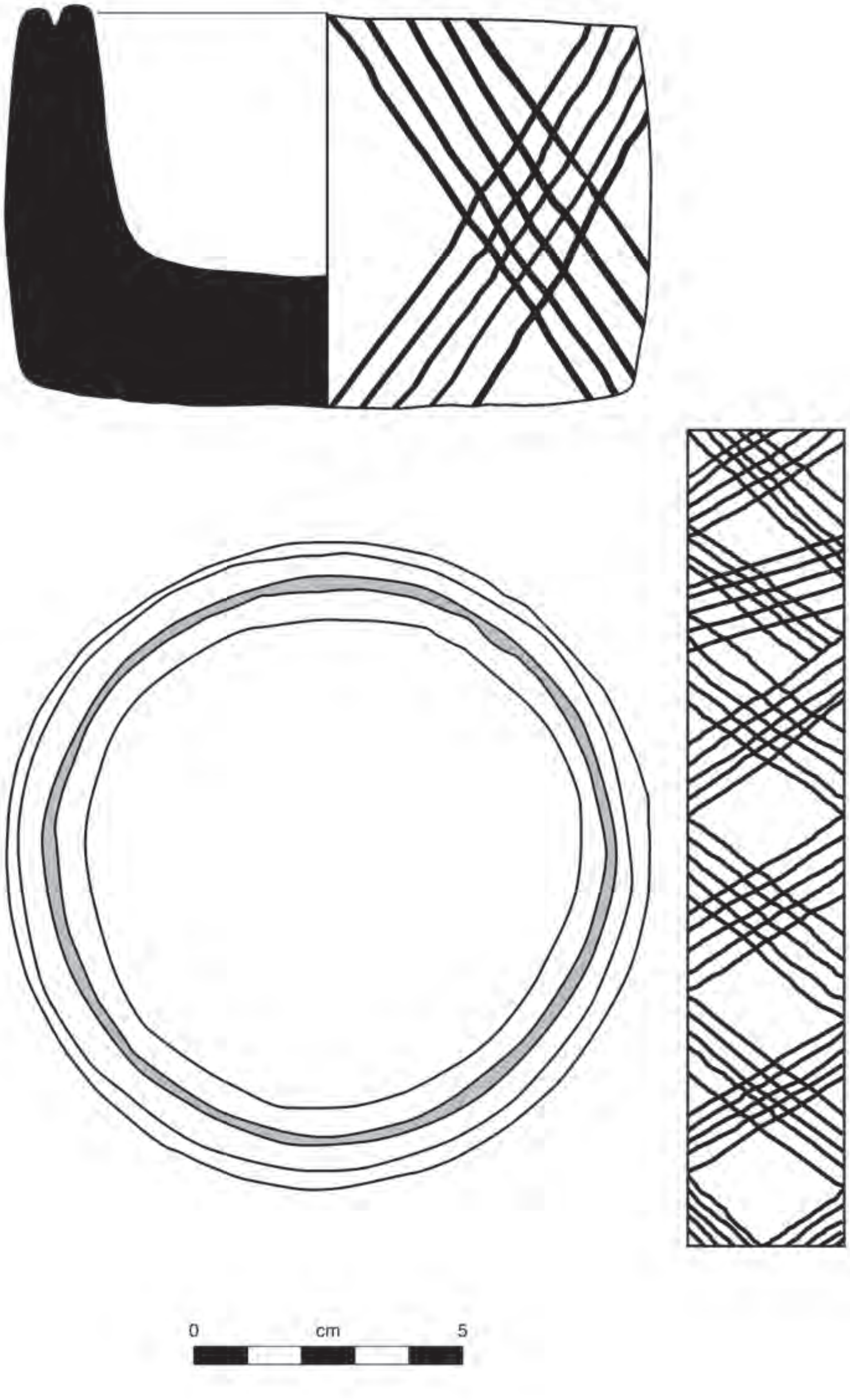


Figure 167. Illustration of stone censer recovered from Feature 4069 in Locus D.

of Sacaton Red-on-buff, which also was used during the Middle Formative B period. Feature 7472 contained a Dragoon Red-on-brown vessel with elaborated design, another style used primarily during the Middle Formative B period (Heckman 2000b). The two urn-cremation burials in Locus D (Features 4057 and 4850) contained plain ware urns that were not clearly associated with a specific regional pottery-making tradition (although a more detailed analysis of formal attributes might indicate a specific regional affiliation).

In all, the range of decorated wares suggests no clear correlation between the urn-cremation-burial practices and a specific regional tradition, but regardless of the small sample size, the observed pattern suggests that the residents of Locus C preferred decorated vessels for cremation urns, whereas the residents of Locus D preferred plain ware vessels. Again, this may indicate a temporal trend. The three urn cremations in Locus C could be confidently assigned to the Middle Formative B period, based on the vessels' painted designs, as explained above. The plain ware urns in Locus D could not be assigned to a specific period, but as explained below, chronometric dating suggested that most of the features in Locus D were used during the Middle Formative A period.

This possible diachronic evidence may suggest a shift from a preference for using plain ware vessels as cremation urns during the Middle Formative A period to a preference for using decorated vessels during the Middle Formative B period. This trend would complement the above argument for a heightened consciousness of identity and communication of social affiliation during the Middle Formative B period, relative to the Middle Formative A period. The very small sample size prevented rigorous evaluation of this hypothesis, but future studies may uncover a larger sample of urn-cremation burials with which this hypothesis can be tested.

Body Position and Head Orientation of Inhumations

For this analysis, we excluded 3 cases with indeterminate data for age and sex, resulting in an analyzed sample of 15 inhumations (Table 207). Excluding 1 additional case in which the body position was not inferable, more than half of the inhumations in our sample (8 of 14, or 57 percent) were buried in an extended and supine position. For 6 additional inhumations, the bodies were situated in a flexed (4 features) or semiflexed (2 features) position but varied with respect to whether the body was placed in a seated position (2 features), a supine position (2 features), or on their right or left sides (1 feature apiece). The extended-supine and non-extended-supine burials were about equally represented in Loci C and D, suggesting no obvious interlocus or temporal patterning in the distributions of extended-supine inhumations among loci. Nor was spatial patterning evident within this locus.

Nine of the 13 inhumations (69 percent) in which head orientations were inferable exhibited eastern orientations. Four additional inhumations revealed head orientations to the northeast, southeast, west, and southwest. All but 2

Table 207. Body Positions and Head Orientations for 15 Inhumations Excavated at Mescal Wash

Feature	Locus	Age and Sex	Body Position	Head Orientation
336	D	adult female	supine, extended	indeterminate
2679	D	adult female	supine, extended	east
3564	D	adult male	supine, extended	east
3943	D	child	seated, possibly flexed	indeterminate
4740	D	adult male	right side, flexed	east
4886	D	adult male	supine, extended	east
5512	D	adult male	seated, semiflexed	west
6007	C	adult male	supine, extended	east
6123	C	child	supine, extended	southwest
6191	C	adult female	supine, extended	east
7170	C	infant	indeterminate	northeast
7457	C	adult male	left side, flexed	east
7833	D	child	supine, extended	east
9410	C	child	supine, semiflexed	southeast
10645	D	adult male	supine, flexed	east

Note: Excludes cases with missing data.

of the 8 extended-supine inhumations were oriented with the head to the east. In 1 case, the head was oriented to the southwest (Feature 6123 in Locus C), and head orientation was indeterminate in another case. Head orientations among the non-extended-supine inhumations included 3 eastern orientations, 1 southeastern orientation, 1 western orientation, and an indeterminate case. Assuming an equal likelihood that a burial will be oriented in one of eight possible directions (east, northeast, north, northwest, west, southwest, etc.), the binomial probability of observing 9 (or more) of 13 burials with an eastern orientation by chance is about 3.3 in 1 million; this pattern is therefore statistically significant and clearly indicative of a cultural preference. An eastern orientation likely had an important cosmological or religious meaning for the inhabitants of Mescal Wash. Less clear are the reasons or cultural significance of the cases that deviate from the eastern orientation.

Overall, 6 inhumations were characterized by a supine and extended body position and an eastern head orientation. Haury (1976:172) reported a similar pattern at Snaketown: the pre-Classic period (mostly Sacaton phase) inhumations were extended, with eastern head orientations. We were unable to detect any consistent secondary patterning in body position or orientation among the remaining inhumations. The other cases represented a mix of body positions and orientations, which could reflect a culturally diverse residential population, but given the uncertain date associations for these burials, we cannot rule out that some of the variability to some extent reflected diachronic changes in mortuary practices. Also, no relationships were evident between age or sex and body positioning; the variability therefore probably reflected individual or cultural preferences rather than mortuary practices specific to age or gender.

Temporal Assessment of Burial Features

Only 1 burial feature was directly subjected to chronometric analysis, inhibiting our ability to infer temporal assignments. Feature 4221, a primary cremation in Locus D, was included in Lengyel's AM analysis (see Chapter 2, this volume), which suggested a rather unspecific date range of A.D. 585–1015. For 20 additional features, we employed indirect evidence to infer approximate and tentative temporal ranges for the burial features (Table 208).

We indirectly inferred temporal range using two methods. First, we assessed the date of each interment based on the presence of temporally diagnostic decorated ceramics. We mainly focused on ceramic materials found in direct association with the burials (e.g., cremation urns or probable offerings), but we also considered cases in which decorated sherds were recovered from the feature fill, with the caveat that these materials may not have been associated with the interment episode and, in fact, may have predated or postdated it (see discussion above). Second, we inferred age based on associations with features (mostly structures) subjected to chronometric analysis. In most cases, we could determine whether a burial was either intrusive into or intruded on by another feature subjected to chronological assessment. This evaluation technique provided a way of establishing a minimum date, if the burial was intrusive into another feature, or maximum date, if another feature was intrusive into the burial (shown by the "pre-" and "post-" dates in Table 208).

The inferred date ranges listed in Table 208 largely corroborate that the burials were mostly interred during the Middle Formative period, with the possible exception of an adult-male inhumation in Feature 10645, near the eastern edge of Locus D (Figure 168). This feature was intruded on by a roasting pit (Feature 4702) that was assigned a date range of 200 B.C.–A.D. 600 based on AM data and stratigraphic position (see Chapter 7, Volume 1). Feature 10645 predated this feature, suggesting a date earlier than A.D. 600. This individual may have been interred during the end of the Late Archaic period or during the Early Formative period, both of which have been documented at Mescal Wash. The individual was placed in a flexed position in a circular pit, which is consistent with burial practices reported in other sites in southern and central Arizona during the Late Archaic and Early Formative period (Mabry, ed. 1998).

Within Loci C and D, the inferred ages were mostly consistent with the broader trend of a predominantly Late Formative A period occupation in Locus D and a Late Formative B period occupation in Locus C. A possible exception in Locus C was Feature 6191, an adult-female inhumation. One Santa Cruz Red-on-buff sherd, with a date range of ca. A.D. 750–850, was recovered from the fill of this feature. But the fill context of this sherd did not provide a firm basis for inferring age; the sherd may have entered the burial matrix in a postdepositional context, as a result of bioturbation or another form of disturbance. We are therefore reluctant to assign this burial to the Middle Formative A period based on this tenuous evidence. In Locus D, all but 2 of the 10 inferred interment dates were consistent with the mostly Late Formative A period occupation; exceptions were the aforementioned Feature 10645 and Feature 3564, an adult-male inhumation. The latter burial included a Dragoon Red-on-brown sherd with elaborated design, suggesting a Middle Formative B period date of interment (following Heckman 2000b).

Elsewhere in the project area, Locus A appeared to have been a single-component occupation during the Middle Formative B period (ca. A.D. 935–1050) (see Lengyel, Chapter 2, this volume), and the burial feature from that locus presumably also dated to this time span. Deaver's

Table 208. Inferred Temporal Affiliations for 21 Burial Features from Mescal Wash

Feature	Locus	Burial Category	Inferred Age	Inferred Period	Method of Inference	Time-Sensitive Artifacts	Association
220	A	secondary cremation	A.D. 935–1050	Middle Formative B	FA		Locus A, considered single-component occupation
333	C	secondary cremation	A.D. 950–1150	Middle Formative B	Cer	Sacaton Red-on-buff urn (A.D. 950–1150)	
2679	D	inhumation	pre-A.D. 1015 (A.D. 750–950?)	Middle Formative A	FA, Cer	Dragoon or San Simon Red-on-brown, fine decoration (A.D. 700–950), in fill	intruded on by structure Feature 3817 (A.D. 650–1015)
3528	D	inhumation	A.D. 500–865? (A.D. 750–850?)	Middle Formative A?	FA, Cer	Cañada del Oro Red-on-brown, in fill (A.D. 750–850)	adjacent to structure Feature 3868 (A.D. 500–865)
3564	D	inhumation	A.D. 950–1100	Middle Formative B	Cer	Dragoon Red-on-brown, elaborated decoration (A.D. 950–1100)	
3604	D	secondary cremation	A.D. 750–950	Middle Formative A	Cer	Dragoon Red-on-brown, fine decoration (A.D. 700–950)	
3875	D	secondary cremation	post-A.D. 835	Middle Formative A	FA		intrusive into structure Feature 3679 (A.D. 835–865)
4221	D	primary cremation	A.D. 585–1015	Middle Formative A	AM		
4740	D	inhumation	pre-A.D. 1015	Middle Formative A	FA		intruded on by structure Feature 3545 (A.D. 860–1015)
5512	D	inhumation	post-A.D. 735	Middle Formative A	FA		intrusive into structure Feature 7880 (A.D. 735–865)
6090	C	secondary cremation	A.D. 950–1150	Middle Formative B	Cer	Rincon Red-on-brown urn (A.D. 950–1150)	
6191	C	inhumation	A.D. 850–950?	Middle Formative A?	Cer	Santa Cruz Red-on-buff (A.D. 850–950), in fill	
7170	C	inhumation	A.D. 950–1100?	Middle Formative B?	Cer	Dragoon Red-on-brown, elaborated decoration (A.D. 950–1100), in fill	
7457	C	inhumation	A.D. 935–1015	Middle Formative B	FA		on floor of structure Feature 6098 (A.D. 935–1015)
7458	C	inhumation	A.D. 935–1015 (A.D. 950–1100?)	Middle Formative B	FA		on floor of structure Feature 6098 (A.D. 935–1015)
7472	C	secondary cremation	A.D. 950–1150	Middle Formative B	Cer	Dragoon Red-on-brown urn, elaborated decoration (A.D. 950–1100)	
7833	D	inhumation	A.D. 635–915	Middle Formative A	FA		on floor of structure Feature 834 (A.D. 635–915)

Feature	Locus	Burial Category	Inferred Age	Inferred Period	Method of Inference	Time-Sensitive Artifacts	Association
9410	C	inhumation	post-A.D. 935	Middle Formative B	FA		intrusive into structure Feature 995 (A.D. 935–1100)
10138	C	secondary cremation	A.D. 935–1015	Middle Formative B	FA		in wall of structure Feature 6129 (A.D. 935–1015)
10645	D	inhumation	pre-A.D. 600	Late Archaic or Early Formative?	FA		intruded on by pit Feature 4702 (200 B.C.–A.D. 600)
10698	C	inhumation	post-A.D. 935?	Middle Formative B?	FA		in rodent burrow, possibly from structure Feature 7461 (A.D. 935–1040)

Key: FA = associated with dated feature; Cer = temporally diagnostic ceramic; AM = archaeomagnetic date (see Lengyel, Chapter 2).

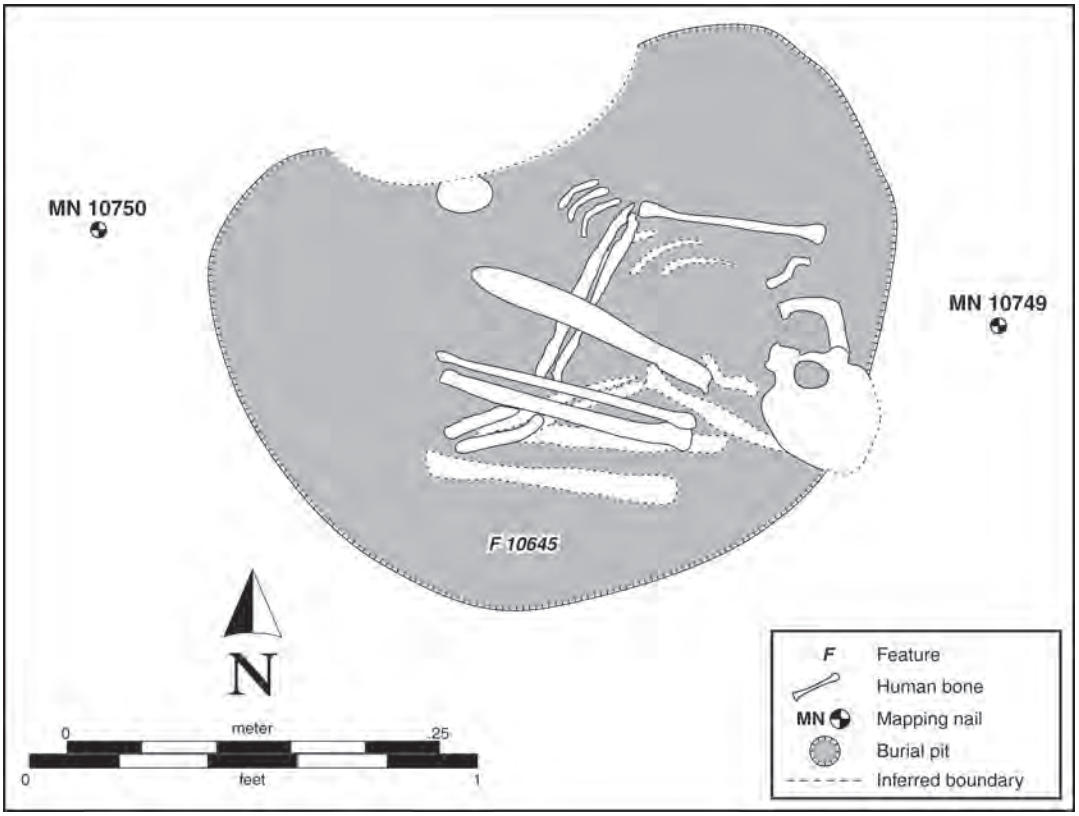


Figure 168. Plan view of Feature 10645, a flexed inhumation in Locus D possibly dating to the Late Archaic or Early Formative period.

(2010) detailed analysis of AM data from Locus A support a Middle Formative B period assignment. Also, two cremations were excavated in Locus E during Phase 1, but the range of ceramics and architecture indicated both Middle and Late Formative period components in this locus. We suspect that the two burials are related to the Middle Formative component, given that they are cremations—a more prevalent mode of interment during the Middle Formative period in the southern deserts—and the presence of Middle Formative ceramics, but we are unable to corroborate this assessment.

In sum, most of the burials in Mescal Wash probably related to the Middle Formative A and B period occupation components, with at least one probable exception (Feature 10645) that likely predated the Middle Formative period. Most of the burials were not incorporated in our temporal analysis, because they neither included temporally diagnostic pottery nor were associated with other, well-dated features. Nevertheless, we have no reason, based on the available evidence, to surmise that any of these “undated” burials were associated with pre– or post–Middle Formative period components. Given these results, we can tentatively interpret diachronic trends in mortuary practices during the Middle Formative period at Mescal Wash by comparing burial attributes in Locus D and Loci A and C. In the following section, we discuss the detection of possible formal burial areas within the study area—another line of evidence for inferring associations among burials, providing an additional basis for inferring age.

Spatial Distribution: Inferring Formal Burial Areas

In this section, we identify possible burial areas within Loci C and D, assuming that most of the burials in these loci were roughly contemporaneous, as explained in the previous section. Below, we evaluate our inferred burial areas in terms of site structure, chronology, and cultural affiliation. A very large and continuous area was stripped and exposed in Locus D, facilitating identification of discrete burial areas. Identification of discrete burial areas was not feasible in Locus C, which included multiple stripped areas substantially smaller than the large stripped area in Locus D.

We identified two burial areas in Locus D that were composed of relatively discrete and well-defined clusters of burials (Burials Areas 1 and 2) and two *possible* burial areas in Loci C and D that contained scattered burials interspersed with nonburial features (Burial Areas 3 and 4). As explained below, we suspect that Burials Areas 1 and 2 were formal, communal burial loci that were established by local groups in discrete areas, away from the residential structures. In contrast, Burial Areas 3 and 4 were probably not discrete or formal burial loci but, rather, loose amalgamations of intramural and extramural burials associated with residential structures. Rather than a shared mortuary space, the site inhabitants in the vicinities of Burial Areas 3 and 4 probably separately and idiosyncratically interred deceased kin members in or near their domiciles. In the following section, we describe each of the proposed burial areas, as well as analyze and compare them.

Burial Area 1, Locus D

Burial Area 1 was located in the eastern half of Locus D, mainly in SU 6795, and consisted of a concentration of five burial features and three additional features within the broader vicinity (Figure 169). SU 6795 encompassed the five burials (Features 464, 4635, 4794, 4798, and 10674) within a discrete area. This area was largely devoid of pre-Hispanic period nonburial features, except for a few thermal pits that may not have been coeval with the burials (a number of unexcavated features also were present in the vicinity). This discrete area was surrounded by a linear concentration of structures to the south (Features 834, 4682, 5994, 7880, 8643, 8644, 8841, and 8842) and a smaller concentration to the east (Features 493 and 4642). (Note that Features 8643 and 8644 were superimposed in a single location, as were Features 8841 and 8842.) As stated above, it seems likely that Burial Area 1 was situated in a common area shared among families that resided in those structures. This house group might have been composed of several generations of kin-related families that buried deceased group members in this communal burial area.

All but one of the structures adjacent to Burial Area 1 was assigned to the Middle Formative A period. Notably, three of the structures (Features 492, 825, and 7880) were included in Lengyel's contemporaneity study, which distinguished groups of roughly contemporaneous structures based on AM data. All three were assigned to her AM Group 3 in Locus D, with an inclusive inferred date range of ca. A.D. 735–865, which suggests occupation during the first half of the Middle Formative A period (ca. A.D. 750–850). Inferred date ranges for the other structures were consistent with the date range for AM Group 3. AM Group 3 accommodated more features than any other of Lengyel's AM groups, suggesting a high likelihood that Burial Area 1 was affiliated with this occupation episode.

Importantly, additional burials were present within and near the aforementioned structures associated with Burial Area 1 (see Figure 169). These included Feature 5512, an intramural inhumation in structure Feature 7880, and extramural secondary-cremation Features 7847 and 10711, located adjacent to structure Features 492 and 5994. The burials may have been interred by the same groups or lineages that used the main communal burial area. Therefore, although these burials were not part of a single discrete area, as were the five previously mentioned features, they could be tentatively classified as part of Burial Area 1. Yet an ensuing question concerns why they would have been interred in isolated locations outside the proposed communal burial area. As argued above, the inhumation (Feature 5512) may have been intentionally placed in an intramural context following the abandonment of structure Feature 7880 as a means of communicating familial land-use rights, but it is not clear why the two cremations (Features 7847 and 10711) would have been interred outside the main burial area.

The five burials in the proposed main burial area consisted of one primary cremation (Feature 4798) and four secondary pit cremations (Features 464, 4794, 5992, and 10674). As explained above, the presence of several patches of burned soil in the vicinity of Feature 4794 suggested that it also may have been a disturbed primary-cremation area with a subfloor secondary cremation. Bioturbation or other postdepositional disturbance may have obscured the evidence for a primary cremation in this location. This concentration therefore included several secondary cremations and at least one primary cremation, which possibly functioned as a crematorium where the secondary interments were incinerated. The three burials located outside the main concentration included one inhumation and two secondary pit cremations. Overall, the inhabitants of this group of structures appeared to have preferred pit cremations. Perhaps important is that the primary cremation and the possible primary cremation (Feature 4794) were located adjacent to one another, along an east-west alignment—a spatial pattern evident also in Burial Area 2. The spatial distribution of burials suggested a possible formal arrangement, with the primary cremation—possibly the central crematorium—located in a central location and secondary interments placed in scattered locations surrounding this central location.

Bone fragments identified in two of the six cremations suggested adults of indeterminate sex between 20 and 40 years of age. The single inhumation included an adult male of 35–45 years of age. This sample was too small to infer the demographic composition of the house group, but as explained below, the absence of subadults or elderly adults potentially suggested seasonal or nonpermanent habitations. Three burials contained offerings, including two different burials interred with bone awls, which were also prevalent among the burials in Burial Area 2 (see below). A small, burned shell fragment was recovered

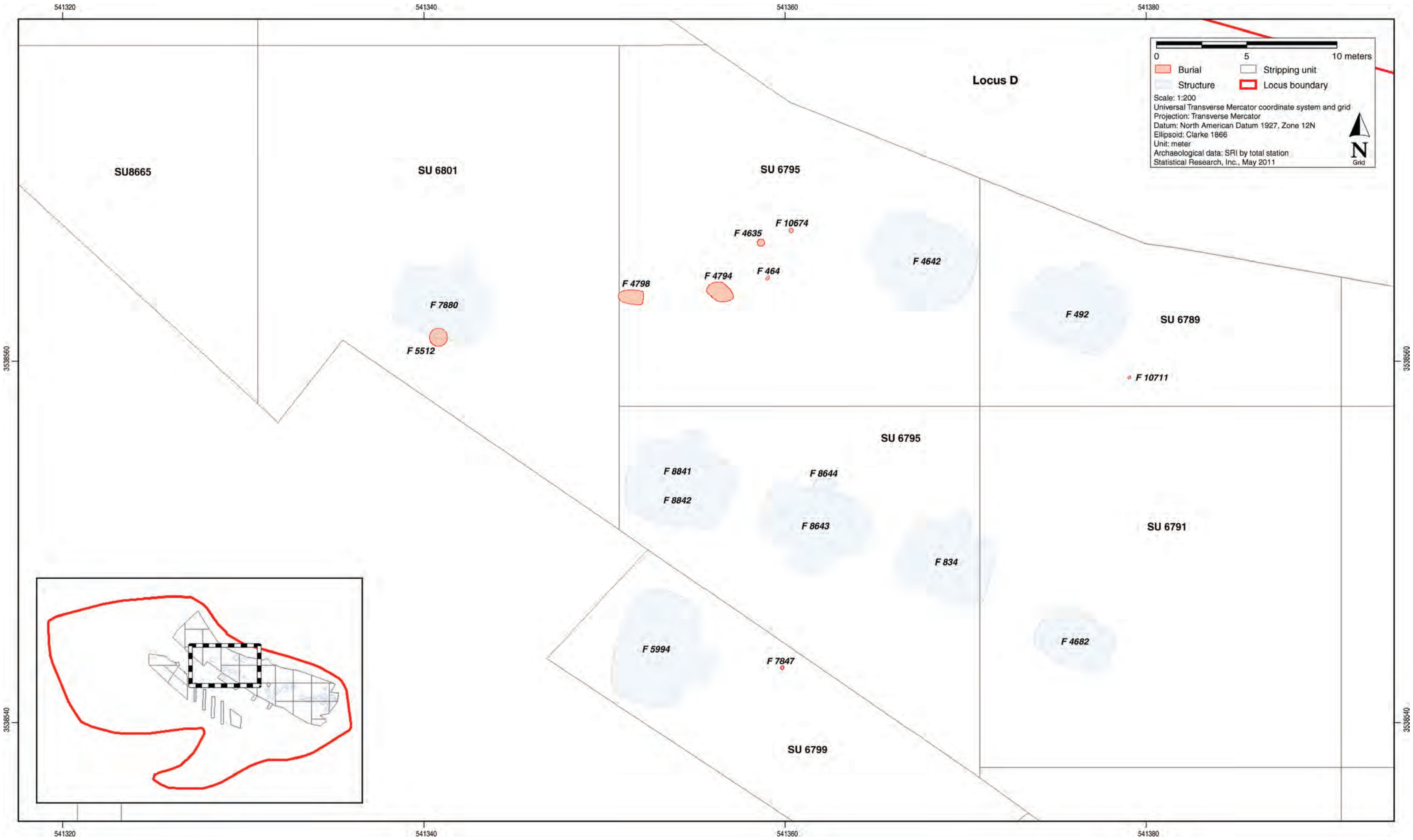


Figure 169. Map of Burial Area 1 in Locus D.

in Feature 4794, and cobbles appeared to have been deliberately placed over the skeletal remains in inhumation Feature 5512. Perhaps the cobbles functioned as place markers visible from the surface at the time of interment, a possibility that is consistent with the above argument that the individual was buried within structure Feature 7880 as a means of communicating land-tenure claims.

Burial Area 2, Locus D

Burial Area 2 was situated in the eastern half of the large, stripped area in Locus D (Figure 170). The nine burial features that composed this group were concentrated in contiguous SUs 3033 and 3035 (Features 336, 561, 562, 3704, 4057, 4069, 4221, 4850, and 4886). Most of these burials were concentrated in a roughly 10-by-15-m area (north-south by east-west), with one burial (Feature 4057) located about 6 m east of the denser concentration. Like Burial Area 1, this area was relatively devoid of nonburial features but included a small number of thermal and nonthermal pits and unexcavated features. Another similarity to Burial Area 1 is that Burial Area 2 was located north and west of a linear concentration of structures (Features 448, 565, 726, 3921, 4043, 4441, 10560, and 10561), several of which consisted of multiple superimposed structures. We hypothesize that Burial Area 2 functioned as a communal burial area for kin-related families residing in this nearby line of structures. Unlike Burial Area 1, Burial Area 2 included no obvious "outlier" burials located away from the main burial concentration. One inhumation was found adjacent to structure Feature 4003, but this structure appeared to be more closely associated with a different linear arrangement of structures to the south.

Unfortunately, a dearth of temporally diagnostic ceramics in these structures prevented a detailed chronological assessment. Date ranges were inferred for three of the nearby structures, based on chronometric data (Features 565, 10560, and 10561), but the latter two were partially superimposed. Notably, Lengyel (see Chapter 2, this volume) assigned Features 565 and 10560 to AM Group 3, suggesting that they were coeval with the structures adjacent to Burial Area 1, to the west. Also, the inclusive date range for these structures was A.D. 735–840, which is essentially identical to the date range of ca. A.D. 735–865 for the structures near Burial Area 1. To be sure, the inferred date range for Feature 10561 was slightly later (ca. A.D. 835–990), but this feature was superimposed over Feature 10560 and probably represented a subsequent occupation episode. In all, we suspect that Burial Area 2 and the associated structures were used during the first half of the Middle Formative A period (ca. A.D. 750–850) and were probably contemporaneous with Burial Area 1 and its associated structures.

Burial Area 2 encompassed a more diverse group of burials than did Burial Area 1: three primary cremations (Features 3704, 4069, and 4221), two secondary urn cremations with inverted vessels (Features 4057 and 4850), one secondary pit cremation (Feature 562), one secondary pit cremation with a capping vessel (Feature 561), and two inhumations (Features 336 and 4886). The site inhabitants that used Burial Area 2 did not seem to have preferred any specific mode of interment but employed multiple modes, perhaps indicating individual or household-level preferences. The inhumations and secondary cremations were not spatially segregated within the proposed burial area. Compared to Burial Area 1, the higher proportion of secondary urn cremations and lower proportion of secondary pit cremations may suggest that the inhabitants of the two areas adhered to culturally distinct mortuary practices. If the two communities were in fact coeval, as proposed here, then these differences in mortuary treatment may suggest a co-occurrence of culturally distinct habitation groups, a matter we explore below in more detail.

Most striking about the spatial distribution of burials in Burial Area 2 was the linear pattern of the three primary cremations. These three features appeared to have been deliberately aligned along an east-west axis. The two inhumations also were oriented east-west but did not conform to the same linear axis. In contrast, the locations of secondary cremations exhibited no obvious spatial patterning or orientation. The line of primary cremations may have constituted a central cremation area within Burial Area 2, with the various secondary cremations scattered throughout the surrounding area.

Osteological analysis of the bone remains indicated that Burial Area 2 included at least three adults and an infant. The three adults identified by sex included one male and two females. Two inhumations, an adult male and an adult female, were interred with shell beads, an undecorated-pottery vessel, and a bone awl. Materials recovered in the primary inhumations included undecorated-pottery fragments, a bone awl, and an ochre-stained carved-stone censer. As explained above, these goods may represent an accumulation of offerings spanning the "life history" of the crematoria. The secondary cremations were mostly devoid of offerings, other than the burial urns and capping vessel, although one urn cremation containing infant remains (Feature 4057) was found in association with burned shell-bracelet fragments.

Burial Area 3, Locus D

Burial Area 3 was located in the far-eastern portion of the large, stripped area in Locus D (Figure 171) and included four burials in SUs 1759, 1881, and 1883 (Features 3528, 3604, 3875, and 4740). These burials all likely dated to the Middle Formative A period, based on their associations with well-dated features (mostly structures) in the area. A possible exception is Feature 4760,which may date to the Late Archaic or Early Formative period, although we have no conclusive evidence (see below). A fifth burial, inhumation

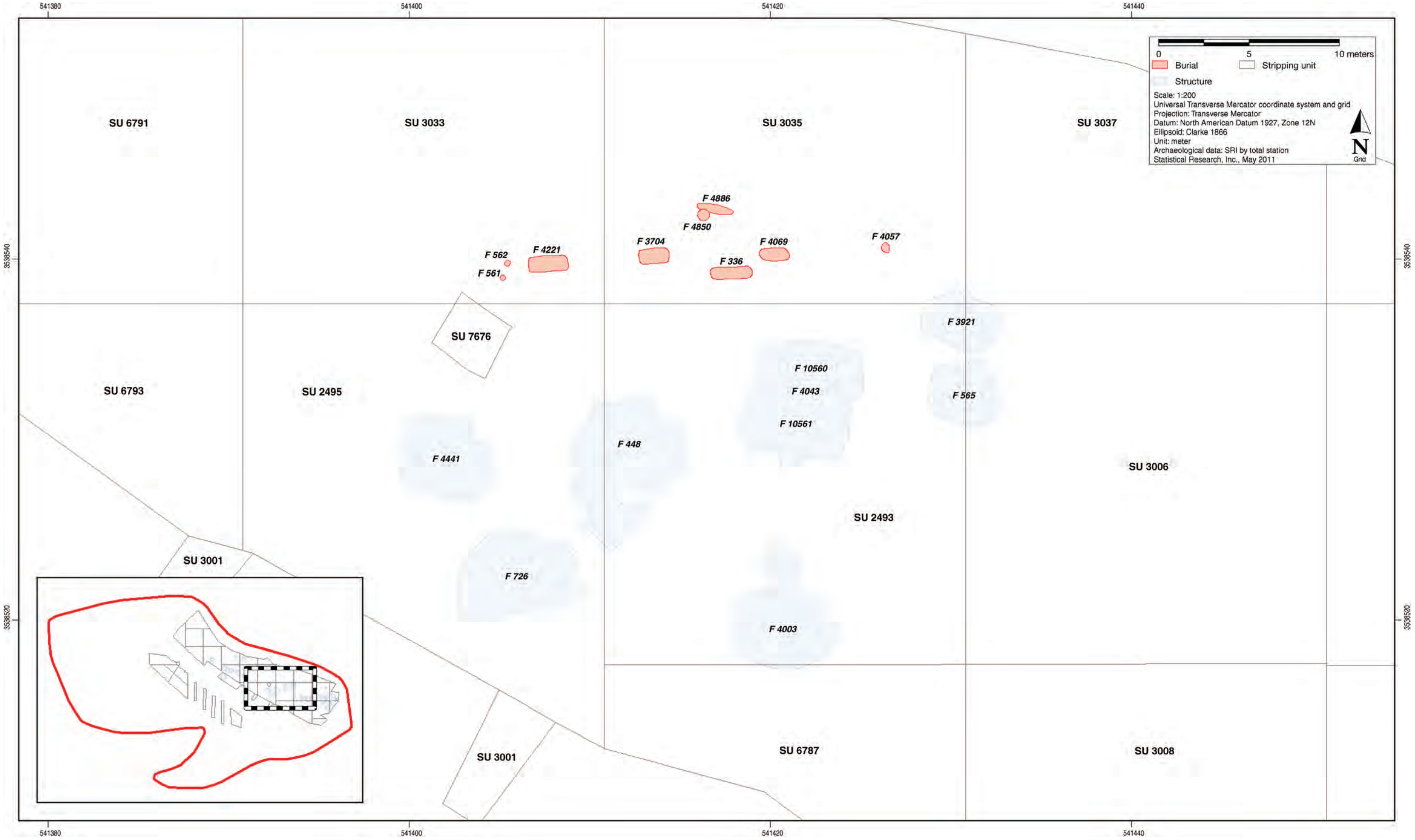


Figure 170. Map of Burial Area 2 in Locus D.

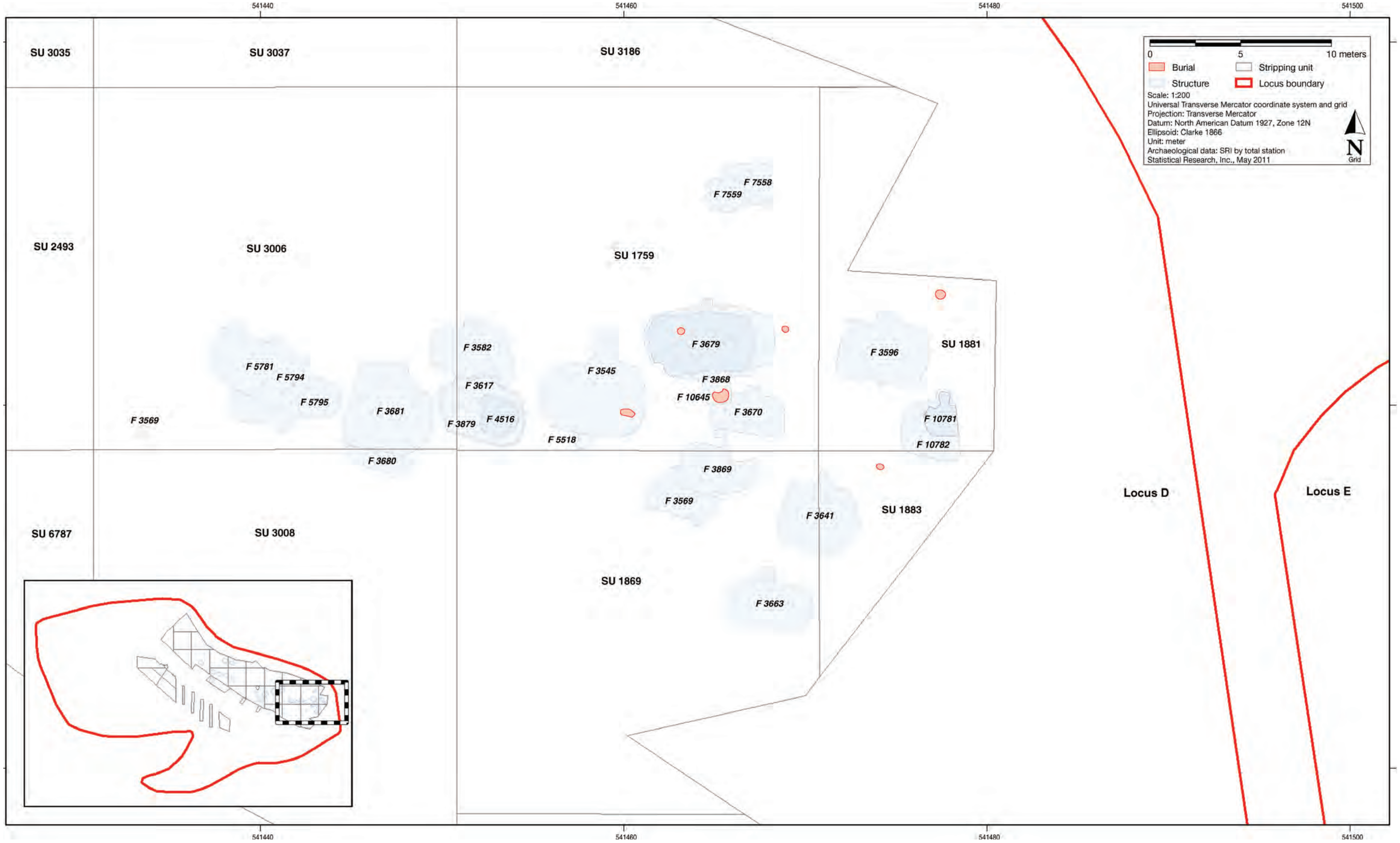


Figure 171. Map of Burial Area 3 in Locus D.

Feature 10645, was recorded in this same vicinity but probably predated the Middle Formative A period. As noted above, we suspect that Feature 10645 dated to the Late Archaic or Early Formative period (pre-A.D. 600) (with a higher probability than Feature 4760); we therefore do not include it in our discussion of Burial Area 3.

This proposed burial area was located within a large cluster of features that included 23 Middle Formative period structures (Features 3545, 3569, 3582, 3596, 3617, 3641, 3663, 3670, 3679, 3681, 3868, 3869, 3879, 3680, 4516, 5518, 5781, 5794, 5795, 7558, 7559, 10781, and 10782), most of which consisted of multiple superimposed structures. Like the structures located adjacent to Burial Areas 1 and 2, this cluster largely consisted of a linear arrangement of structures, and it might extend beyond the eastern boundary of the stripped area. Inferring spatial relationships among the structures in this area was a challenge, mainly because of their large number and frequent superimposition and the presence of multiple occupation components. Based on Lengyel's AM analysis, the structures in this area spanned the entire reconstructed occupation sequence for Locus D, which included seven distinct occupation episodes spanning the Middle Formative A and B periods.

In contrast with Burials Areas 1 and 2, Burial Area 3 was not spatially discrete; it included four burials dispersed among various nonmortuary features, three of which were directly associated with structures. Feature 3528, a heavily disturbed infant inhumation, was located adjacent to superimposed structure Features 3679 and 3868. Nearby Feature 3875, a secondary pit cremation, was intrusive into Feature 3679. Finally, Feature 4740, an adult-male inhumation, was superimposed by a pair of later structures, Feature 3545 and 5581, which shared the same house pit and floor surface. Therefore, this burial may have been located in an extramural space at the time of the interment. We interpreted Burial Areas 1 and 2 as possible formal and spatially segregated burial loci situated in shared common areas away from domestic structures and everyday-activity areas. Burial Area 3 did not conform to this pattern. Rather, residents in this area may have intermittently buried deceased group members in or around their houses, with no common or shared extramural burial location. No spatial patterning was evident among the burials.

This complex arrangement of structures presented a challenge for inferring temporal associations. One of the four burials (Feature 3528) was located within or adjacent to a group of superimposed structures (Features 3679 and 3868), which have been interpreted as having date ranges of A.D. 835–865 and A.D. 500–865, respectively. Burial Feature 3875 was intrusive into these structures, suggesting interment after A.D. 835 (the minimum date for Feature 3679). In addition, burial Feature 4740 was intruded by—and therefore predated—structures Features 3545 and 5518, which together had a combined inferred date range of A.D. 700–1015. Another burial (Feature 3604) included two Dragoon Red-on-brown bowls with fine-line decoration, suggesting a date range of A.D. 750–900 (Heckman 2000b).

Overall, the chronological evidence was consistent with the possibility that Burial Area 3 was coeval with Burials Areas 1 and 2. Structure Feature 3679 was assigned to AM Group 3 (ca. A.D. 735–865), as were various dated structures in the vicinities of Burial Areas 1 and 2. Another nearby structure (Feature 7559) and a nearby activity area (Feature 11342) also were assigned to AM Group 3. To be sure, several additional nearby features were assigned to different AM groups, but none were directly associated with the burial features. In all, these limited data suggested dates of interment during the Middle Formative A period, possible during the span of AM Group 3, the occupation episode likely associated with Burial Areas 1 and 2.

The burials in this area included two inhumations (Features 3528, and 4740) and two secondary pit cremations (Features 3604 and 3875), suggesting no strong preference for a specific mode of interment. Mortuary practices also included variable burials classified as the same mode of interment. For example, one of the two secondary pit cremations (Feature 3604) was placed in a likely reused extramural pit, with two decorated vessels as offerings. The other secondary pit cremation (Feature 3875) was placed in an intramural location (postabandonment) in a formally prepared, rock-lined pit. Variability was also evident among the two inhumations. Inhumation Feature 4740 included the remains of an adult male in a tightly flexed position placed on the left side in a rock-lined, oval pit with sloping walls. In contrast, Feature 3528 included the scattered remains of an infant in a subrectangular pit with straight walls. In this case, the variability may be due to temporal factors, in particular because there is a chance that Feature 4740 did not date to the middle Formative A period at all. Given the flexed position and the oval pit shape, it would not be surprising if Feature 4740 (which underlaid Feature 5518 [A.D. 700–1115]) dated to the Late Archaic or Early Formative period.

Osteological analysis was feasible on only two sets of skeletal remains in Burial Area 3 and indicated interments of an infant and an elderly adult male. Burial offerings were absent in three of the five burials. Feature 3604, a secondary cremation two decorated Dragoon Red-on-brown vessels as offerings. So, this burial area did not exhibit a range of durable offerings comparable to those recorded in Burial Areas 1 and 2. In addition, none of the burials in Burial Area 3 included shell artifacts or bone awls, both of which were recovered in several features within Burials Areas 1 and 2.

Burial Area 4, Locus C

Compared to Locus D, the stripped area in Locus C was too small to include multiple spatially segregated burial areas, but a relatively sizable stripped area that included contiguous

SUs 5190 and 5195 encompassed a dense concentration of structures, extramural features, and burials, most of which dated to the Middle Formative B period. We tentatively classified all of the12 burials located within these two SUs as Burial Area 4 (Figure 172): Features 333, 6090, 6123, 7170, 7335, 7456, 7457, 7458, 7472, 9410, 10136, and 10698. This large number of burials, relative to the other proposed burial areas, reflected the extensive area and the dispersed distribution, rather than any legitimate variability in interment frequency. The burials in this area were considerably more dispersed and spatially extensive than those that composed the other three proposed burial areas; therefore, we only tentatively describe it as a "burial area."

Like Burial Area 3, these burials were dispersed among structures, with no indication of the spatially separated, communal burial area located away from the residences inferred for Burial Areas 1 and 2. Rather, like Burial Area 3, this area probably encompassed a series of burials placed within or adjacent to domestic structures, most of which have been assigned to the Middle Formative B period (Features 376, 379, 995, 6095, 6098, 6129, 6138, 6139, 6153, 6154, 7201, and 7461). These structures did not exhibit the linear arrangements observed in Locus D but, rather, appeared to form two smaller concentrations on the east and west sides of the SUs, surrounding an area of extramural features. Lengyel's AM study revealed four occupational episodes (AM groups) during the Middle Formative B period in Locus C, and various structures were assigned to all four episodes. So, this burial area probably was not associated with one occupational episode, as might be the case with Burials Areas 1 and 2 and possibly Burial Area 3. Rather, it may have contained burials relating to several successive episodes over a roughly 200-year span, from about A.D. 950 to 1150.

Date ranges for several burials were directly inferable, based on associations with dated structures. As noted above, two inhumations, of an adult male and a child (Features 7457 and 7458), in structure Feature 6098 may have been placed on the structure floor at the time of abandonment; if so, they were probably interred between A.D. 935 and 1015—the AM date range inferred for this structure. Also, a secondary pit cremation of an adult of indeterminate age (Feature 10138) was found in the wall trench of structure Feature 6129 and may have been interred during construction of the structure; AM dating indicated a date range of A.D. 935–1015 for this structure, suggesting a likely date of interment during this span. A heavily disturbed infant inhumation (Feature 10698) was found in a rodent burrow near structure Feature 7461 (A.D. 935–1040) and may have been originally interred within this structure. Finally, one adult-male inhumation (Feature 9410) was found in a pit that originated in the fill of a structure (Feature 995), assigned to the Middle Formative B period, based on the presence of a Dragoon Red-on-brown vessel on the floor. The 12 burials in this area included various modes of interment: 6 inhumations, 3 secondary pit cremations, 2 secondary urn cremations with upright vessels, and 1 secondary urn cremation with an inverted vessel. Again, this diversity probably reflects variability in mortuary preferences among residential kin groups and households, as well as possibly diachronic changes in mortuary practices by multiple generations over the span of the Middle Formative B period. Variability was also evident within the modes of interment. The inhumations included 2 possible floor-level deposits (possibly not formally buried; see above), 1 burial placed in a likely reused extramural nonthermal pit, 1 burial placed in an extramural burial pit, and 1 burial interred in a pit originating in the fill of an abandoned structure. The final inhumation included the heavily disturbed infant remains noted above.

Among the cremations, the three secondary pit cremations consisted of two extramural burials, one of which included a capping vessel, and an intramural burial found in the wall trench of a structure. The secondary urn cremation with an inverted vessel was associated with a Sacaton Red-on-buff jar. The two urn cremations with upright vessels were placed in Rincon- and Dragoon-style red-on-brown vessels, one of which (the former) also included a plain ware lid (bowl). Therefore, the three urn cremations exhibited three different arrangements. The Spatial distribution indicates a dispersed arrangement of intramural and extramural cremations and inhumations interspersed with residential structures and other domestic features.

Osteological analysis of the bone remains indicated that Burial Area 4 included at least 7 adults, 3 children, 1 infant, and 1 neonate (Feature 7456 contained the remains of 2 individuals). Sex was inferable for 3 adults, which included 2 males and 1 female. Excluding burial urns, the nonperishable offerings included shell beads (2 features), a shell ring or pendant, and a clay ball associated with 2 inhumations and 1 cremation; 10 of the 12 burials contained no durable offerings. Bone awls, which were prevalent in Burial Areas 1 and 2, were absent in Burial Area 4.

Comparing the Proposed Burial Areas

As noted above, a principal research question for the project is to understand the diversity of material culture and the site residents' relationships with the various "regional communities" in the southern deserts (Altschul et al. 2000:13). Inspection of variability among the burial areas may shed light on this issue, assuming that each of the four proposed burial areas was separately maintained by a different kin or residential group in its vicinity. One hypothesis is that the inhabitants of these different residential or kin groups migrated to the site from different nonlocal "regional communities" (e.g., the Phoenix Basin, the Tucson Basin, or the Dragoon area), bringing with them the mortuary

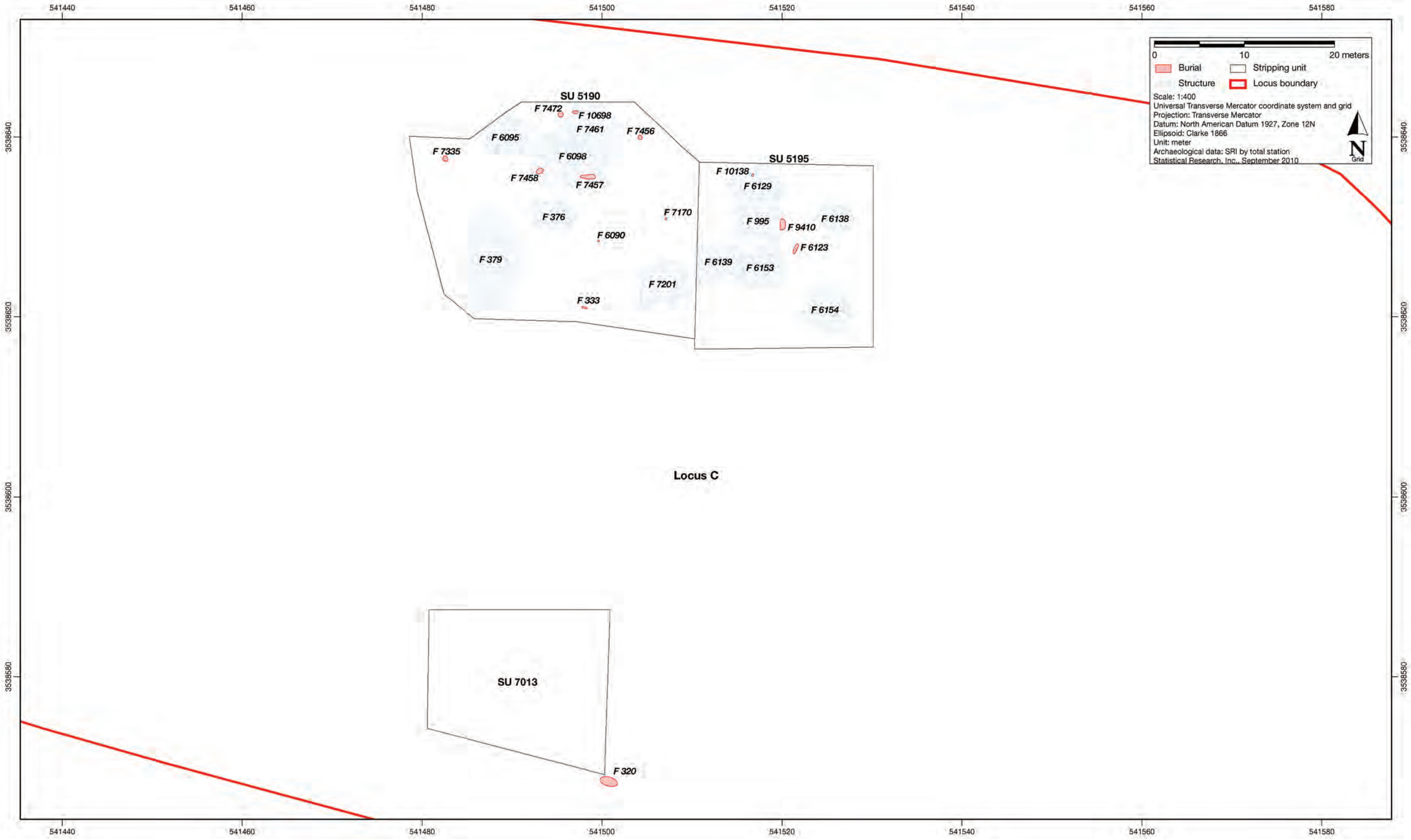


Figure 172. Map of Burial Area 4 in Locus C.

customs of their homelands. A competing hypothesis is that the various residential or kin groups were local to the area and shared a similar suite of mortuary practices. We explore these hypotheses in the following section by analyzing (1) the range of burial classes in each burial area and (2) their painted ceramics, based on which we can develop hypotheses concerning cultural affiliation.

Variability of Mortuary Practices

Table 209 shows the distribution of the various modes of interment among the four proposed burial areas. All four areas included a mix of inhumations and cremations, although their ratios varied. Burial Areas 1 and 2 contained more secondary cremations than inhumations, but Burial Areas 3 and 4 contained roughly equal numbers of both. As noted above, Burial Areas 1 and 2 and Burial Areas 3 and 4 also varied in their spatial configurations; the former areas included well-defined extramural burial areas, and the latter areas included burials that were interspersed with residential and domestic features. Burial Areas 3 and 4 also contained a higher proportion of intramural burials than Burial Areas 1 and 2. On the surface, these differences could be interpreted as evidence for variability in mortuary practices among the proposed house groups or kin groups, but this interpretation overlooks several points of similarity among the burial areas. First, Burial Area 1, like Burial Areas 3 and 4, contained several burials located away from the main burial area and interspersed with residential features, including one intramural inhumation. Second, Burial Areas 3 and 4 were located near the edges of large stripping areas adjacent to areas disturbed by road construction. Burial Area 3 was just west of the large borrow pit constructed by ADOT in the eastern en of Locus D (see Volume 1, Chapter 7). Burial Area 4 was immediately south of I-10. In both cases, we cannot rule out the possibility that well-defined extramural burial areas were present in the impacted areas.

Worth noting is that the 11 burials excavated and reported by Buckles, Klimas, and Deaver (2010:3.50–3.54) in Loci A and G were, as in Burial Areas 3 and 4, interspersed with residential features and nearby extramural activity areas. This is significant, given that the features in Loci A and C largely postdated those from Locus D. The Locus D burials were probably interred during the Middle Formative A period, and the burials in Loci A, C, and G were probably interred during the subsequent Middle Formative B period. If so, the variability among the burials could indicate a diachronic change from placement of burials in discrete extramural burial loci to placement of burials in the vicinities of domestic structures. The salient question concerns Burial Area 3 in Locus D, which was characterized by interspersed burials, and we have no reason to suspect that it postdated Burial Areas 1 and 2 in Locus D. Additional chronological data will be required

Table 209. Distribution of Modes of Interment among the Four Proposed Burial Areas

Burial Area/ Locus	Probable Period	Burials	Primary Cremations	Secondary Pit Cremations	Secondary Urn Cremations	Extramural Inhumations	Intramural Inhumations	Burials with Offerings[a]	Ratio of Secondary Cremations to Inhumations
1/D	Middle Formative A	8	1	6	—	—	1	3 (37%)	6 to 1
2/D	Middle Formative A	9	3	2[b]	2[c]	2	—	6 (66%)	2 to 1
3/D	Middle Formative A	4	—	2	—	2	—	1 (25%)	1 to 1
4/C	Middle Formative B	13	—	4[b]	3[d]	2[e]	4[f]	4 (31%)	1.2 to 1

[a] Excludes cremation urns.
[b] Includes one secondary pit cremation with capping vessel.
[c] Both inverted vessels.
[d] One inverted vessel and two upright vessels.
[e] Includes one disturbed burial found in a rodent burrow near a structure.
[f] Includes two burials likely left on the floor of an abandoned structure.

to further assess our hypothesis of diachronic change in burial placement at Mescal Wash.

Buckles, Klimas, and Deaver (2010:3.53) suggested that the interspersed burial locations were reminiscent of the Mogollon-Dragoon tradition to the east but not the Hohokam tradition to the west. These burial patterns resembled those observed at Tres Alamos and the Gleeson site in the San Pedro Valley (Fulton and Tuthill 1940:26–27) but varied from burial patterns recorded at well-documented pre-Classic period sites in the Phoenix and Tucson Basins. Buckles, Klimas, and Deaver (2010) pointed out that burial areas are generally separated from residential loci in pre-Classic period Hohokam sites, such as Snaketown in the Phoenix Basin (Haury 1976:164) and Los Morteros in the Tucson Basin (Wallace 1995:756). In contrast, Dragoon-area burials tended to be placed "within and beneath structures" (Buckles, Klimas, and Deaver 2010:3.53). Thus, it is reasonable to hypothesize that Burial Areas 1 and 2 reflected a pre-Classic period Hohokam mortuary tradition and that the interspersed burial practices observed in Burial Areas 3 and 4 (and in Loci A and G) reflected an "eastern" Mogollon-Dragoon mortuary tradition. Further, in line with this argument, the diachronic pattern indicated above could reflect a shift in "cultural affiliations" among the site's inhabitants—from Hohokam to Mogollon-Dragoon—over the course of the Middle Formative period. Again, more evidence will be required to evaluate these hypotheses.

The four proposed burial areas also varied with respect to the frequencies of different classes of secondary cremations. Secondary pit cremations constituted the most frequent class of cremation at the site as a whole and in three of the four burial areas. Burial Area 2 contained an equal number of secondary pit cremations and secondary urn cremations (two of each), and Burial Area 4 contained only one more secondary pit cremation than secondary urn cremation. Buckles, Klimas, and Deaver (2010:3.53) argued that urn cremation was frequently practiced in the Tucson Basin (after Ferg 1984:801) but was infrequent in the Phoenix Basin and the San Pedro Valley. Thus, the site inhabitants associated with Burial Area 2 may have maintained social or cultural ties to the Tucson Basin. Also possibly significant is that both of the secondary urn cremations in Burial Area 2 contained inverted urns, whereas two of the three secondary urn cremations in Burial Area 4 contained upright urns. In this case, the variability may reflect temporal change rather than "cultural variability," as Burial Area 4 probably postdated Burial Area 2 by one or two centuries (see above).

Finally, the burial areas varied according to the numbers of burials with associated offerings. Excluding burial urns (both containers and lids), the percentages of burials with offerings in Burial Areas 1, 3, and 4 ranged from 31 to 40 percent, suggesting a relatively consistent rate of interring burials with durable, nonorganic offerings. In Burial Area 2, two-thirds of burials contained offerings. The unknown number of burials with perishable offerings complicates this pattern; nevertheless, if we assume that the burials in the four areas were equally likely to contain perishable and nonperishable goods, then we can reasonably interpret Burial Area 2 as having had more burials with offerings than the other three burial areas. What is not clear is whether this difference reflects cultural differences in mortuary practices or social differences related to variability in status or rank among lineages or groups.

Variability of Painted Pottery

A different way of assessing diversity among burial areas is to compare the decorated-ceramic types recovered directly from the burials. Unfortunately, only four burials included in one of the four burial areas contained painted pottery, three of which were assigned to Burial Area 4. The three burials in Burial Area 4 included a mix of types associated with the Hohokam Buff Ware, Tucson Basin Brown Ware, and Dragoon Brown Ware traditions. These data did not clearly indicate a specific cultural affiliation, but as noted above, Burial Area 4 was widely dispersed and may have included burials interred during different occupational episodes. Therefore, unlike Burial Areas 1 and 2, it was not possible to affiliate Burial Area 4 with a specific occupational episode or residential group. One burial in Burial Area 3 contained two Dragoon Red-on-brown vessels, but a single case provided insufficient grounds for inferring a Dragoon-Mogollon cultural affiliation for this burial area.

Another way of assessing diversity among the burial areas is to inspect the materials recovered from the structures and features associated with each of them (as posited above for each burial area). Here, we gleaned information from the distribution of painted-pottery types from concentrations of features (feature groups) situated in proximity to the burial areas, based on Garraty and Heckman's spatial analysis in Chapter 3. Garraty and Heckman identify concentrations of features, or feature groups, assigned to the Middle Formative A and B periods and compare sherd distributions among them. Their analysis highlights variability in painted pottery among the feature groups. The groups provide grounds for evaluating differences in cultural affiliation among the residential groups associated with the four burial areas.

Burial Area 1 was situated near Garraty and Heckman's Feature Group 1 for the Middle Formative A period (Features 825, 834, and 8644), which contained an unusually high percentage of Phoenix Basin buff wares. The group also contained a relatively low percentage of Tucson Basin brown wares and no Dragoon brown wares. Although not included in Feature Group 1, two additional structures in the vicinity of Burial Area 1 (Features 7880 and 8644) also included high percentages of Phoenix Basin buff wares, but several features contained an insufficient number of painted sherds to include in our analysis. Based on this evidence, it is possible that the site residential or kin group that maintained Burial Area 1 was affiliated with the Phoenix Basin Hohokam tradition. The dominance of secondary pit cremations and the separation of the burials from residential loci (with some exceptions) further implied Phoenix Basin Hohokam mortuary practices (Haury 1976:164). Less clear is whether this residential group and burial area was founded by migrants from the Phoenix Basin or by local people that allied or affiliated themselves with the Phoenix Basin Hohokam tradition (for additional discussion of this issue, see Garraty and Heckman, Chapter 3, this volume).

Unfortunately, the features situated in proximity to Burial Area 2 generally contained sparse sherd collections, with few painted types that indicated a specific regional affiliation. A total of three painted sherds (two Phoenix Basin buff ware and one Tucson Basin brown ware) were recovered among these structures. Moreover, one structure with a sizable sherd collection (Feature 448) produced only plain wares. Therefore, it is not currently possible to infer cultural affiliation for the burial area based on proportions of painted sherds associated with different regional traditions. The dearth of painted types might itself indicate a conscious effort to eschew expressions of affiliation with nonlocal populations and nonlocal regional communities. But as noted above, the presence of urn cremations could indicate a Tucson Basin affiliation (Ferg 1984:801).

Burial Area 3 was situated close to Garraty and Heckman's Feature Group 4 for the Middle Formative A period (Features 3582, 3617, 3679, and 3681). This group was characterized by a very high percentage of Tucson Basin brown wares and a low percentage of Phoenix Basin buff ware and Dragoon brown ware sherds. Other Middle Formative A period features in the area were not included in Garraty and Heckman's study because of their small sherd collections, but inspections of these collections also revealed a predominance of Tucson Basin brown wares. Overall, these data suggested a possible affiliation with the Tucson Basin Hohokam tradition in Burial Area 3, although the intermingling of burials and residences was not consistent with the Hohokam tradition of placing burial areas away from residential loci, noted by Buckles, Klimas, and Deaver (2010). Also, it is an open question whether decorated pottery is a reliable indicator of affiliation. It is plausible that groups from the San Pedro Valley settled in the area and employed "traditional" mortuary practices but obtained decorated pottery from local or nearby sources affiliated with the Tucson Basin pottery tradition.

As explained above, Burial Area 4 in Locus C probably postdated the three areas in Locus D; therefore, differences between this burial area and others might be attributable to temporal trends, rather than different mortuary practices. Garraty and Heckman classify the Middle Formative B period structures in Locus C as Feature Group 2, which contained predominantly Tucson Basin brown wares, as was the case with the other Middle Formative B period feature groups. But it also contained slightly higher percentages of Phoenix Basin buff wares and Dragoon brown wares than the other groups. It is possible that households in this group maintained stronger ties to populations in the Phoenix Basin and the Dragoon area than did the Middle Formative B period households in other areas of the site. These data did not indicate an unambiguous cultural affiliation for Burial Area 4, but it is worth emphasizing that both Burial Areas 3 and 4 contained predominantly Tucson Basin brown wares and exhibited a similar organization of burials interspersed with structures and domestic features. The groups associated with these two burial areas may have shared a common mortuary tradition.

Comparison Summary

In sum, the painted sherd and burial evidence suggested variability among the four proposed burial areas. The spatial arrangements of burials and painted-ceramic data both suggested tantalizing evidence of distinct cultural affiliations among the residential or kin groups that buried deceased group members in these burial areas. For example, the households that maintained Burial Area 1 may have been affiliated with groups in the Phoenix Basin, and the households that maintained Burial Areas 3 and 4 might have maintained social ties to groups in the San Pedro Valley. We were unable to infer a possible cultural affiliation for Burial Area 2, because of the dearth of painted sherds recovered from features in the vicinity, but the presence of urn cremations might have indicated a Tucson Basin affiliation. In all, additional thought and study is needed to explore the connections between the variability and spatial distribution of painted sherds and burial classes, as well as their implications concerning the nature of culture diversity in Mescal Wash during the Middle Formative period.

Summary and Conclusion

Forty-eight burials were recovered during SRI's 2000–2001 excavations at Mescal Wash, including a mix of primary and secondary cremations and inhumations. We subdivided the secondary-cremation burials into four categories. Most were classified as secondary pit cremations, and smaller numbers were classified as secondary urn cremations with inverted vessels, secondary urn cremations with upright vessels, and secondary pit cremations with capping vessels. Most of the burials appeared to have been placed in formally prepared burial pits with flat or rounded bases and straight, slightly sloping side walls. A small number of individuals were interred in reused extramural domestic pits or in what appeared to be informal and expediently prepared pits. Three sets of remains may have been left unburied on the floors of abandoned structures. Also, several inhumations were severely disturbed by postdepositional processes, including rodent activity and postburial construction.

We tentatively inferred period assignments for the burials, based mainly on associations with chronometrically dated features and the presence of temporally diagnostic painted-pottery types. Based on these data, we posited that most of the burials were interred during the Middle Formative period (ca. A.D. 750–1150). One likely exception was Feature 10645 in Locus D, which appeared to have been interred during the Late Archaic or Early Formative period (based on having been disturbed by later features dated to the Early Formative period). Most of the burials in Locus D probably were interred during the Middle Formative A period (ca. A.D. 750–950), and most of the burials in Locus C probably were interred during the subsequent Middle Formative B period (ca. A.D. 950–1150), although both loci probably contained some exceptions. Therefore, any variability in burial attributes between Loci C and D can be tentatively attributed to diachronic changes in mortuary practices.

Inferences concerning the ages, sex, and pathological conditions of the interred individuals in Mescal Wash were severely limited by the dearth of observable bone elements from the cremation burials, but at least one notable demographic trend was inferable, based on the skeletons from which age and sex information could be inferred. The age distribution revealed no individuals between 7 and 14 years old and fewer than expected elderly adults in our sample. Based on this evidence, we hypothesized that adults of reproductive age and their dependent neophytes visited Mescal Wash on a temporary basis, perhaps for the purpose of resource procurement or exchange with other groups. Children and elderly individuals may have remained in the larger villages, although we cannot rule out the effects of sampling vagaries on these results, given the small sample of skeletal remains that were identifiable by age and sex.

Nonperishable burial goods were present in about one-third of the burials, with no statistically significant patterning in distribution according to age, sex, or mode of interment. Worth noting is that slightly more goods per feature were present in primary cremations than in secondary cremations, which probably resulted from an accumulation of materials from multiple incomplete gleaning episodes. Burial goods were also slightly more prevalent among adults than subadults and among male adults than female adults, but our sample size was insufficient to yield statistically significant results.

A higher proportion of burials in Locus D included burial goods than in Locus C, a statistically significant pattern (at the 0.10 level) that suggested a probable diachronic trend in the frequency of mortuary offerings. The burials in Locus D also contained a greater variety of goods, suggesting a diachronic trend from more-diverse burial offerings (Middle Formative A period in Locus D) to a smaller number and narrower range of offerings (Middle Formative B period in Locus C). Also, among the secondary urn cremations, decorated urns were more prevalent in Locus C than in Locus D, suggesting more-frequent use of decorated pottery as burial urns during the Middle Formative B period than during the Middle Formative A period. This latter pattern parallels a more general pattern of increasing decorated-pottery use during the Middle Formative B period, which possibly reflects heightened concern with social identity and material expressions of affiliation, relative to the Middle Formative A period.

We identified four possible burial areas in the current project area, three of which were identified in Locus D (Burial Areas 1–3). Burial Areas 1 and 2 were mostly situated in spatially discrete extramural areas adjacent to linear arrangements of structures and probably marked the locations of shared extramural burial loci for the kin groups or lineages that resided in those structures. Burial Area 3 was not a discrete extramural burial locus but included various intramural and extramural burials interspersed with structures and other domestic features near the eastern edge of Locus D, although we cannot rule out the possibility that a discrete burial area was once present in the vicinity of these features (comparable to Burial Areas 1 and 2) outside the stripped area in the locus portion destroyed by the ADOT borrow pit. Burial Area 4 was located over a large area in Locus C, included a scattered distribution of intramural and extramural burials dispersed among the nonmortuary features, and likely dated to the Middle Formative B period. Again, we cannot rule out that a discrete extramural burial locus may have been present in the vicinity, but outside the stripped area in the area now occupied by I-10.

Burials Areas 1, 2, and 3 in Locus D appeared to be roughly contemporaneous and probably were used during Lengyel's third occupation episode in Locus D (ca. A.D. 735–865) (see Chapter 2, this volume). So, the differences in mortuary practices among them could be interpreted as evidence for cultural variability among coeval groups (i.e., differences in mortuary practices among groups from different learning environments). As explained above, the modes of interment and frequencies of burial goods varied among these three burial areas, possibly suggesting that discrete groups practiced their own mortuary customs that were possibly brought with them from their homelands, assuming nonlocal and temporary site inhabitants (see above).

Burial Area 4 included fewer burial offerings and more intramural inhumations than Burial Areas 1–3. The Middle Formative B period inhabitants in Locus C may have been more concerned with land tenure and use-rights claims than their predecessors and may have expressed their claims by interring inhumations within or adjacent to abandoned structures (see Lincoln-Babb et al. 2010). As explained previously, Vanderpot (2001:18) characterized Mescal Wash as a "persistent place" that received repeated occupation over a long span; therefore, expressions of claims to lands and use rights were probably prevalent. Land-use rights may have been more frequently contested during the Middle Formative B period than during the earlier Middle Formative A period.

Above, we suggested that the burial evidence provided grounds for better understanding intrasite social and cultural variability at Mescal Wash. We suggested that the concordance of variability in mortuary practices and material culture among coeval groups is potentially indicative of movement of people that brought with them a whole suite of material culture and practices from their respective homelands. In contrast, consistency or similarity in mortuary practices among areas or loci with distinct material-cultural styles implies a more uniform site population that shared mortuary customs but differed with respect to material expressions of social affiliation. Our above analyses favor the former hypothesis—i.e., that the site (specifically, Locus D) was inhabited by multiple culturally distinct groups during the Middle Formative A period. In Locus D, the likely kin-related groups in the vicinities of Burial Areas 1, 2, and 3 appeared to have preferred certain decorated-pottery styles and mortuary practices (possibly related to their homelands). This evidence might indicate culturally distinct groups who migrated to the site from different areas of the southern deserts, including the Phoenix Basin, the Tucson Basin, and the San Pedro Valley. The demographic profile inferred from the skeletal remains suggested a possible nonpermanent residential population that inhabited the site on a temporary basis, indicating a possible mix of migrants from these (and possibly other) areas.

Mescal Wash may have functioned as a culturally diverse settlement composed of visiting groups from others areas of the region that shared or coinhabited the site for short periods to procure resources and to facilitate interaction and exchange with nonlocal groups. Migrating groups may have resided at the site for part of the year, leaving elderly adults and older children (7–14 years of age) in their home villages. Each of these groups may have coinhabited the site and maintained their own mortuary practices and decorated-pottery styles. The evidence for this model is tentative, given the small sample sizes of burials. Therefore, we present this argument as a series of hypotheses to be subjected to additional testing with a larger sample of burial data and other evidence.

APPENDIX 1.A

Summary of Excavated Features at the Mescal Wash Site, by Locus

For an explanation of abbreviations used in this appendix, see the key at the end of the table.

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
			Locus A				
200	structure	recessed hearth	all	1	2	A.D. 935–1040	MF
207	structure	house-in-pit	all	1	2	A.D. 935–1150	MF
220	burial	secondary pit cremation	all	1	1	not dated	
288	nonthermal pit	nonthermal pit, general	part	1	2	A.D. 950–1150	MF-B
290	structure	house-in-pit	all	1	2	A.D. 1010–1150	MF-B
522	trash mound	trash mound	part	1	2	not dated	
1143	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
1144	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
1146	thermal feature	roasting pit, basic	part	2	2	not dated	
1149	thermal feature	*horno*	part	2	2	not dated	
1150	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
1179	nonthermal pit	nonthermal pit, general	part	1	2	A.D. 700–950	MF-A
1180	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 950–1150	MF-B
1182	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
1184	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
1185	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
1186	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
1187	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
1188	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
1189	structure	house-in-pit	part	2	2	A.D. 935–1040	MF
1195	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
1196	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2143	midden	midden	part	2	2	A.D. 950–1150	MF-B
2153	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
2157	structure	house-in-pit	all	2	2	A.D. 935–1040	MF
2160	structure	recessed hearth	all	2	2	A.D. 935–1040	MF
2161	thermal feature	roasting pit, basic	all	2	2	not dated	
2162	thermal feature	roasting pit, basic	all	2	2	not dated	

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
2165	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2166	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2168	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 950–1150	MF-B
2169	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
2171	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2172	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2174	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2177	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2180	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2183	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2184	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
2185	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2186	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
2188	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2190	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
2192	structure	recessed hearth	all	2	2	A.D. 700–1150	EF/MF
2195	structure	house-in-pit	part	1	2	A.D. 860–990	MF
2197	thermal feature	roasting pit, basic	part	2	2	A.D. 950–1150	MF-B
6463	thermal feature	roasting pit, basic	part	2	2	A.D. 950–1150	MF-B
8411	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
			Locus B				
364	structure	unknown structure	part	1	1	not dated	
1018	midden	midden	part	1	2	not dated	
			Locus C				
235	structure	adobe walled	all	1	2	A.D. 1160–1450	LF
276	structure	house-in-pit	all	1	2	A.D. 650–1150	EF/MF
278	thermal feature	roasting pit, basic	part	1	2	A.D. 500–1450	F
320	burial	secondary pit cremation	all	1	1	not dated	
333	burial	secondary urn cremation	all	1	2	not dated	

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
376	structure	house-in-pit	part	1	2	A.D. 835–1015	MF
379	structure	recessed hearth	all	1	2	A.D. 1010–1140	MF-B
896	nonthermal pit	nonthermal pit, general	part	1	1	not dated	
917	thermal feature	roasting pit, basic	part	1	2	not dated	
922	thermal feature	roasting pit, basic	part	1	2	not dated	
995	structure	recessed hearth	all	1	2	A.D. 935–1100	MF
999	midden	midden	part	1	2	not dated	
1141	thermal feature	firepit	part	2	2	A.D. 950–1150	MF-B
6007	burial	inhumation	all	2	2	not dated	
6010	structure	house-in-pit	part	2	2	A.D. 700–950	MF
6020	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6021	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6026	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	not dated	
6027	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6028	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6040	thermal feature	roasting pit, basic	part	2	2	not dated	
6045	burial	secondary pit cremation	all	2	2	not dated	
6074	burial	secondary pit cremation	all	2	2	not dated	
6081	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6085	thermal feature	roasting pit, basic	part	2	2	not dated	
6086	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6087	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	not dated	
6088	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6090	burial	secondary urn cremation	all	2	2	not dated	
6095	structure	house-in-pit	part	2	2	A.D. 935–1040	MF
6098	structure	recessed hearth	all	2	2	A.D. 935–1015	MF
6099	thermal feature	roasting pit, basic	part	2	2	not dated	
6101	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
6107	nonthermal pit	nonthermal pit, general	all	2	2	not dated	

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
6109	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6114	thermal feature	roasting pit, basic	all	2	2	A.D. 950–1150	MF-B
6123	burial	inhumation	all	2	2	not dated	
6129	structure	house-in-pit	all	2	2	A.D. 935–1015	MF
6134	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6135	thermal feature	roasting pit, basic	part	2	2	A.D. 950–1150	MF-B
6136	thermal feature	roasting pit, basic	part	2	2	2000 B.C.–A.D. 1150	MA/MF
6138	structure	house-in-pit	part	2	2	A.D. 935–1315	MF/LF
6139	structure	house-in-pit	part	2	2	A.D. 700–1040	EF/MF
6140	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6141	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6142	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6143	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6144	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6145	thermal feature	firepit	part	2	2	not dated	
6146	thermal feature	firepit	part	2	2	A.D. 950–1150	MF-B
6147	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6148	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 950–1150	MF-B
6149	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1450	MF-B/LF
6150	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6151	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6152	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6153	structure	house-in-pit	part	2	2	A.D. 1010–1040	MF-B
6154	structure	house-in-pit	all	2	2	A.D. 935–1015	MF
6162	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 950–1150	MF-B
6171	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 700–1450	EF/LF
6182	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
6187	thermal feature	roasting pit, rock-lined	part	2	2	not dated	
6191	burial	inhumation	all	2	2	A.D. 700–1450	EF/LF
7145	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7153	thermal feature	*horno*	part	2	2	A.D. 985–1040	MF-B

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
7163	thermal feature	roasting pit, basic	part	2	2	not dated	
7168	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7170	burial	inhumation	all	2	2	A.D. 950–1150	MF-B
7171	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7174	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7180	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7182	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7187	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7193	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
7194	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1150	MF-B
7195	thermal feature	hearth	all	2	2	not dated	
7196	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 950–1150	MF-B
7201	structure	house-in-pit	part	2	2	A.D. 935–1015	MF
7205	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	not dated	
7330	animal burial (nonhuman)	animal burial (nonhuman)	all	2	2	A.D. 935–1450	MF/LF
7335	burial	secondary pit cremation	all	2	2	not dated	
7456	burial	secondary pit cremation	all	2	2	not dated	
7457	burial	inhumation	all	2	2	A.D. 950–1150	MF-B
7458	burial	inhumation	all	2	2	A.D. 950–1150	MF-B
7461	structure	house-in-pit	all	2	2	A.D. 935–1040	MF
7472	burial	secondary urn cremation	all	2	2	not dated	
9327	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	A.D. 950–1150	MF-B
9328	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	A.D. 950–1150	MF-B
9409	thermal feature	roasting pit, rock-lined	all	2	2	A.D. 935–1450	MF/LF
9410	burial	inhumation	all	2	2	A.D. 935–1450	MF/LF
9487	thermal feature	roasting pit, basic	all	2	2	A.D. 935–1450	MF/LF
10,133	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	A.D. 935–1450	MF/LF
10,138	burial	secondary pit cremation	all	2	2	A.D. 935–1450	MF/LF

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
10,367	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 650–1450	EF/LF
10,380	thermal feature	firepit	part	2	2	2000 B.C.–A.D. 1015	MA/MF
10,698	burial	inhumation	all	2	2	A.D. 935–1450	MF/LF
10,707	burial	secondary pit cremation	all	2	2	not dated	
	Locus D						
336	burial	inhumation	all	1	1	A.D. 1–1450	F
411	nonthermal pit	nonthermal pit, bell-shaped	part	1	1	1100–900 B.C.	LA
415	thermal feature	roasting pit, basic	all	1	1	not dated	
432	thermal feature	roasting pit, rock-lined	all	1	1	not dated	
437	multiple features	multiple features	all	1	2	mixed	
438	structure	house-in-pit	all	1	2	A.D. 735–865	EF/MF-A
446	thermal feature	roasting pit, basic	all	1	1	not dated	
448	structure	house-in-pit	part	1	2	not dated	
457	thermal feature	roasting pit, basic	all	1	1	A.D. 500–1450	F
464	burial	secondary pit cremation	all	1	1	A.D. 1–1450	F
472	multiple features	multiple features	all	1	2	A.D. 825–1090	MF
491	thermal feature	roasting pit, basic	all	1	1	A.D. 500–1450	F
492	structure	house-in-pit	part	1	2	A.D. 735–840	EF/MF-A
493	thermal feature	roasting pit, basic	all	1	1	not dated	
494	thermal feature	roasting pit, basic	all	1	1	not dated	
561	burial	secondary pit cremation	all	1	1	A.D. 1–1450	F
562	burial	secondary pit cremation	all	1	1	not dated	
565	structure	house-in-pit	part	1	2	A.D. 735–840	EF/MF-A
572	thermal feature	roasting pit, basic	all	1	1	not dated	
575	structure	house-in-pit	part	1	2	A.D. 700–1150	EF/MF
578	nonthermal pit	nonthermal pit, general	all	1	1	A.D. 500–1450	F
714	thermal feature	roasting pit, bell-shaped	part	1	1	A.D. 500–1450	F
723	nonthermal pit	nonthermal pit, general	part	1	1	A.D. 500–1450	F
724	nonthermal pit	nonthermal pit, bell-shaped	part	1	1	A.D. 500–1450	F
726	structure	house-in-pit	part	1	2	A.D. 1–1450	F
771	thermal feature	roasting pit, bell-shaped	all	1	1	not dated	
784	multiple features	multiple features	all	1	2	A.D. 700–1150	EF/MF-B
825	multiple features	multiple features	part	1	2	A.D. 735–865	EF/MF-A

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
833	multiple features	multiple features	part	1	2	A.D. 700–1150	EF/MF-B
834	structure	house-in-pit	part	1	2	A.D. 685–915	EF/MF-A
1545	nonthermal pit	cache	all	2	2	not dated	
1553	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
1555	thermal feature	firepit	part	2	2	A.D. 1–1450	F
1556	thermal feature	hearth	part	2	2	not dated	
1571	structure	house-in-pit	all	2	2	A.D. 1–1150	EF/MF
1575	structure	adobe walled	all	2	2	A.D. 1385–1450	LF-B
1582	thermal feature	rock pile	all	2	2	not dated	
1597	thermal feature	roasting pit, basic	part	2	2	not dated	
1794	thermal feature	firepit	part	2	2	A.D. 1–1450	F
1802	thermal feature	roasting pit, basic	part	2	2	not dated	
1808	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
1812	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	not dated	
1815	structure	pole and brush	all	2	2	1500 B.C.–A.D. 700	LA/EF
1816	structure	pole and brush	all	2	2	1500 B.C.–A.D. 700	LA/EF
2650	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	2000 B.C.–A.D. 1050	A/MF-A
2670	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 700–1450	F
2679	burial	inhumation	all	2	2	A.D. 700–1450	F
2697	nonthermal pit	borrow pit	all	2	2	A.D. 685–1450	F
3027	nonthermal pit	borrow pit	part	2	2	A.D. 1–865	EF/MF-A
3067	thermal feature	roasting pit, basic	all	2	2	A.D. 835–1450	MF/LF
3097	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	2000 B.C.–A.D. 865	A/MF-A
3203	nonthermal pit	nonthermal pit, general	part	2	2	2000 B.C.–A.D. 865	A/MF-A
3366	thermal feature	roasting pit, rock-lined	all	2	2	A.D. 700–1450	F
3426	thermal feature	roasting pit, basic	part	2	2	A.D. 500–1450	F
3433	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 700–1450	F
3437	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	A.D. 835–1450	MF/LF
3501	multiple features	multiple features	all	2	2	mixed	
3528	burial	inhumation	all	2	2	2000 B.C.–A.D. 865	A/MF-A
3544	multiple features	multiple features	all	2	2	not dated	
3545	structure	house-in-pit	all	2	2	A.D. 860–1015	MF

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
3558	indeterminate pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
3564	burial	inhumation	all	2	2	not dated	
3569	structure	house-in-pit	all	2	2	A.D. 935–1015	MF
3579	thermal feature	rock pile	part	2	2	A.D. 950–1150	MF-B
3582	structure	house-in-pit	all	2	2	A.D. 700–950	EF/MF-A
3595	multiple features	multiple features	part	2	2	A.D. 700–950	EF/MF-A
3596	structure	house-in-pit	part	2	2	A.D. 500–1450	F
3604	burial	secondary pit cremation	all	2	2	not dated	
3617	structure	house-in-pit	all	2	2	A.D. 700–950	EF/MF-A
3624	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3631	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 1300–1450	LF-B
3641	structure	house-in-pit	part	2	2	A.D. 1–690	EF
3642	thermal feature	roasting pit, basic	part	2	2	A.D. 1–1450	F
3663	structure	house-in-pit	part	2	2	A.D. 935–1040	MF
3668	thermal feature	roasting pit, rock-lined	all	2	2	A.D. 835–915	MF-A
3669	thermal feature	roasting pit, basic	all	2	2	A.D. 685–1450	F
3670	structure	house-in-pit	all	2	2	A.D. 685–990	EF/MF
3672	thermal feature	rock pile	part	2	2	not dated	
3673	thermal feature	rock pile	part	2	2	A.D. 1–1450	F
3677	structure	house-in-pit	part	2	2	A.D. 1–1450	F
3679	structure	house-in-pit	all	2	2	A.D. 835–865	MF-A
3680	structure	house-in-pit	all	2	2	2000 B.C.–A.D. 950	A/MF-A
3681	structure	house-in-pit	all	2	2	A.D. 700–950	EF/MF-A
3691	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3692	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
3693	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3696	thermal feature	roasting pit, basic	part	2	2	A.D. 835–915	MF-A
3698	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3699	thermal feature	roasting pit, basic	part	2	2	not dated	
3703	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3704	burial	primary cremation	all	2	2	not dated	
3710	structure	house-in-pit	all	2	2	A.D. 685–915	EF/MF-A
3711	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 1–1450	F
3723	indeterminate pit	indeterminate pit	probed	2	2	not dated	

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
3724	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3727	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
3728	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
3737	multiple features	multiple features	part	2	2	mixed	
3748	nonthermal pit	borrow pit	part	2	2	A.D. 785–950	MF-A
3756	thermal feature	roasting pit, bell-shaped	all	2	2	A.D. 685–740	EF
3790	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 500–865	EF/MF-A
3792	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 500–865	EF/MF-A
3817	structure	house-in-pit	all	2	2	A.D. 700–1015	EF/MF
3818	thermal feature	*horno*	part	2	2	A.D. 935–1015	MF-A
3868	structure	house-in-pit	all	2	2	A.D. 600–865	EF/MF-A
3869	structure	recessed hearth	all	2	2	A.D. 700–1050	EF/MF
3870	nonthermal pit	borrow pit	part	2	2	A.D. 700–1050	EF/MF
3871	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 700–1450	F
3872	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 700–1450	F
3875	burial	secondary pit cremation	all	2	2	A.D. 835–1450	MF/LF
3876	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
3878	thermal feature	roasting pit, rock-lined	all	2	2	A.D. 860–1450	MF/LF
3879	structure	house-in-pit	all	2	2	A.D. 700–950	EF/MF-A
3895	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 700–950	EF/MF-A
3897	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3921	structure	house-in-pit	part	2	2	not dated	
3926	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3938	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3939	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3942	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3943	burial	inhumation	all	2	2	not dated	
3945	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3946	indeterminate pit	indeterminate pit	probed	2	2	not dated	

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
3949	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3950	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3951	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3952	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3953	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3954	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3956	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3957	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3958	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3959	indeterminate pit	indeterminate pit	probed	2	2	not dated	
3960	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
3963	thermal feature	roasting pit, basic	part	2	2	A.D. 1–1450	F
3964	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3965	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3966	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3967	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
3968	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 700–950	EF/MF-A
3976	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	1280–1010 B.C.	LA
3977	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 1–1450	F
3983	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	1070–900 B.C.	LA
4003	structure	house-in-pit	part	2	2	A.D. 1–1445	F
4033	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4035	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4043	multiple features	multiple features	part	2	2	mixed	
4044	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4045	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
4046	nonthermal pit	nonthermal pit, general	part	2	2	not dated	

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
4047	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
4048	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
4049	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4050	thermal feature	roasting pit, basic	part	2	2	A.D. 1–1450	F
4051	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
4053	thermal feature	roasting pit, basic	part	2	2	A.D. 1–1450	F
4054	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
4055	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4057	burial	secondary urn cremation	all	2	2	not dated	
4058	indeterminate pit	nonthermal pit, general	all	2	2	not dated	
4059	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4063	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4069	burial	primary cremation	all	2	2	A.D. 1–1450	F
4076	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4091	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4097	nonthermal pit	borrow pit	part	2	2	A.D. 500–1450	F
4105	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	200 B.C.–A.D. 840	LA/MF-A
4108	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4119	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4120	thermal feature	roasting pit, rock-lined	all	2	2	A.D. 500–1450	F
4121	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4128	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4143	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4149	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 1–1450	F
4164	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4193	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4196	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4220	thermal feature	*horno*	part	2	2	A.D. 500–1450	F
4221	burial	primary cremation	all	2	2	A.D. 585–1015	EF/MF-A

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
4230	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4295	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	not dated	
4299	multiple features	multiple features	part	2	2	mixed	
4310	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4312	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	1500 B.C.–A.D. 300	LA/EF
4326	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–300	EF
4333	structure	house-in-pit	part	2	2	A.D. 685–1015	EF/MF
4369	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
4441	structure	house-in-pit	part	1	2	not dated	
4462	structure	house-in-pit	part	2	2	A.D. 1–1450	F
4516	structure	pole and brush	all	2	2	A.D. 700–950	EF/MF-A
4556	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4560	indeterminate pit	indeterminate pit	probed	2	2	not dated	
4561	indeterminate pit	indeterminate pit	probed	2	2	A.D. 500–1450	F
4571	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 500–1450	F
4631	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4635	thermal feature	roasting pit, basic	all	2	2	A.D. 1–1450	F
4642	structure	house-in-pit	part	2	2	A.D. 500–915	EF/MF-A
4649	thermal feature	firepit	all	2	2	A.D. 500–1450	F
4660	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 1–1450	F
4682	structure	house-in-pit	all	2	2	A.D. 825–1015	MF
4683	structure	adobe walled	all	2	2	A.D. 1385–1450	LF-B
4684	structure	adobe walled	all	2	2	A.D. 1310–1690	LF-B
4702	thermal feature	roasting pit, rock-lined	part	2	2	A.D. 600–865	EF/MF-A
4716	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 700–1450	F
4725	multiple features	multiple features	all	2	2	mixed	
4728	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4729	structure	adobe walled	all	2	2	A.D. 1340–1390	LF-B
4730	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4731	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4732	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4733	structure	pole and brush	all	2	2	A.D. 500–1450	F

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
4735	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 500–1450	F
4739	burial	secondary pit cremation	all	2	2	not dated	
4740	burial	inhumation	all	2	2	2000 B.C.–A.D. 1015	A/MF
4750	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4753	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4757	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4759	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4768	structure	house-in-pit	all	2	2	A.D. 1010–1090	MF-B
4780	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4793	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4794	burial	secondary pit cremation	all	2	2	not dated	
4798	burial	primary cremation	all	2	2	not dated	
4849	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	820–590 B.C.	LA
4850	burial	secondary urn cremation	all	2	2	not dated	
4857	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4871	thermal feature	roasting pit, bell-shaped	part	2	2	A.D. 990–1160	MF-B
4882	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4886	burial	inhumation	all	2	2	not dated	
4887	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 1–1450	F
4888	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
4895	multiple features	multiple features	part	2	2	mixed	
4896	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4902	thermal feature	roasting pit, basic	part	2	2	A.D. 1–1450	F
4909	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4912	structure	pole and brush	all	2	2	200 B.C.–A.D. 700	LA/EF
4931	thermal feature	roasting pit, basic	part	2	2	A.D. 985–1315	MF/LF
4932	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4935	structure	pole and brush	all	2	2	200 B.C.–A.D. 1450	LA/F

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
4943	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4945	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4954	thermal feature	roasting pit, basic	part	2	2	not dated	
4966	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4973	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 1–1450	F
4976	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
4984	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4985	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
4996	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
5504	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
5505	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	1110–900 B.C.	LA
5512	burial	inhumation	all	2	2	A.D. 735–1450	F
5513	structure	house-in-pit	all	2	2	A.D. 500–1390	F
5518	structure	house-in-pit	part	2	2	A.D. 700–1015	EF/MF
5520	thermal feature	firepit	all	2	2	A.D. 735–1450	F
5568	thermal feature	roasting pit, basic	part	2	2	A.D. 1–1450	F
5612	thermal feature	roasting pit, bell-shaped	all	2	2	A.D. 650–950	EF/MF-A
5616	structure	house-in-pit	part	2	2	A.D. 500–1310	F
5619	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 1–1450	F
5624	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
5647	nonthermal pit	nonthermal pit, general	all	2	2	A.D. 700–1450	F
5766	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 935–1450	MF/LF
5781	structure	house-in-pit	all	2	2	A.D. 660–940	EF/MF-A
5793	nonthermal pit	borrow pit	part	2	2	A.D. 660–1450	F
5794	structure	house-in-pit	part	2	2	A.D. 910–1015	MF
5795	structure	house-in-pit	part	1	2	A.D. 910–1150	MF
5809	nonthermal pit	nonthermal pit, bell-shaped	all	2	2	A.D. 1–300	LA/EF
5980	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	A.D. 1–1450	F
5982	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
5983	nonthermal pit	nonthermal pit, general	part	2	2	not dated	

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
5986	structure	house-in-pit	all	2	2	A.D. 700–865	EF/MF-A
5992	burial	secondary pit cremation	all	2	2	not dated	
5994	structure	house-in-pit	part	2	2	A.D. 650–950	EF/MF-A
7501	cache	cache	all	2	2	A.D. 1–1450	F
7558	structure	pole and brush	all	2	2	A.D. 710–740	EF
7559	structure	pole and brush	all	2	2	A.D. 785–840	MF-A
7560	thermal feature	roasting pit, basic	all	2	2	A.D. 500–1450	F
7664	nonthermal pit	borrow pit	part	2	2	A.D. 1–1390	F
7697	multiple features	multiple features	all	2	2	mixed	
7742	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 735–1450	F
7827	thermal feature	roasting pit, bell-shaped	part	2	2	A.D. 660–790	EF/MF-A
7833	burial	inhumation	all	2	2	A.D. 500–1450	F
7847	burial	secondary pit cremation	all	2	2	not dated	
7879	structure	house-in-pit	all	2	2	2000 B.C.–A.D. 865	A/MF-A
7880	structure	house-in-pit	all	2	2	A.D. 735–865	EF/MF-A
7940	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 950–1450	MF/LF
7942	structure	house-in-pit	all	2	2	A.D. 700–925	EF/MF-A
7943	structure	house-in-pit	all	2	2	A.D. 700–925	EF/MF-A
7978	structure	house-in-pit	all	2	2	A.D. 700–865	EF/MF-A
8607	structure	unknown structure	all	2	2	not dated	
8643	structure	house-in-pit	part	2	2	A.D. 700–915	EF/MF-A
8644	structure	house-in-pit	part	2	2	A.D. 685–915	EF/MF-A
8655	structure	house-in-pit	all	2	2	A.D. 825–1090	MF
8798	thermal feature	roasting pit, bell-shaped	part	2	2	A.D. 1–865	EF/MF-A
8841	structure	house-in-pit	part	2	2	A.D. 835–865	MF-A
8842	structure	house-in-pit	part	2	2	A.D. 735–840	EF/MF-A
8887	nonthermal pit	nonthermal pit, general	part	2	2	A.D. 685–1450	F
9729	structure	house-in-pit	part	2	2	A.D. 500–840	EF/MF-A
9867	structure	house-in-pit	part	2	2	A.D. 760–840	MF-A
10,507	thermal feature	roasting pit, bell-shaped	all	2	2	A.D. 600–1000	EF/MF
10,560	structure	house-in-pit	part	2	2	A.D. 735–840	EF/MF-A
10,561	structure	house-in-pit	part	2	2	A.D. 835–990	MF
10,587	nonthermal pit	nonthermal pit, general	part	2	2	not dated	
10,612	nonthermal pit	nonthermal pit, bell-shaped	part	2	2	not dated	
10,645	burial	inhumation	all	2	2	1200 B.C.–A.D. 600	LA/EF

continued on next page

Feature No.	General Feature Type	Specific Feature Type	Level of Effort	Discovery Phase	Excavation Phase	Date Range	Period
10,692	thermal feature	firepit	all	2	2	2000 B.C.–A.D. 600	LA/EF
10,711	burial	secondary pit cremation	all	2	2	not dated	
10,720	nonthermal pit	nonthermal pit, general	all	2	2	not dated	
10,729	structure	house-in-pit	part	2	2	A.D. 935–1015	MF
10,781	structure	recessed hearth	part	2	2	A.D. 935–1015	MF
10,782	structure	house-in-pit	part	2	2	A.D. 935–1015	MF
11,251	structure	pole and brush	all	2	2	200 B.C.–A.D. 700	LA/EF
11,342	activity surface	activity surface	part	2	2	A.D. 760–840	MF-A
11,352	midden	midden	part	2	2	A.D. 750–850	MF-A
11,390	structure	house-in-pit	part	2	2	A.D. 760–1450	MF/LF
11,442	cache	cache	all	2	2	A.D. 865–1450	MF/F
380	burial	secondary pit cremation	all	1	1	not dated	
381	burial	secondary pit cremation	all	1	1	not dated	
652	structure	unknown structure	part	1	1	not dated	
672	trash mound	trash mound	part	1	1	not dated	

Key: A = Archaic period; all = completely excavated; EF = Early Formative period; F = Formative period; LA = Late Archaic period; LF = Late Formative period; LF-B = Late Formative B period; MA = Middle Archaic period; MF = Middle Formative period; MF-A = Middle Formative A period; MF-B = Middle Formative B period; part = partially excavated; probed = probed only.

APPENDIX 2.A

Archaeomagnetic Sampling, Analysis, and Dating Procedures

A total of 107 archaeomagnetic (AM) dating samples was collected from architectural structures and extramural features in three loci at the Mescal Wash site (AZ EE:2:51 [ASM]). Ninety-four of these samples were measured and analyzed by the Archaeomagnetic Research Program at Statistical Research, Inc., in Tucson, and the remaining 13 samples were archived for future research. Most of the sampled structures and features have been dated archaeologically to the Middle Formative period (ca. A.D. 750–1150) or the Late Formative period (ca. A.D. 1150–1450) based on the painted design styles of associated ceramics. Reliable archaeomagnetic signals were obtained for 79 of the samples. This appendix reports on collection and analysis methods, and presents the archaeomagnetic data.

Basis of Archaeomagnetic Dating

In the American Southwest, thousands of samples from archaeological features have been archaeomagnetically dated. This type of dating involves two stages of research that are guided by palaeomagnetic and archaeological principles. The first stage employs well-established palaeomagnetic procedures to collect archaeological materials, measure the magnetic remanence in these materials, and analyze the magnetic measurements. The sole objective during this stage is to obtain an accurate and precise measurement of the AM remanence inherent in the subject archaeological materials using currently available techniques and machinery. Any judgements as to the quality or accuracy of the measured remanence are based on properties inherent in the remanence itself, independent of any archaeological expectations.

In the second stage, the magnetic data obtained from the archaeological materials are used to ascertain the age of certain archaeological phenomena. This stage is primarily interpretive and encompasses a wide variety of methods and techniques for assigning an age to the moment in the past when the AM remanence was acquired. The objective of the second stage is to obtain the most accurate and precise estimate possible for the age or date of the archaeological event. Unlike the first stage, which is independent of archaeological inference and expectations, the procedures and techniques used to infer ages or dates, as well as subsequent judgements as to the quality or accuracy of the AM dates, fall within the domain of archaeological method, theory, and inference (Wolfman 1990:349).

The potential for archaeomagnetically dating past human events and episodes results from the inadvertent effect human behaviors have had on the magnetic minerals present in most sediments and artifacts, as governed by the behavior of the Earth's geomagnetic field. Most native sediments used in the construction of archaeological features and artifacts contain ferromagnetic minerals that, under a variety of conditions, will acquire a magnetic remanence parallel to the prevailing magnetic field (Aitken 1974; McElhinny 1973; Sternberg 1982, 1990; Tarling 1983). Once established, these magnetizations are stable and enduring unless reexposed to the same or other magnetizing conditions.

There are a number of processes whereby ferromagnetic minerals can become magnetized. More detailed information on these is available from a variety of texts (Butler 1992; Eighmy and Sternberg 1990; Irving 1964; McElhinny 1973; Tarling 1983). The following discussion refers to the most common process, heating, to outline the basis of AM dating. Most AM dating samples derive from sediments that were heated through human activities sometime in the past. The ferromagnetic minerals in these sediments acquired a thermoremanent magnetization (TRM) or a partial thermoremanent magnetization (pTRM) upon cooling. Whether a TRM or a pTRM remanence pertains in particular situations depends on whether the temperature achieved allowed for the uniform magnetization of all magnetic minerals in the materials (TRM) or only a portion of the minerals (pTRM). Most archaeological sediments were heated at relatively low temperatures (less than 350° C), and they probably carry a pTRM (Sternberg 1982:41–44, 1990:15).

For the most part, this distinction between TRM and pTRM is inconsequential with respect to the orientation of the magnetization and the process of relating this to ancient human events. In most cases, enough minerals will be magnetized in the same orientation to produce a dominant remanence. The proportion of uniformly magnetized grains to randomly magnetized grains can, however, have an impact on the consistency and strength of the magnetic signal. If the temperature or duration of heating was too low, the proportion of randomly magnetized grains will exceed that of uniformly magnetized grains and the remanence will be weak and unstable. A similar situation occurs when the proportion of nonmagnetic minerals (e.g., quartz) in a material is greater than that of magnetic minerals (e.g., magnetite).

The pTRM or TRM records the direction and strength of the magnetic field at the time of cooling. Typically, the heating and cooling events relate to specific, recognizable archaeological events. In the case of hearths used on multiple occasions, intuition leads to the conclusion that the remanence recorded probably represents the last heating and cooling cycle of this feature (Sternberg 1982:44, 1990:27). For hearths associated with structures, the last use probably approximates the abandonment of the structure. In the case of samples collected from walls and floors heated during a house fire, the magnetic remanence clearly relates to this particular event.

The Earth’s geomagnetic field is in a constant state of flux referred to as secular variation. Both the direction and the strength of the geomagnetic field change, but AM studies in the U.S. Southwest only focus on changes in the direction of the geomagnetic field. The phenomenon of secular variation is at the core of AM dating. The constant changing of the magnetic field imbues each AM remanence with a unique temporal signature: the direction and strength of the ambient magnetic field as it existed during a particular moment in the past. Common sense then leads to the assertion that archaeological sediments magnetized at the same time will have similar magnetic signatures, and conversely, sediments magnetized at different points in time will have dissimilar magnetic signatures. Thus AM dating of archaeological events and episodes results from the comparison of the AM directions obtained from the archaeological materials.

Archaeomagnetism

Archaeomagnetism involves a sequence of carefully controlled procedures for the collection of the materials for measurement, the measurement of the magnetic remanence or other magnetic properties of the materials, and the analysis of these measurements. Some words about terminology and sampling hierarchy are appropriate before outlining the experimental procedures. The process or event that allowed for the magnetization of the archaeological materials is referred to as the *archaeomagnetic event.* Only two levels of sampling hierarchy are germane to the basic AM process detailed here. The first level represents the individually oriented and measured pieces of archaeological material. These are referred to as *specimens*. The second level represents a group of individually oriented specimens collected from a specific locality (e.g., an archaeological feature) representing the same AM event. This group of specimens make up the *sample.* Thus, the experimental process in archaeomagnetism begins with individual specimen measurements and results in calculated averages for the sample from a particular locality.

Sample Collection

Sample collection follows standard procedures as described by Eighmy (1990). Typically, a set of 12 oriented specimens is carefully extracted from the archaeologically baked sediments. Occasionally, more or fewer specimens may be collected depending on the nature of the sampling situation and the availability of material. Each specimen is oriented using a Brunton compass set to 0° north. When possible, specimens are oriented using a sun compass as well.

Sample Measurement

The directions of the magnetic remanence in the Mescal Wash AM specimens were measured either in a two-axis cryogenic magnetometer (ScT C-102) at the University of Arizona Paleomagnetism Laboratory (UAPL) or in a Schonstedt Spinner magnetometer (SSM-1) at the Archaeomagnetic Research Program (ARP) at Statistical Research, Inc. The process employed at each laboratory follows established and well-tested procedures as outlined by Sternberg (1990:19–22). At the UAPL, specimens are brought into the laboratory several days before measurement and stored in a magnetically shielded room with an average field intensity <200 nT. This allows any weak, ambient-temperature, viscous components present to decay before measurement begins. At the ARP, specimens are stored in a Mu metal shield for a minimum of 48 hours prior to measurement in order to allow these viscous components to decay.

In both laboratories, specimens are measured using a procedure referred to as progressive demagnetization (PDM). The PDM experiment involves measuring the specimen's natural remanent magnetization (NRM) and then magnetically "cleaning" the specimen through successively higher levels, or peak field strengths, of alternating field (AF) demagnetization (Butler 1992:106–107). The NRM is simply the magnetization that is present prior to laboratory treatment. Typically, the NRM consists of the primary magnetization of interest (the pTRM) and weaker secondary components that may have been acquired through prolonged exposure to changes in the ambient geomagnetic field. Experimental evidence indicates that magnetite or titanomagnetite is the primary carrier of the total remanence (Sternberg 1982:34–37). Alternating field (AF) demagnetization is a useful and appropriate means of removing the undesired secondary magnetic component(s) (Sternberg 1990:20). Essentially, the specimen is subjected to a series of linearly decreasing alternating magnetic fields that randomize the orientation of weakly magnetized grains such that they no longer contribute to the overall magnetization (Butler 1992:Figure 5.1). The specimen is exposed to these alternating fields in successively stronger peak-field strengths, and the residual magnetization is measured after each demagnetization treatment.

At the UAPL, the NRM of each specimen is measured and then specimens are routinely demagnetized and measured at peak AF strengths of 10, 15, 20, 25, and 40 mT. At the ARP, the routine demagnetization series includes peak AF strengths of 5, 10, 15, 20 and 25 mT. Both series of measurements provide a broad spectrum of data for evaluating the magnetic profile of each specimen. Evaluation of the large body of AM specimens measured at the University of Arizona and at the Archaeometric Laboratory at Colorado State University (Eighmy et al. 1987; Eighmy and Klein 1988, 1990; Labelle and Eighmy 1995) shows that most archaeological materials are magnetically "clean," that is that any confounding secondary components have been removed, at typical field strengths less than 10–15 mT. These data and experience also indicate that peak AF strengths greater than 40 mT excessively erode the primary magnetic signal, and the specimen remanence begins to behave erratically. Therefore, the optimum demagnetization range of most specimens lies between NRM and 40 mT.

To obtain an accurate and precise determination of the magnetic remanence it is necessary to account for the geographic location of the sampling locality and to reference the measured remanences to true north. Typically, all sample localities are given the geographic coordinates for the center of the archaeological site within which they are located, measured in degrees north latitude and east longitude. Only rarely does the size of the archaeological site and the distribution of sampling localities require determining more than one geographic reference point within an archaeological site. The laboratory measurements for each specimen are corrected to their in situ relationships using the magnetic azimuths recorded in the field when each specimen was oriented and collected. The remanence for all specimens then are corrected to true north using either direct field measurements as determined by a comparison of the sun and magnetic compass readings, or by estimating the local magnetic declination using the current International Geomagnetic Reference Field model available over the internet through the National Geophysical Data Center of the National Oceanic and Atmospheric Administration (NGDC 2005).

Data Analysis

The data gathered during the PDM experiment are subjected to two analyses before a sample average is calculated. First, the results of the AF demagnetization experiment are evaluated to determine if each specimen has a stable magnetic remanence. Second, after segregating specimens with unstable remanences from those with stable remanences, each sample is evaluated for outliers.

The stability of the magnetic components is deduced from the magnetic profiles revealed through the successive steps of the PDM experiment. The additional time required to subject each specimen to the PDM experiment yields its rewards at this time. The presence of a stable remanence is indicated by a magnetic component that persists through successive demagnetization steps. For each specimen the measured declinations and inclinations at each demagnetization step are plotted on a vector endpoint diagram. Sternberg (1990:20–21) describes and illustrates this technique. This diagram depicts two curves for each specimen: one depicting the behavior of the declination through the successive demagnetization steps, and the other depicting the behavior of the inclination through the successive demagnetization steps. The presence and progressive neutralization of a secondary magnetic component is indicated by arcing curves resulting from changes in either the declination, the inclination, or both between successive steps. Isolation of a single primary component is indicated by a straight line through successive demagnetization steps progressing toward the graph origin.

One of three magnetic profiles typically pertains for a specimen. First, specimens most commonly show demagnetization curves with a slight arc through the initial AF demagnetization steps, settling into a straight line progressing toward the graph origin through the subsequent AF demagnetization steps. Such a graph indicates neutralization of a weak secondary component at the weaker AF demagnetization fields and the subsequent isolation of a single primary component at the stronger AF demagnetization fields. Second, many specimens show straight demagnetization curves progressing toward the origin from NRM through all subsequent AF demagnetization steps. These specimens clearly have a robust, singular, primary component. Third, some specimens exhibit erratic behavior during the PDM experiment. It is difficult to establish a general pattern for these specimens, but they are all characterized by demagnetization curves that lack straight-line segments or that never progress toward the graph origin. This third group of specimens lacks, for some reason, a stable and reliable magnetic remanence. For this group, there is essentially no stable and reliable magnetic signal.

For all specimens there is always some noise inherent in the magnetic remanence and a small amount of error introduced during measurement. Repeat measurements of standards in the lab indicate that measurement error is small, but present. Inherent noise in the remanence, however, presents a greater detriment to delineating the direction of the primary magnetic remanence, and some specimens exhibit noisier primary components than others. The quality of all primary components isolated in the PDM experiment (the straight portion of the demagnetization curve) is analyzed by principal component analysis (Kirschvink 1980). A least-squares line is fit to the portions of the declination and inclination curves representing measurements of only the primary AM component. The measured minimum angular deviation (MAD) of these lines provides a measure of the quality and stability of the magnetic remanence.

Because the magnetization of archaeological materials is rather simple, only two stringent criteria are needed to evaluate the stability of the primary magnetic component. First, the primary component should be represented preferably by four measurements, but no fewer than three, that delineate a straight line progressing toward the graph origin. Second, the MAD of the fitted line to this component must be less than 5.0. Any specimens failing on either of these two criteria are considered unstable and unreliable. The conclusion is that no stable primary magnetic component exists, or that the direction of the primary component is excessively obscured by undesirable noise in the sampled materials. Specimens failing either of these criteria are not included in any further analyses, and they are always excluded from computation of the sample average. In some cases, a magnetically unstable, and hence excluded, specimen will have a direction of remanence that is consistent with those of other specimens in the same sample. In general, though, these magnetically unreliable specimens have directions of magnetization that are inconsistent with those of other specimens from the same sample. It must be emphasized that these specimens are excluded because they are magnetically unstable and not because they posses a different magnetic orientation. They are different from outliers, which are considered below.

After analysis of the PDM data, the directions of all specimens that satisfied the stability evaluation are plotted on a stereograph and visually inspected for potential outliers. As used here, an outlier is a specimen that has an apparently stable and reliable remanence but shows an aberrant direction when compared to other specimens in the same sample. The divergence of these specimens cannot be explained based on the PDM experimental evidence but may result from other causes. Three criteria are used to evaluate these outliers. First, the field sampling forms are reviewed to determine if there was any observable characteristic that may give rise to an anomalous direction. Second, the experimental evidence is reviewed to determine whether the specimen differs considerably in magnetic properties that were not evaluated in the test for stability. Third, in the absence of any physical or experimental evidence to corroborate the suspicion that the direction is unreliable, the suspected outlier is evaluated statistically against the remaining specimens from the sample (see Sternberg 1982:25–29).

The field sampling forms can provide important clues that suspected outlying specimens may differ physically from the others. A variety of agents might affect the archaeological materials in ways leading to aberrant measurements. Some of these are inherent in the archaeological materials themselves. Others are external to the archaeological materials. Some situations that have occurred include specimens that contained gravels, particularly volcanic rocks (compositional inhomogeneity); specimens that were composed of different materials such as sands instead of clays, or fired subsoil instead of adobe plaster (lithic inhomogeneity); specimens showing different colorations or hardness suggesting that they may have not been fired as well (firing inhomogeneity); specimens located near highly localized magnetic anomalies such as buried volcanic cobbles, electric lines, or iron pipes; and specimens taken from portions of the archaeological matrix that had cracked and separated from the parent material or that moved during specimen collection (mechanical displacement). All of these will ultimately affect the reliability of the magnetic remanence.

In the absence of physical evidence recorded in the field notes, the experimental data can be reviewed again to look for a possible explanation. Often specimens will satisfy the criteria for having a stable magnetization but still be different in some magnetic properties from the other specimens from the same sample. The magnetization may be an order of magnitude weaker than the other specimens, or the specimen may satisfy the MAD requirement but still have a MAD considerably larger than other specimens from this sample. These criteria are not enough in and of themselves to conclude a specimen is an outlier, but they can corroborate the suspicion created by the aberrant direction.

Finally, there may be no physical evidence recorded on the field form or any additional experimental evidence to corroborate the suspicion that a specimen direction is unreliable. In this case, the specimen is evaluated statistically. The potential outlier is excluded momentarily from the sample and a new mean is computed. If the specimen direction differs from the new mean at .05 significance it is considered different and judged to be an outlier. If there are two or more potential outliers, all are excluded from computation of the new mean and similarly evaluated. Exclusion based on the statistical comparison relies on the knowledge that some potentially confounding agents may not have been recognizable during specimen collection or experimentally evident without additional studies. One type of error that would avoid detection through the field notes or in the experimental evidence would be reading and recording the specimen orientation incorrectly or mismarking the orientation direction on the specimen. The latter typically results in errors of ± 90 or ± 180. The former could result in errors of any magnitude, and it is suspected in situations where the inclination angle of the specimen is within the range of others from the same sample, but the declination angle diverges widely.

Sample averages are obtained by averaging the individual specimen directions using Fisherian statistics (Fisher 1953; Irving 1964; McElhinny 1973). Specimens with unstable remanences and those deemed outliers are excluded. By convention, a virtual geomagnetic pole (VGP) is computed for each sample mean. This is simply a mathematical conversion that accounts for spatial variation inherent in the Earth's geomagnetic field (Shuey et al. 1970), and it facilitates comparison of data from across a relatively large region. Because these poles derive from archaeological events and are used to interpret the temporal dimension of the archaeological record, they are referred to as AM poles.

Archaeomagnetic Dating

In the broadest sense, AM dating refers to the interpretive aspect of deducing an age or a calendrical date for past archaeological events. Conventionally, AM poles are compared to a master record of Southwestern U.S. geomagnetic secular variation to obtain estimates for the calendrical dates for when the magnetization event occurred. Current reconstructions of the regional geomagnetic field extend back to about A.D. 585 (e.g., Labelle and Eighmy 1997). This type of AM dating is limited to the period of time encompassed by the regional dating curve. Although this type of AM dating is conventionally accepted, it is only one of several dating solutions. Often archaeologists may be concerned only with the contemporaneity, the ordering of archaeological events, or the apparent temporal dimension among sets of contexts over a limited period of time. These venues of research about the relative ages of archaeological events can be reached more directly by another avenue of analysis (Deaver 1988, 1989). Even for regions or periods where there is no master record of past geomagnetic secular variation, AM dating of the latter kind is viable and can contribute significantly to the understanding of archaeological cultures.

Two types of AM dating are considered here. Conventional AM dating is referred to as *calendrical dating*. The objective of this type of dating is to determine when an event occurred according to the modern Christian calendar. The alternative dating scenarios are referred to collectively as *relative dating* methods. The objective of this type of dating is to determine when events occurred relative to other events. These two avenues of dating are interrelated, but each specifically addresses different kinds of chronological questions. Both approaches, however, are based on the fundamental principle that contemporary archaeological contexts were magnetized in the same geomagnetic field and therefore should possess similar archaeomagnetic directions, and noncontemporary materials were magnetized in different geomagnetic fields and should have different archaeomagnetic directions. As a matter of standard procedure, only calendrical AM dates are presented with this report. Relative dating is discussed briefly to provide some information about the potentials of this approach to dating.

Calendrical Dating

As noted above, calendrical dating involves a process of comparing calculated AM poles with a master reconstruction of the ancient pattern of regional secular variation. Currently, calendrical dates are obtained using the master curve SWCV595 developed by the Archaeometric Laboratory at Colorado State University (Labelle and Eighmy 1997), and dates are derived using the quantitative statistical dating procedure developed by Sternberg (1982:104–105; also Sternberg and McGuire 1990:125–129). Use of this curve is not an endorsement that it is necessarily the best reconstruction of the ancient geomagnetic secular variation for the U.S. Southwest, but it is the curve most widely used. More recent reconstructions have been presented (Deaver and Whittlesey 2004a; Lengyel and Eighmy 2002) that focus on improving specific segments of the southwestern secular variation records, but these lack the statistical parameters necessary to apply the statistical dating method used here.

Similarly, use of the mathematical dating procedure developed by Sternberg does not endorse this as the best dating method, but currently it is the only one that applies an objective procedure that can produce replicable results. Other dating methods are available (Deaver and Whittlesey 2004a; Lanos 2004; Sternberg and McGuire 1990:122–124; Wolfman 1990:350–351). The statistics are interpreted at 95 percent confidence as described by Sternberg (1982:104–105; also Sternberg and McGuire 1990:126) to obtain a date range at 95 percent confidence. Because of the vermicular character of the AM dating curve, multiple, mutually exclusive date options may result. There is presently no independent means to archaeomagnetically distinguish which date may be most correct. All options must be evaluated relative to other available information to determine the most probable date.

Relative Dating

The primary difference between calendrical dating and relative dating is not in the analytical methods, but in the referents. In relative dating, the referents are other AM events. The method as it has been proposed and applied (Deaver 1988, 1989, 1994, 1997; Deaver and Whittlesey 2004b) seeks to define the chronological relationships among archaeological events and episodes within the occupation span of individual sites, as well as across large regions. In relative dating, the potential contemporaneity of archaeological events is evaluated through statistical comparisons of the AM poles representing the archaeological events. The AM measurements obtained from the samples are compared to one another using the statistical methods of McFadden and Lowes (1981), the same methods used in calendrical dating. This method is currently the most precise and accurate way of determining if two archaeological events may or may not have been contemporary.

Essentially, the statistics are set up to test the null hypothesis that the two AM poles are the same at the 5 percent significance level. Thus, if there is less than a 5 percent chance that the two poles are the same, the null hypothesis is rejected, and it is concluded that the two AM signatures were obtained at different points in time. The sampled materials, then, are said to be archaeomagnetically noncontemporary. If, however, there is a greater than 5 percent chance that the two AM poles are the same, the null hypothesis is accepted, and it is concluded that the two AM signatures *may* have been obtained at the same time. The sampled materials are said to be archaeomagnetically contemporary, but this does not mean that they were absolutely contemporary. It simply means that their AM directions cannot be distinguished at the level of precision with which we can measure them. The likelihood that two statistically indistinguishable directions were absolutely contemporary increases as the error margins (i.e., a_{95}s) associated with those directions decreases and as the rate of secular variation increases.

This method may conclude that two contexts had a very low probability of being contemporary, even if the derived AM calendrical dates overlap (see Deaver 1988). This situation occurs because the factors that must be considered in constructing the master dating curves, particularly assessing the age of the AM events used to construct the curve, contribute to additional uncertainties in the calendrical dates but do not come into play in strictly evaluating the contemporaneity of two archaeological contexts.

Results

A total of 107 AM dating samples was obtained from 88 archaeological features in three loci at the Mescal Wash site (Table 2.A.1). Ninety-four of these samples (88 percent) were measured. Overall, sample quality was good, and 79 of the measured samples (84 percent) produced acceptably precise data (i.e., $a_{95} < 9.0$). In addition, 33 of the measured samples (35 percent) produced good archaeomagnetic data (2.5 a_{95} 5.0), and 27 (29 percent) produced excellent data (a_{95} 2.5). Samples with an a_{95} of greater than or equal to 9.0 were judged to exhibit an unacceptably large dispersion of specimen directions. This is an indication that these materials were not well magnetized, and the samples were excluded from further analysis. The 15 samples that failed to meet the precision criteria are designated with an asterisk in the data table (see Table 2.A.1). No AM dates were obtained for these samples.

Multiple AM dating samples were collected and measured from three structures in Locus A (Features 200, 2157, and 2160), three structures in Locus C (Features 6098, 6129, and 6153), and five structures in Locus D (Features 438, 1575, 3679, 4682, and 4768). The data collected from each structure were compared using the statistical tests of McFadden and Lowes (1981) to test whether they represented the same archaeological event. If samples collected from the same structure had statistically indistinct AM directions, the data were combined to calculate a composite mean for the structure. These composite means were assigned a new sample number followed by the appendix “-avg” (see Table 2.A.1). Samples with statistically different directions, however, were not combined because of the possibility that they reflected temporally different events. Differences in directions also can be the result of some unknown mechanical displacement (e.g., bioturbation of floors, settling and shifting of walls) of one or more of the samples.

Three AM samples were collected from Feature 200 in Locus A, one each from two separate hearths and one from a fired area of the floor. Statistical comparison of the sample means for the two hearths indicated no difference in the AM directions; whatever real difference in ages that occurred between the use of these two hearths was not detectable archaeomagnetically. The sample mean from the floor (SRI 2363), however, was statistically different from those of both hearths. It is possible, although not likely, that the magnetization of the hearths and the floor represent temporally discrete events. The field notes associated with this sample indicate that the specimens may have shifted during collection. It also is possible that the fired patch of floor had mechanically shifted at some point after abandonment, in which case the direction measured in the lab would not accurately reflect the true direction of the magnetic field at the time of firing. It is notable that the precision (k) of the floor sample was less than half that of the two hearth samples (see Table 2.A.1). Without additional evidence, we cannot determine if the difference between the floor sample and the hearth samples represents a real difference in age or some mechanical displacement of the floor sample. Therefore, only the data from the hearths were combined to calculate the composite mean for Feature 200.

Table 2.A.1. Archaeomagnetic Data from Mescal Wash Features, by Locus

Feature No.	Sample No.	N	Inclination	Declination	Intensity (Gauss)	α95	k	Plat (N)	Plong (E)	dm	dp
					Locus A						
200	SRI 2363	10	55.98	345.44	6.96E-04	4.1	140.27	77.15	184.1	5.88	4.22
200.01	SRI 2361	10	58.32	352.28	2.87E-04	2.7	321.93	80.58	209.79	3.99	2.95
200.86	SRI 2362	14	58.84	351.45	1.04E-03	2	401.03	79.72	209.48	2.96	2.2
200	SRI 4000-avg	22	58.36	352.12	6.79E-04	1.7	320.86	80.46	209.47	2.57	1.9
207.01	SRI 2366	11	58.53	351.9	9.60E-05	3.7	149.6	80.22	209.5	5.56	4.12
290.01	SRI 2364	10	60.09	349.6	9.74E-05	2.9	285.57	77.73	209.56	4.33	3.28
1189.01	SRI 2365	10	59.58	356.2	4.97E-05	4.2	133.08	81.04	230.52	6.32	4.75
2157	SRI 2369	9	59.53	359.02	7.07E-05	6.2	71.03	81.59	244.32	9.24	6.94
2157.01	SRI 2404	10	59.53	350.99	1.74E-04	1.6	956.71	78.92	211.05	2.35	1.76
2157	SRI 4001-avg	17	59.3	351.71	1.62E-04	1.9	339.72	79.48	212.25	2.9	2.18
2160.01	SRI 2405	12	57.41	353.51	2.00E-04	2	479.73	81.95	209.92	2.9	2.12
2160.05	SRI 2368	10	57.6	355.01	5.40E-04	5.8	69.7	82.54	217.67	8.54	6.26
2160	SRI 4002-avg	21	57.2	354.03	4.70E-04	2.7	135.43	82.4	211.04	4	2.92
2192.01	SRI 2403[a]	11	51.8	355.59	2.63E-05	11.7	16.13	86.24	167.29	16	10.92
2195.01	SRI 2367	10	49.83	5.64	1.48E-04	3.5	191.8	85	353.61	4.66	3.11
					Locus C						
235.01	SRI 2370	8	56.78	354.48	1.00E-04	5	125.26	82.97	210.79	7.21	5.23
276.01	SRI 2441[a]	7	47.04	16.85	2.30E-05	10.4	34.85	74.97	349.54	13.41	8.67
376.01	SRI 2425	5	52.26	2.26	4.37E-05	7.4	107.64	87.9	314.14	10.17	6.98
379.82	SRI 2424	12	58.85	349.31	7.76E-04	1.7	665.05	78.48	203.75	2.51	1.87
995.01	SRI 2432[a]	7	55.85	355.12	4.64E-05	9.3	43.15	84.03	208.28	13.33	9.55
6095.01	SRI 2426	8	58.05	354.86	1.54E-04	3.5	252.95	82.07	218.98	5.14	3.79
6098.01	SRI 2428	12	56.74	355.03	6.10E-04	2.2	389.93	83.29	213.31	3.19	2.31
6098.02	SRI 2429	11	58.34	344.95	7.80E-04	2.7	288.03	75.89	193.59	3.99	2.95
6129.01	SRI 2396	10	55.21	5.87	2.05E-04	2.1	538.75	83.86	300.23	2.96	2.11
6129.78	SRI 2397	11	56.92	1.36	9.14E-05	3.7	150.16	84.37	260.47	5.43	3.95
6129	SRI 3965-avg	22	56.46	4.93	4.71E-05	2.4	174.53	83.53	287	3.4	2.46
6138.01	SRI 2395	12	58.71	350.16	2.66E-04	2.4	316.66	79.09	205.25	3.63	2.7
6145	SRI 2438	—									

continued on next page

Feature No.	Sample No.	N	Inclination	Declination	Intensity (Gauss)	α95	k	Plat (N)	Plong (E)	dm	dp
6146	SRI 2433	—									
6153.01	SRI 2399	6	59.62	350.26	4.25E-05	2.6	652.8	78.46	209.38	3.95	2.97
6153.02	SRI 2398	9	58.25	351.96	1.48E-04	2.5	417.2	80.46	208.4	3.73	2.76
6153	SRI 3966-avg	16	59.1	351.5	8.08E-05	1.7	493.98	79.54	210.76	2.48	1.86
6154.01	SRI 2427	7	57.52	359.57	1.24E-04	4.2	204.14	83.84	246.28	6.2	4.54
7153	SRI 2440	14	56.04	351.58	7.97E-04	1.5	699.33	81.66	195.26	2.16	1.55
7195	SRI 2439	—									
7201.01	SRI 2402	9	57.1	358.4	1.44E-04	2.9	318.06	84.15	236.91	4.21	3.07
7461.01	SRI 2430	12	55.72	350.8	1.83E-03	2.2	399.7	81.27	191.24	3.11	2.23
9487	SRI 2431	—									
					Locus D						
438	SRI 2387	12	47.82	358.66	5.45E-05	7.8	51.45	86.71	90.24	10.17	6.63
438	SRI 2455	12	39.63	2.59	1.10E-03	1.2	1310.34	80.24	55.21	1.44	0.86
438.01	SRI 2456[a]	12	49.74	17.86	3.60E-05	13.45	11.37	74.69	340.04	17.93	11.95
438	SRI 3989-avg	24	42.89	1.16	3.30E-04	3.4	95.6	82.86	60.95	4.15	2.57
492.01	SRI 2454	12	40.34	1.27	1.52E-03	3.6	144.58	80.95	61.98	4.37	2.64
565	SRI 2442	12	40.53	1.06	1.47E-03	1.4	899.18	81.12	63.09	1.75	1.06
834	SRI 2437	8	44.46	4.06	5.68E-05	5.9	88.8	83.16	37.16	7.43	4.68
1571.01	SRI 2406[a]	12	54.3	24.55	1.55E-05	11.59	14.98	69.36	324.8	16.31	11.47
1575	SRI 2419	9	49.86	3.99	3.05E-05	7.4	49.17	86.35	359.52	9.89	6.6
1575	SRI 2418	12	55.64	1.46	9.48E-05	4.3	104.58	85.63	265.09	6.1	4.36
1575.01	SRI 3990-avg	21	52.61	2.38	6.25E-05	4	64.63	87.66	307.73	5.49	3.78
1575	SRI 2421	—									
3545.01	SRI 2377	8	51.65	4.96	6.81E-05	4.7	137.2	85.79	333.91	6.47	4.4
3569.01	SRI 2373	8	55.91	1.38	3.97E-04	2.5	474.17	85.38	263.39	3.65	2.62
3569.01	SRI 2445[a]	12	49	353.15	3.48E-05	9.06	23.92	83.77	141.77	11.97	7.91
3641.01	SRI 2446	8	52.19	7.22	1.17E-04	2.5	477.94	83.85	329.9	3.48	2.38
3663.01	SRI 2447	12	56.88	353.66	2.04E-04	3.1	194.9	82.44	207.65	4.53	3.29
3668	SRI 2457	10	43.88	8.4	1.00E-04	5.3	83.5	80.32	17.92	6.65	4.16
3670.01	SRI 2463	10	46.05	1.77	7.76E-05	4.4	123.37	85.19	50.39	5.59	3.57
3677.01	SRI 2448[a]	12	48.84	14.62	2.91E-05	28.61	3.27	77.27	345.61	37.74	24.89
3679.01	SRI 2376	12	41.36	3.82	1.41E-04	2.5	305.43	81.11	46.17	3.03	1.85

Feature No.	Sample No.	N	Inclination	Declination	Intensity (Gauss)	α95	*k*	Plat (N)	Plong (E)	*dm*	*dp*
3679.02	SRI 2375	11	43.06	5.09	6.24E-04	2.2	450.53	81.75	35.37	2.67	1.66
3679	SRI 3991-avg	22	42.54	4.44	1.03E-05	1.7	322.47	81.69	40.3	2.13	1.32
3679	SRI 2381	—									
3681.01	SRI 2459	—									
3696	SRI 2389	11	45.13	6.07	2.25E-04	3.2	209.18	82.51	23.02	4.01	2.54
3710.01	SRI 2390	11	45.19	5.33	7.67E-05	4	130.42	82.98	26.64	5.09	3.22
3756	SRI 2374	11	47.89	5.51	1.71E-04	2.1	463.24	84.37	10.53	2.77	1.81
3817.01	SRI 2382[a]	8	61.64	32.04	2.25E-05	23.8	6.35	62.55	307.03	36.83	28.44
3818	SRI 2458	10	56.91	357.38	2.05E-04	4.6	112.79	84.08	228.83	6.64	4.82
3869.01	SRI 2464[a]	12	57.39	356.92	4.49E-05	11.9	14.27	83.47	227.58	17.4	12.72
3879.01	SRI 2378[a]	12	54.63	354.58	3.77E-05	11.57	15.03	84.48	196.06	16.34	11.54
4069	SRI 2400	10	43.44	11.03	1.51E-04	5.9	68.22	78.27	11.14	7.33	4.56
4220	SRI 2460	—									
4221	SRI 2401	8	50.87	4.09	2.04E-05	7.7	52.55	86.5	344.97	10.41	7.03
4333	SRI 2391	9	47.11	358.5	9.03E-05	5.4	90.4	86.09	89.14	7.04	4.56
4516.01	SRI 2379[a]	12	41.4	6.31	5.08E-05	12.55	12.92	80.1	33.67	15.31	9.34
4642.01	SRI 2453	12	50.25	11.89	2.62E-05	8.68	25.97	79.82	341.77	11.63	7.8
4682	SRI 2410	11	44.84	10.77	1.82E-04	5.4	72.8	79.1	7.25	6.8	4.3
4682.01	SRI 2411	5	49.23	2.39	6.02E-05	8	92.74	87.23	21.15	10.58	7.01
4682	SRI 3992-avg	16	46.25	8.61	1.53E-05	4.2	77	81.33	7.71	5.42	3.48
4683.01	SRI 2383	11	53.74	1.4	1.36E-04	3	231.19	87.42	276.1	4.2	2.94
4683	SRI 2388	—									
4684.01	SRI 2384	10	48.38	357.86	2.58E-05	8.9	30.56	86.81	105.18	11.65	7.64
4702	SRI 2461	7	44.18	6.9	1.20E-04	2.1	847.93	81.45	22.86	2.6	1.63
4729.01	SRI 2385	12	55.63	359.44	7.26E-04	2.7	255.03	85.79	243.27	3.89	2.78
4729	SRI 2386	—									
4768	SRI 2434	12	59.27	348.54	7.10E-04	1.8	595.84	77.71	203.81	2.67	2
4768.01	SRI 2450	12	59.01	350.77	2.65E-04	1.7	651.03	79.21	208.25	2.54	1.9
4768	SRI 3993-avg	24	59.16	349.82	1.47E-05	1.2	626.34	78.55	206.36	1.77	1.32
4871	SRI 2392	7	39.13	10.84	7.59E-02	4.4	187.35	76.23	22.4	5.28	3.15
4902	SRI 2393	9	57.85	17.76	2.00E-04	4.2	148.37	74.13	310.25	6.24	4.59

continued on next page

Feature No.	Sample No.	N	Inclination	Declination	Intensity (Gauss)	α95	k	Plat (N)	Plong (E)	dm	dp
4931	SRI 2394	10	58.25	351.33	1.05E-03	2.1	521.63	80.1	206.44	3.13	2.31
5781.01	SRI 2414	13	45.47	4.45	6.81E-05	6.12	46.85	83.65	30.75	7.78	4.94
5794.01	SRI 2415	12	57.19	6.07	4.14E-05	6.54	45.01	82.34	288.3	9.54	6.96
5795.01	SRI 2416[a]	12	53.68	11.93	3.81E-05	11.98	14.08	79.77	323.58	16.73	11.68
5994	SRI 2409[a]	12	43.02	12.01	2.28E-05	11.47	15.29	77.59	8.42	14.29	8.9
5994.01	SRI 2408	—									
7558	SRI 2371	11	45.67	4.52	7.28E-04	1.9	594.91	83.74	29.37	2.39	1.52
7559	SRI 2372	9	37.26	3.31	7.01E-04	3.1	270.52	78.46	53.8	3.68	2.16
7827	SRI 2420	—									
7880.01	SRI 2407	8	42.49	2.28	6.85E-05	2.9	358.04	82.36	53.65	3.61	2.23
7942.01	SRI 2449	12	47.81	5.48	1.13E-03	1.3	1036.78	84.35	11.29	1.76	1.15
8607.01	SRI 2417[a]	12	44.69	11.17	4.69E-05	9.31	22.72	78.73	6.73	11.73	7.4
8643.01	SRI 2412[a]	12	45.63	20.7	3.42E-05	18.33	6.57	71.36	349.37	23.33	14.86
8644.01	SRI 2413	12	44.01	4.13	6.54E-05	5.62	60.52	82.83	32.17	4.41	7.04
8655	SRI 2452	12	41.44	5.12	2.28E-04	1.4	957.17	80.67	39.2	1.71	1.05
8798	SRI 2436	5	43.49	10.1	2.97E-04	6	164.93	78.96	13.63	7.44	4.63
8841.01	SRI 2422	12	42.35	12.36	3.43E-05	8.64	26.18	76.81	10.85	10.64	6.55
8841	SRI 2423	—									
8842.01	SRI 2435	9	40.82	1.73	1.49E-07	2.4	476.03	81.24	58.96	2.87	1.74
9867.01	SRI 2451	12	40.59	3.95	9.34E-05	2.5	299.34	80.54	46.79	3.04	1.84
10507	SRI 2462	7	45.86	10.19	7.43E-05	3.9	238.27	79.97	4.89	5	3.19
10560	SRI 2443	12	39.63	2.08	2.34E-03	3.5	150.52	80.34	57.89	4.26	2.55
10561	SRI 2467	7	47.47	2.48	1.72E-04	3.9	242.66	85.99	36.5	5.04	3.28
10729.01	SRI 2466	12	55.31	358.75	1.42E-04	2	494.98	86	234.7	2.78	1.98
10781.01	SRI 2465	9	53.8	6.43	9.90E-05	4	169.35	84.12	314.01	5.55	3.88
10782.01	SRI 2444	12	59.34	359.72	2.62E-04	2.7	258.25	81.83	247.96	4.06	3.04
11342	SRI 2380	12	39.07	4.15	3.41E-04	3.7	136.43	79.44	47.96	4.45	2.66

Key: n = number of specimens used to calculate the average; *k* = precision parameter; Plat = paleolatitude of archaeomagnetic pole; Plong = paleolongitude of archaeomagnetic pole; *dm* = semi-major axis of confidence oval of archaeomagnetic pole; *dp* = semi-minor axis of confidence oval of archaeomagnetic pole.

Note: Samples with no data were not measured.

[a] These samples had large α95 values and were too imprecise to date.

A sample was collected from the hearth in Feature 2157 in Locus A, and a second sample was collected from an oxidized area of the floor. Statistical comparison of the sample means failed to discern any significant difference in the two AM directions. Any real difference in the ages of these two events was not detectable archaeomagnetically, and a composite mean was calculated for this structure. Likewise, a sample was collected from the hearth in Feature 2160 in Locus A, and a second sample was collected from a burned posthole collar. The sample means from the two subfeatures were statistically indistinct, and a composite mean was calculated for this structure.

In Locus C, two samples were collected from Feature 6098: one from the hearth and a second from the wall of the recessed hearth area. They were found to have statistically different directions, suggesting that they represented different archaeological events. Because of this, the data from the two samples were not combined, and a composite mean was not calculated for the structure. On the other hand, two samples were collected from each of two other structures in Locus C (Features 6129 and 6153), and they were found to be statistically indistinct for each respective feature. Thus, the samples collected from each hearth in Feature 6129 were combined to calculate the composite mean for the structure, and the samples collected from each hearth in Feature 6153 were combined to calculate the composite mean for that structure.

In Locus D, three samples were collected from Feature 438: two from oxidized areas of the floor and a third from the hearth. The sample from the hearth was not magnetically stable and was excluded from this analysis. The means from the two floor samples were found to be statistically indistinct, and they were combined to calculate the composite mean for the structure. Likewise, the means from two samples collected from separate hearths in Feature 3679 were compared statistically, and no significant difference in the AM directions was found. A composite mean was calculated for this structure from the two hearth samples. Finally, a sample was collected from the hearth and a second sample was collected from the floor in each of three structures (Features 1575, 4682, 4768). Statistical comparison of the sample means from each structure failed to discern any significant difference in their respective AM directions. Therefore, the respective sample data were combined, and a composite mean was calculated for each structure.

With the exceptions of the 15 poorly magnetized samples, all but 8 of the measured samples yielded AM date ranges against SWCV595 (Table 2.A.2). The resulting date ranges are presented at 95 percent confidence (Sternberg and McGuire 1990:127) and represent the composite range(s) of all portions of the dating curve from which the subject AM determination is not different at 95 percent probability. The 8 samples (SRI 2392, SRI 2400, SRI 2410, SRI 2436, SRI 2449, SRI 2452, SRI 2461, and SRI 2462) that could not be dated against the reference curve produced AM pole locations that plotted in the low latitudes and longitudes of the northeast quadrant of the polar plot (e.g., paleolatitudes <85, paleolongitude <40). It is possible that this area predated the beginning of the reference curve SWCV595, and, therefore, that the sampled materials were magnetized at some point prior to A.D. 585. However, it is equally likely that some inaccuracy in the reference curve prevented these sample data from being dated. The AM poles for all of these samples were located along the outside edge of the A.D. 700–900 loop of the dating curve. Several researchers have shown that the amplitude of looped areas of the dating curve such as this tend to become dampened (Cox and Blinman 1999; Lengyel 1999; Lengyel and Eighmy 2002) by the particular method used to generate the curve from the available individual data points. The results obtained for the three most precise samples in the group (SRI 2449, SRI 2452, and SRI 2461) are consistent with the extensions of the secular variation curves posited by these other researchers (e.g., Lengyel and Eighmy 2002). Although they did not produce dates against SWCV595, we can surmise that these samples represent valid reference points and that they relate to archaeological events that occurred sometime around A.D. 700 or 900, A.D. 850, and A.D. 850, respectively. It is probable that the data from three of the less precise samples (SRI 2392, SRI 2410, and SRI 2462), as well as a composite sample (SRI 3992), were acquired at some point between A.D. 700 and 900 as well. This hypothesis is supported by additional sources of archaeological data (see Appendix 2C).

The remaining two samples (SRI 2400 and SRI 2436), however, may reflect activities that occurred prior to A.D. 585. These samples produced nearly identical data that were similar to those of the six preceding samples; however, unlike the other samples, no archaeological evidence was recovered that supported a post- A.D. 585 acquisition date. Given the imprecision of these data and the lack of additional archaeological evidence, no temporal information could be ascertained from these samples. An additional sample, SRI 2393, most likely belongs in this subset as well, even though it produced a date range against the reference curve. The AM pole for this sample is located directly below the end of the curve, and it is likely that the feature predates the beginning of the dating curve. Furthermore, the historical date range obtained for the sample seems unrealistic given other archaeological evidence from the feature. The three samples in this subset are designated with an asterisk (*) in the date range table (see Table 2.A.2). One additional sample (SRI 2446) is designated with an asterisk because it is possible that it was magnetized at or slightly before A.D. 585 and that the early end of its date range is artificially truncated by the limitations of the curve.

Table 2.A.2. Archaeomagnetic Date Ranges for Measured Samples

Locus	Sample No.	Feature No.	Date Range Options (years A.D.)
A	SRI 2361	200.01	935–1040, 1160–1365
A	SRI 2362	200.86	935–1040, 1160–1315
A	SRI 2363	200	935–1240
A	SRI 2364	290.01	1010–1290
A	SRI 2365	1189.01	935–1040, 1210–1565, 1635–1690
A	SRI 2366	207.01	935–1390
A	SRI 2367	2195.01	585–740, 860–915, 935–990, 1535–1565
A	SRI 2368	2160.05	910–1690
A	SRI 2369	2157	635–665, 935–1040, 1185–1690
C	SRI 2370	235.01	935–1090, 1160–1690
D	SRI 2371	7558	710–740, 835–915
D	SRI 2372	7559	785–840
D	SRI 2373	3569.01	635–665, 935–1015, 1385–1615, 1635–1690
D	SRI 2374	3756	685–740, 860–915
D	SRI 2375	3679.02	835–865
D	SRI 2376	3679.01	735–865
D	SRI 2377	3545.01	585–740, 860–1015, 1535–1615, 1760–1815
D	SRI 2378	3879.01	too imprecise
D	SRI 2379	4516.01	too imprecise
D	SRI 2380	11342	760–840
D	SRI 2382	3817.01	too imprecise
D	SRI 2383	4683.01	635–690, 910–1015, 1385–1690
D	SRI 2384	4684.01	585–1015, 1310–1690
D	SRI 2385	4729.01	935–1015, 1310–1690
D	SRI 2387	438	635–1015, 1385–1690
D	SRI 2389	3696	835–915
D	SRI 2390	3710.01	685–790, 835–915
D	SRI 2391	4333	685–790, 835–1015, 1535–1615
D	SRI 2392	4871	no date, near 850
D	SRI 2393	4902	1835–1890[a]
D	SRI 2394	4931	985–1040, 1060–1090, 1160–1315
C	SRI 2395	6138.01	935–1315
C	SRI 2396	6129.01	585–690, 1535–1590, 1760–1815
C	SRI 2397	6129.78	635–665, 935–1015, 1310–1690
C	SRI 2398	6153.02	935–1040, 1160–1365
C	SRI 2399	6153.01	1010–1140, 1160–1215, 1235–1315
D	SRI 2400	4069	no date[a]
D	SRI 2401	4221	585–790, 835–1015, 1385–1815
C	SRI 2402	7201.01	935–1015, 1310–1690
A	SRI 2403	2192.01	too imprecise
A	SRI 2404	2157.01	1010–1040, 1235–1290
A	SRI 2405	2160.01	935–1040, 1210–1365
D	SRI 2406	1571.01	too imprecise
D	SRI 2407	7880.01	735–865
D	SRI 2409	5994	too imprecise

Locus	Sample No.	Feature No.	Date Range Options (years A.D.)
D	SRI 2410	4682	no date, near 900
D	SRI 2411	4682.01	585–1015, 1385–1690
D	SRI 2412	8643.01	too imprecise
D	SRI 2413	8644.01	685–915
D	SRI 2414	5781.01	660–940
D	SRI 2415	5794.01	585–690, 910–1015, 1335–1890
D	SRI 2416	5795.01	too imprecise
D	SRI 2417	8607.01	too imprecise
D	SRI 2418	1575.01	585–690, 910–1015, 1310–1690
D	SRI 2419	1575	585–790, 835–1015, 1385–1815
D	SRI 2422	8841.01	835–865
C	SRI 2424	379.82	1010–1140, 1160–1265
C	SRI 2425	376.01	585–740, 835–1015, 1310–1815
C	SRI 2426	6095.01	935–1040, 1185–1590, 1635–1690
C	SRI 2427	6154.01	935–1015, 1310–1690
C	SRI 2428	6098.01	935–1015, 1235–1415, 1535–1590
C	SRI 2429	6098.02	1010–1190
C	SRI 2430	7461.01	935–1040, 1160–1315
C	SRI 2432	995.01	too imprecise
D	SRI 2434	4768	1010–1190, 1235–1265
D	SRI 2435	8842.01	735–840
D	SRI 2436	8798	no date[a]
D	SRI 2437	834	685–915, 935–990
C	SRI 2440	7153	985–1040, 1185–1315
C	SRI 2441	276.01	too imprecise
D	SRI 2442	565	735–840
D	SRI 2443	10560	735–840
D	SRI 2444	10782.01	935–1015, 1335–1390
D	SRI 2445	3569.01	too imprecise
D	SRI 2446	3641.01	585–690, 1760–1815[a]
D	SRI 2447	3663.01	935–1040, 1160–1415
D	SRI 2448	3677.01	too imprecise
D	SRI 2449	7942.01	no date, near 700 and 900
D	SRI 2450	4768.01	1010–1040, 1160–1315
D	SRI 2451	9867.01	760–840
D	SRI 2452	8655	no date, near 850
D	SRI 2453	4642.01	585–740, 835–915, 1535–1590, 1760–1890
D	SRI 2454	492.01	735–840
D	SRI 2455	438	785–840
D	SRI 2456	438.01	too imprecise
D	SRI 2457	3668	835–915
D	SRI 2458	3818	935–1015, 1210–1690
D	SRI 2461	4702	no date, near 850
D	SRI 2462	10507	no date, near 700 and 900
D	SRI 2463	3670.01	685–790, 835–990
D	SRI 2464	3869.01	too imprecise

continued on next page

Locus	Sample No.	Feature No.	Date Range Options (years A.D.)
D	SRI 2465	10781.01	585–690, 935–1015, 1535–1590, 1760–1815
D	SRI 2466	10729.01	935–1015, 1310–1690
D	SRI 2467	10561	685–765, 835–990, 1535–1590
C	SRI 3965–avg	6129	635–665, 935–1015, 1535–1590, 1760–1815
C	SRI 3966–avg	6153	1010–1040, 1185–1215, 1235–1315
D	SRI 3989–avg	438	735–865, 935–990
D	SRI 3990–avg	1575	585–740, 910–1015, 1385–1690
D	SRI 3991–avg	3679	835–865
D	SRI 3992–avg	4682	no date, near 900
D	SRI 3993–avg	4768	1010–1040, 1060–1090, 1160–1190, 1235–1265
A	SRI 4000–avg	200	935–1040, 1185–1315
A	SRI 4001–avg	2157	935–1040, 1185–1215, 1235–1315
A	SRI 4002–avg	2160	935–1040, 1185–1390

[a] Sampled feature probably predates the reference curve, SWCV595 (i.e., predates A.D. 585).

References Cited

Aitken, Martin J.

1974 *Physics and Archaeology*. Second edition. Clarendon Press, Oxford.

Butler, Robert F.

1992 *Paleomagnetism: Magnetic Domains to Geologic Terranes*. Blackwell Scientific Publications, Boston.

Cox, Jeffrey R., and Eric Blinman

1999 Results of Archaeomagnetic Sample Analysis. In *Pipeline Archaeology 1990–1993: The El Paso Natural Gas North System Expansion Project, New Mexico and Arizona*, Volume 12, edited by T. M. Kerns and J. L. McVickar, pp. 19.1–19.56. Western Cultural Resources Management, Farmington, New Mexico.

Deaver, William L.

1988 Identifying Contemporary Archaeological Events through a Comparison of Archaeomagnetic Directions. In *The 1982–1984 Excavations at Las Colinas: The Site and Its Features*, by David A. Gregory, William L. Deaver, Suzanne K. Fish, Ronald Gardiner, Robert W. Layhe, Fred L. Nials, Lynn S. Teague, pp. 73–120. Archaeological Series No. 162, vol. 2. Arizona State Museum, University of Arizona, Tucson.

1989 Southwestern Archaeomagnetic Secular Variation: The Hohokam Data. In *The 1982–1984 Excavations at Las Colinas: Synthesis and Conclusions*, by Lynn S. Teague and William L. Deaver, pp. 7–42. Archaeological Series No.162, vol. 6. Arizona State Museum, University of Arizona, Tucson.

1994 Analysis of Northern Periphery Archaeomagnetic Data. In *Prehistoric Rural Settlements in the Tonto Basin*, edited by Richard Ciolek-Torrello, Steven D. Shelley, and Su Benaron, pp. C.2–C.8. The Roosevelt Rural Sites Study, vol. 2. Technical Series 28. Statistical Research, Tucson, Arizona.

1997 Chronological Issues of the LVAP. In *Overview, Synthesis, and Conclusions*, edited by Stephanie M. Whittlesey, Richard Ciolek-Torrello, and Jeffrey H. Altschul, pp. 447–490. Vanishing River: Landscapes and Lives of the Lower Verde Valley: The Lower Verde Archaeological Project. SRI Press, Tucson, Arizona.

Deaver, William L., and Stephanie M. Whittlesey

2004a Archaeomagnetic Dating. In *Synthesis and Interpretations*, edited by Stephanie M. Whittlesey, pp. 101–134. Pots, Potters, and Models: Archaeological Investigations at the SRI Locus of the West Branch Site, Tucson, Arizona, vol. 2. Technical Series 80. SRI Press, Tucson, Arizona.

2004b Chronology and Settlement History. In *Synthesis and Interpretations*, edited by Stephanie M. Whittlesey, pp. 59–100. Pots, Potters, and Models: Archaeological Investigations at the SRI Locus of the West Branch Site, Tucson, Arizona, vol. 2. Technical Series 80. SRI Press, Tucson, Arizona.

Eighmy, Jeffrey L.

1990 Archaeomagnetic Dating: Practical Problems for the Archaeologist. In *Archaeomagnetic Dating*, edited by Jeffrey L. Eighmy and Robert S. Sternberg, pp. 33–64. University of Arizona Press, Tucson.

Eighmy, Jeffrey L., J. Holly Hathaway, and Sharilee Counce

1987 *Independently Dated Virtual Geomagnetic Poles: The Colorado State University Archaeometric Data Base.* Technical Series No. 1. Archeometric Laboratory, Department of Anthropology, Colorado State University, Fort Collins.

Eighmy, Jeffrey L., and Pamela Y. Klein

1988 *1988 Additions to the List of Independently Dated Virtual Geomagnetic Poles and the Southwest Master Curve.* Technical Series No. 4. Archeometric Lab, Department of Anthropology, Colorado State University, Fort Collins.

1990 *1988 Additions to the List of Independently Dated Virtual Geomagnetic Poles and the Southwest Master Curve.* Technical Series No. 6. Archeometric Laboratory, Department of Anthropology, Colorado State University, Fort Collins.

Eighmy, Jeffrey L., and Robert S. Sternberg
1990 *Archaeomagnetic Dating*. University of Arizona Press, Tucson.

Fisher, R. A.
1953 Dispersion on a Sphere. *Proceedings of the Royal Society of London* A217:295–305.

Irving, E.
1964 *Palaeomagnetism and Its Application to Geological and Geophysical Problems*. John Wiley, New York.

Kirschvink, J. L.
1980 The Least-Squares Line and Plane and the Analysis of Paleomagnetic Data. *Journal of the Royal Physics Society* 62:699–718.

Labelle, Jason M., and Jeffrey L. Eighmy
1995 1995 *Additions to the List of Independently Dated Virtual Geomagnetic Poles and the Southwest Master Curve*. Technical Series No. 7. Archaeometric Laboratory, Department of Anthropology, Colorado State University, Fort Collins.

1997 Additional Archaeomagnetic Data on the South-West USA Master Geomagnetic Pole Curve. *Archaeometry* 39(2):431–439.

Lanos, Philippe
2004 Bayesian Inference of Calibration Curves: Application to Archaeomagnetism. In *Tools for Constructing Chronologies: Crossing Disciplinary Boundaries*, edited by Caitlin E. Buck and Andrew R. Millard, pp. 43–82. Springer, London.

Lengyel, Stacey N.
1999 *The Application of Archaeomagnetic Dating to Sociobehavioral Problems.* Unpublished Master's thesis. Department of Anthropology, Colorado State University, Fort Collins.

Lengyel, Stacey N., and Jeffrey L. Eighmy
2002 A Revision to the U.S. Southwest Archaeomagentic Master Curve. *Journal of Archaeological Science* 29:1423–1433.

McElhinny, M. W.
1973 *Paleomagnetism and Plate Tectonics*. Cambridge University Press, London.

McFadden, Phillip L., and F. J. Lowes
1981 The Discrimination of Mean Directions Drawn from Fisher Distributions. *Geophysical Journal of the Royal Astronomical Society* 34:163–189.

NGDC
2005 Declination Calculator, Electronic document. http://www.ngdc.noaa.gov/seg/geomag/jsp/Declination.jsp, accessed December 27, 2005. National Geomagnetic Data Center, NOAA Satallite and Information Services.

Shuey, R. T., E. R. Cole, and M. J. Mikulich
1970 Geographic Correction of Archaeomagnetic Data. *Journal of Geomagnetism and Geoelectricity* 22:485–489.

Sternberg, Robert S.
1982 *Archaeomagnetic Secular Variation of Direction and Paleointensity in the American Southwest*. Ph.D. dissertation, University of Arizona, Tucson. University Microfilms, Ann Arbor.

1990 The Geophysical Basis of Archaeomagnetic Dating. In *Archaeomagnetic Dating*, edited by Jeffrey L. Eighmy and Robert S. Sternberg, pp. 5–28. University of Arizona Press, Tucson.

Sternberg, Robert S., and Randall H. McGuire
1990 Techniques for Constructing Secular Variation Curves and for Interpreting Archaeomagnetic Dates. In *Archaeomagnetic Dating*, edited by Jeffrey L. Eighmy and Robert S. Sternberg, pp. 109–136. University of Arizona Press, Tucson.

Tarling, Donald H.
1983 *Paleomagnetism: Principles and Applications in Geology, Geophysics, and Archaeology*. Chapman and Hall, London.

Wolfman, Daniel
1990 Retrospect and Prospect. In *Archaeomagnetic Dating*, edited by Jeffrey L. Eighmy and Robert S. Sternberg, pp. 313–366. University of Arizona Press, Tucson.

APPENDIX 2.B

Radiocarbon Analysis

Eleven radiocarbon samples were collected from 10 features in Locus D of the Mescal Wash site. Samples were submitted to Beta Analytic, Inc., for AMS dating. The results of these assessments are presented in Table 2B.1. Documentation for the analysis conducted by Beta Analytic is presented on the following pages.

Table 2.B.1. AMS ^{14}C Measurements at the Mescal Wash Site (AZ EE:2:51 [ASM])

Feature No.	Material (Charred)	Sample No.	Conventional ^{14}C Age (Years B.P.)	^{13}C/^{12}C Ratio (‰)	Calibrated Age (2σ)
411	columnar celled seed coats	Beta-206388	2830 ± 40	-23.3	1100–900 cal B.C.
3557	*Zea mays*	Beta-206386	2820 ± 40	-10.2	1060–880 cal B.C.
3668	*Zea mays* cupules	Beta-206381	1170 ± 40	-10.3	cal A.D. 770–980
3976	*Zea mays*; columnar coated seed coat; unknown seed	Beta-206382	2940 ± 40	-25.1	1280–1010 cal B.C.
3983	walnut shell fragments	Beta-206378	2870 ± 40	-23.8	1140–920 cal B.C.
3983	walnut shell fragments	Beta-206379	2810 ± 40	-24.3	1040–850 cal B.C.
4729	monocot tissue	Beta-206385	680 ± 40	-24.3	cal A.D. 1270–1320; 1340–1390
4849	*Zea mays* cupules	Beta-206383	2580 ± 40	-10.7	820–760; 620–590 cal B.C.
4871	prosopis twig fragment	Beta-206384	990 ± 40	-23.8	cal A.D. 990–1160
5505	*Zea mays*; yucca seed	Beta-206380	2840 ± 40	-15.3	1110–900 cal B.C.
7827	monocot tissue; *Zea mays*	Beta-206387	1290 ± 40	-20.5	cal A.D. 660–790

FROM: Darden Hood, Director (mailto:mailto:dhood@radiocarbon.com)

(This is a copy of the letter being mailed. Invoices/receipts follow only by mail.)

July 26, 2005

Mr. Jeffrey Altschul/Stacey Lengyel
Statistical Research, Incorporated
6099 East Speedway Boulevard
Tucson, AZ 85712
USA

RE: Radiocarbon Dating Results For Samples SRIMARS2589A, SRIMARS2589B, SRIMARS11339, SRIMARST3382, SRIMARST5778, SRIMARST5852, SRIMARST6233, SRIMARST6728, SRIMARST7694, SRIMARST7828, SRIMARSTA925

Dear Jeff and Stacey:

Enclosed are the radiocarbon dating results for 11 samples recently sent to us. They each provided plenty of carbon for accurate measurements and all the analyses went normally. As usual, the method of analysis is listed on the report with the results and calibration data is provided where applicable.

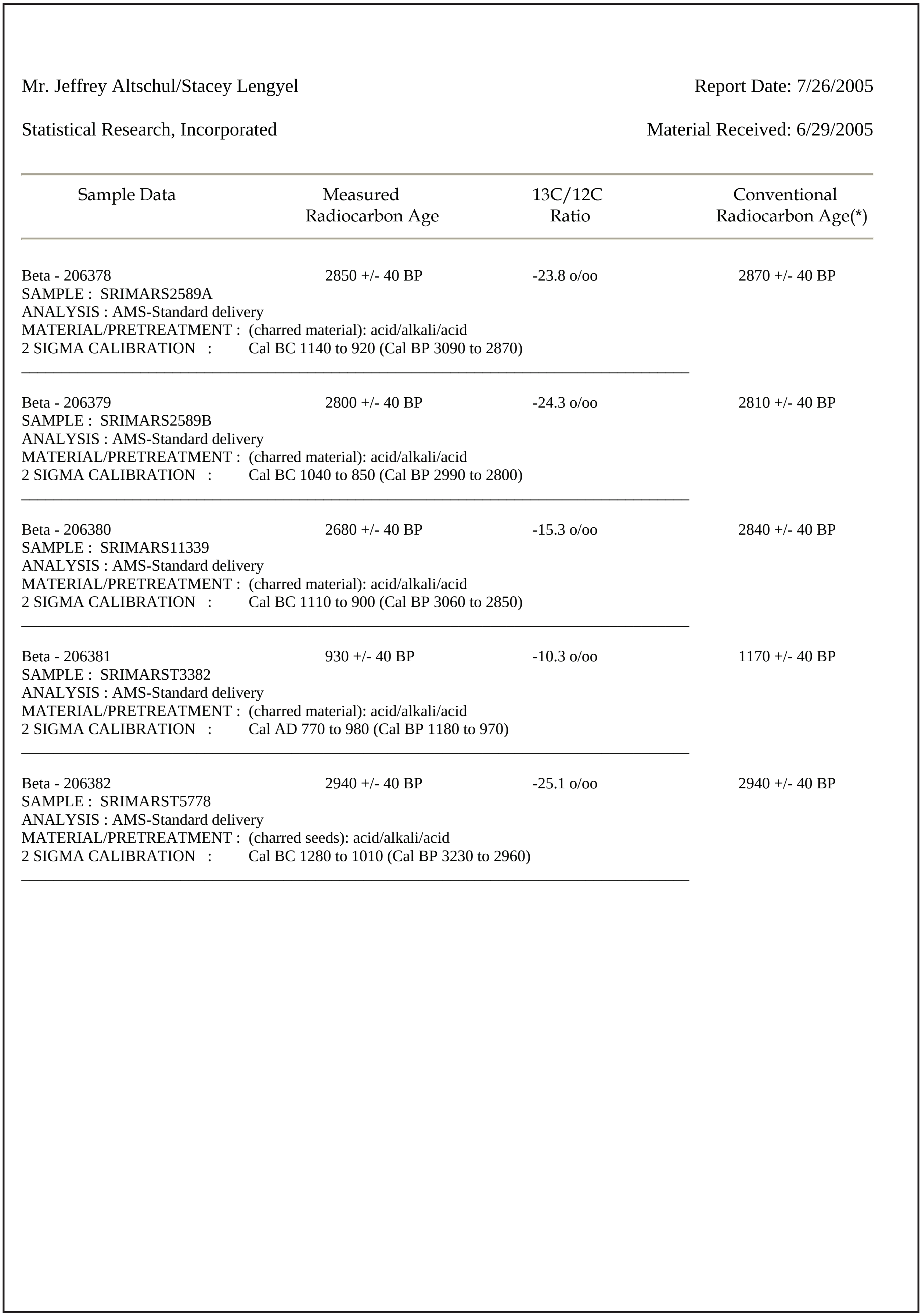
As always, no students or intern researchers who would necessarily be distracted with other obligations and priorities were used in the analyses. We analyzed them with the combined attention of our entire professional staff.

If you have specific questions about the analyses, please contact us. We are always available to answer your questions.

Our invoice is enclosed. Please, forward it to the appropriate officer or send VISA charge authorization. Thank you. As always, if you have any questions or would like to discuss the results, don't hesitate to contact me.

Sincerely,

Darden Hood



Mr. Jeffrey Altschul/Stacey Lengyel — Report Date: 7/26/2005

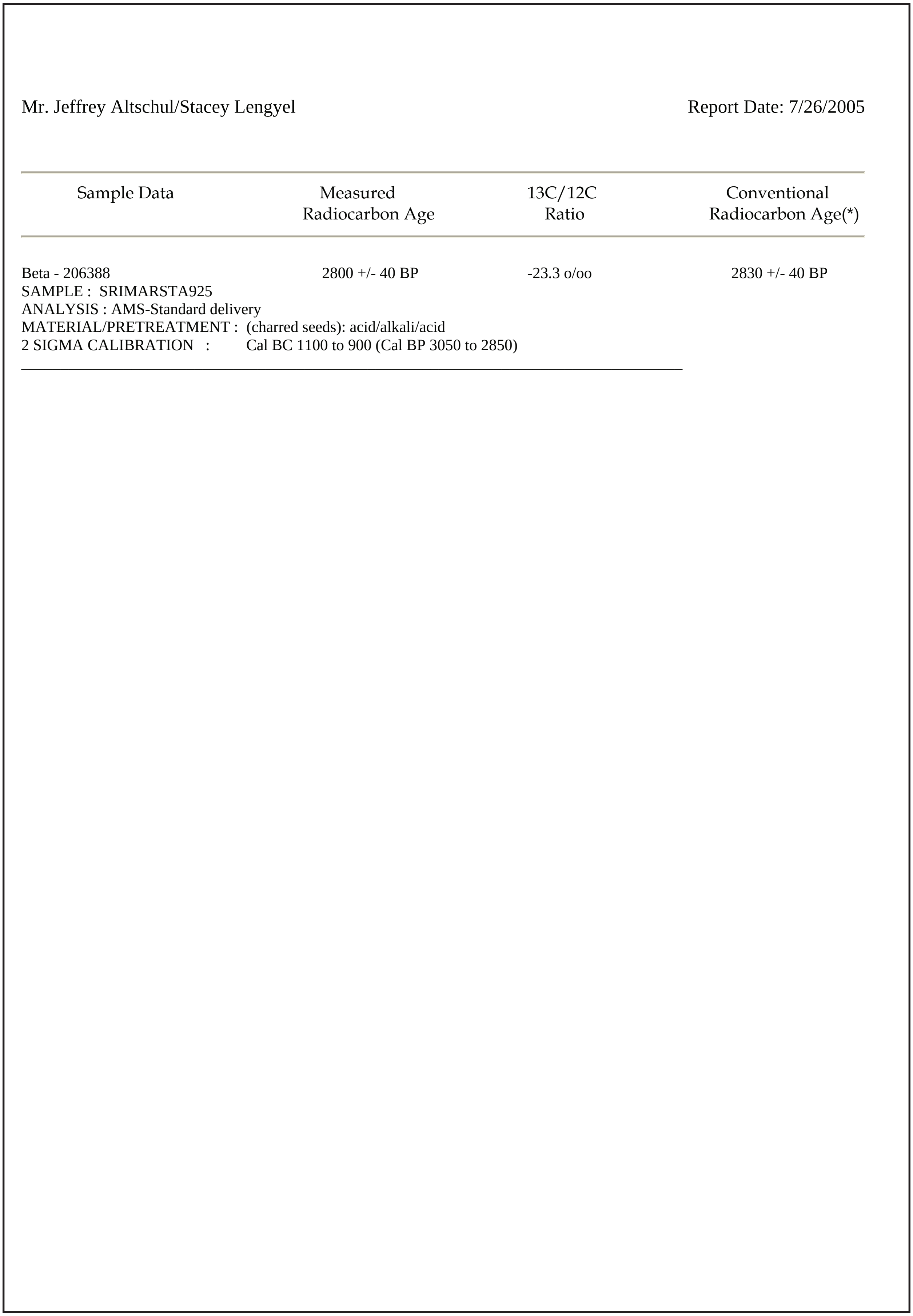
Statistical Research, Incorporated — Material Received: 6/29/2005

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 206378 SAMPLE : SRIMARS2589A ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 1140 to 920 (Cal BP 3090 to 2870)	2850 +/- 40 BP	-23.8 o/oo	2870 +/- 40 BP
Beta - 206379 SAMPLE : SRIMARS2589B ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 1040 to 850 (Cal BP 2990 to 2800)	2800 +/- 40 BP	-24.3 o/oo	2810 +/- 40 BP
Beta - 206380 SAMPLE : SRIMARS11339 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 1110 to 900 (Cal BP 3060 to 2850)	2680 +/- 40 BP	-15.3 o/oo	2840 +/- 40 BP
Beta - 206381 SAMPLE : SRIMARST3382 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 770 to 980 (Cal BP 1180 to 970)	930 +/- 40 BP	-10.3 o/oo	1170 +/- 40 BP
Beta - 206382 SAMPLE : SRIMARST5778 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred seeds): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 1280 to 1010 (Cal BP 3230 to 2960)	2940 +/- 40 BP	-25.1 o/oo	2940 +/- 40 BP

Mr. Jeffrey Altschul/Stacey Lengyel

Report Date: 7/26/2005

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 206383 SAMPLE : SRIMARST5852 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 820 to 760 (Cal BP 2760 to 2710) AND Cal BC 620 to 590 (Cal BP 2560 to 2540)	2350 +/- 40 BP	-10.7 o/oo	2580 +/- 40 BP
Beta - 206384 SAMPLE : SRIMARST6233 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 990 to 1160 (Cal BP 960 to 790)	970 +/- 40 BP	-23.8 o/oo	990 +/- 40 BP
Beta - 206385 SAMPLE : SRIMARST6728 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (plant material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 1270 to 1320 (Cal BP 680 to 630) AND Cal AD 1340 to 1390 (Cal BP 600 to 560)	670 +/- 40 BP	-24.3 o/oo	680 +/- 40 BP
Beta - 206386 SAMPLE : SRIMARST7694 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (charred material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal BC 1060 to 880 (Cal BP 3000 to 2840)	2580 +/- 40 BP	-10.2 o/oo	2820 +/- 40 BP
Beta - 206387 SAMPLE : SRIMARST7828 ANALYSIS : AMS-Standard delivery MATERIAL/PRETREATMENT : (plant material): acid/alkali/acid 2 SIGMA CALIBRATION : Cal AD 660 to 790 (Cal BP 1290 to 1160)	1220 +/- 40 BP	-20.5 o/oo	1290 +/- 40 BP



Mr. Jeffrey Altschul/Stacey Lengyel

Report Date: 7/26/2005

Sample Data	Measured Radiocarbon Age	13C/12C Ratio	Conventional Radiocarbon Age(*)
Beta - 206388	2800 +/- 40 BP	-23.3 o/oo	2830 +/- 40 BP

SAMPLE : SRIMARSTA925
ANALYSIS : AMS-Standard delivery
MATERIAL/PRETREATMENT : (charred seeds): acid/alkali/acid
2 SIGMA CALIBRATION : Cal BC 1100 to 900 (Cal BP 3050 to 2850)

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.8:lab. mult=1)

Laboratory number: **Beta-206378**

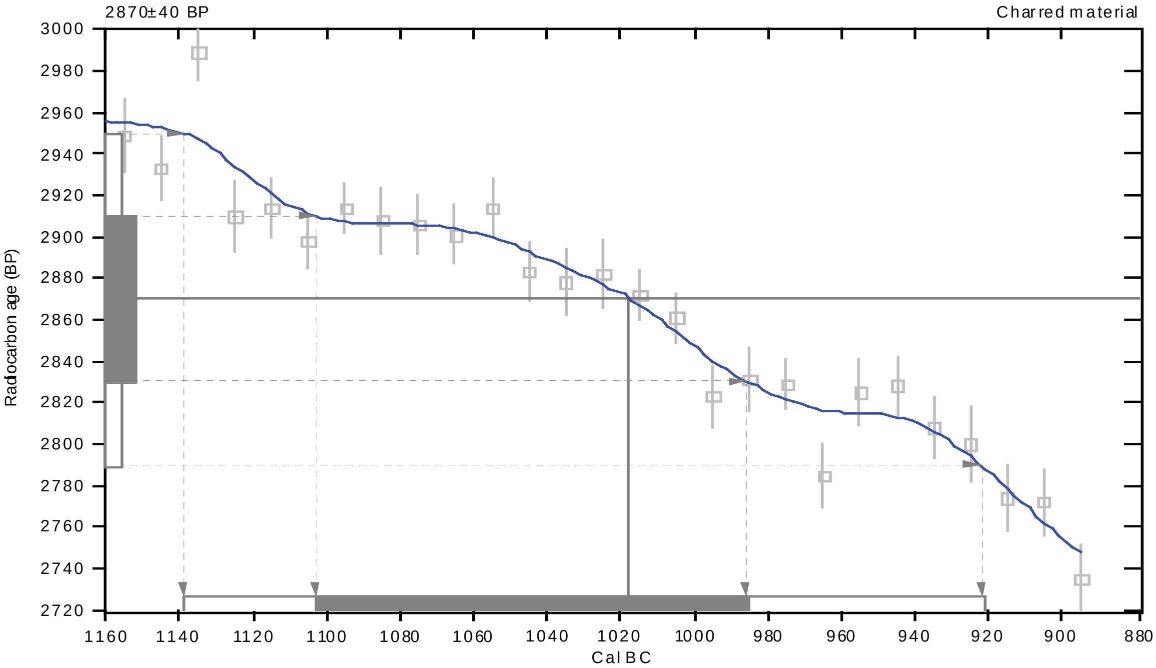
Conventional radiocarbon age: **2870±40 BP**

2 Sigma calibrated result: **Cal BC 1140 to 920 (Cal BP 3090 to 2870)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 1020 (Cal BP 2970)

1 Sigma calibrated result: Cal BC 1100 to 990 (Cal BP 3050 to 2940)
(68% probability)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.3:lab. mult=1)

Laboratory number: **Beta-206379**

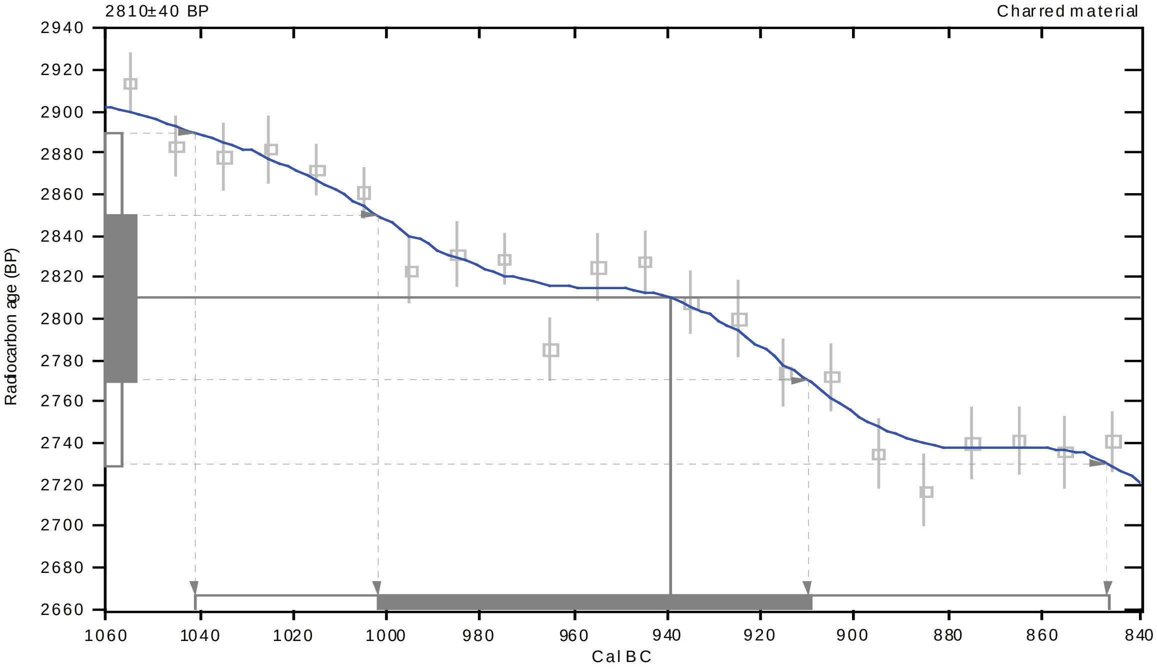
Conventional radiocarbon age: **2810±40 BP**

2 Sigma calibrated result: **Cal BC 1040 to 850 (Cal BP 2990 to 2800)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 940 (Cal BP 2890)

1 Sigma calibrated result: Cal BC 1000 to 910 (Cal BP 2950 to 2860)
(68% probability)



References:
Database used
INTCAL 98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-15.3:lab. mult=1)

Laboratory number: **Beta-206380**

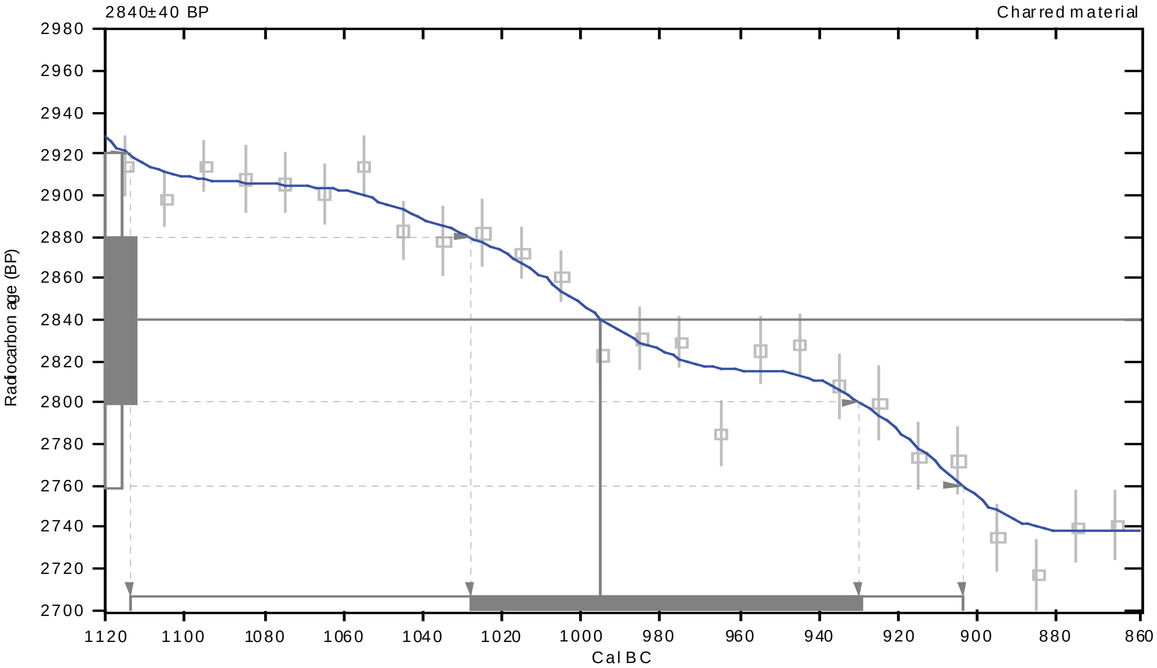
Conventional radiocarbon age: **2840±40 BP**

2 Sigma calibrated result: **Cal BC 1110 to 900 (Cal BP 3060 to 2850)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 1000 (Cal BP 2940)

1 Sigma calibrated result: Cal BC 1030 to 930 (Cal BP 2980 to 2880)
(68% probability)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

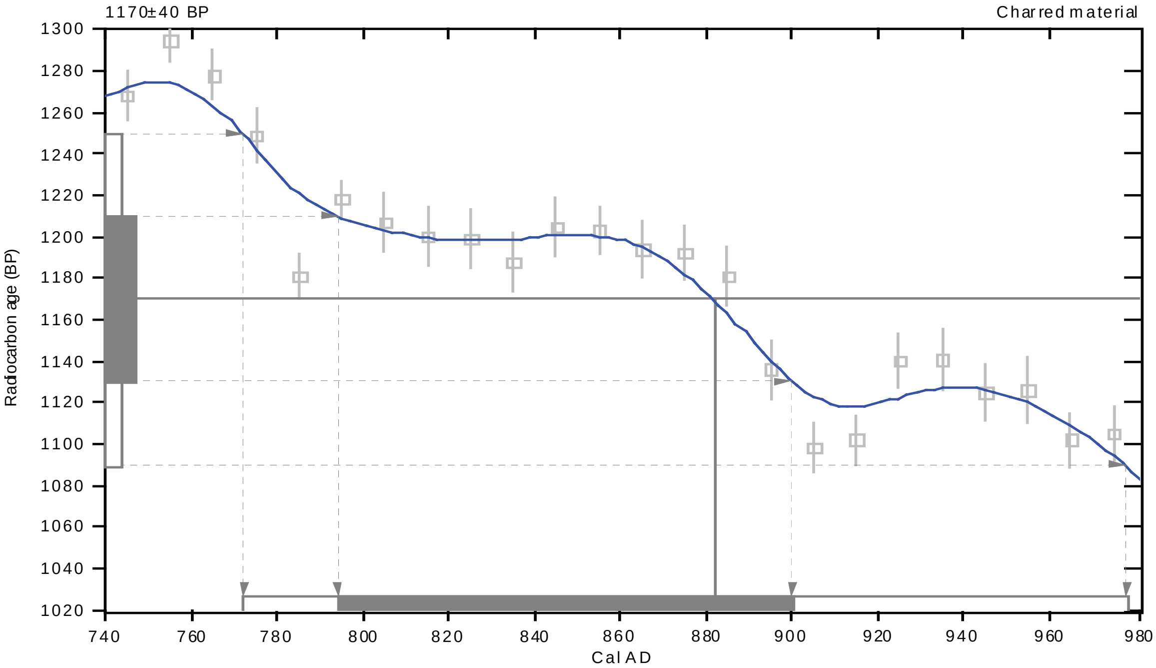
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-10.3:lab. mult=1)

Laboratory number:	**Beta-206381**
Conventional radiocarbon age:	**1170±40 BP**
2 Sigma calibrated result: **(95% probability)**	**Cal AD 770 to 980 (Cal BP 1180 to 970)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal AD 880 (Cal BP 1070)
1 Sigma calibrated result: (68% probability)	Cal AD 790 to 900 (Cal BP 1160 to 1050)



References:
Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-25.1:lab. mult=1)

Laboratory number: **Beta-206382**

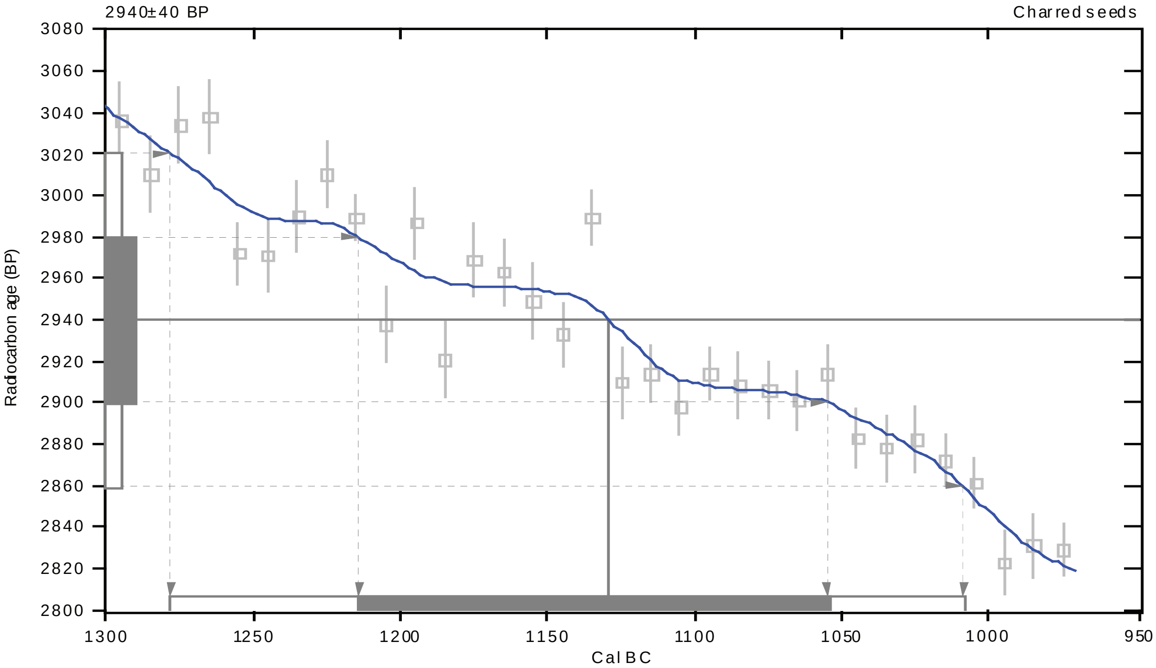
Conventional radiocarbon age: **2940±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 1280 to 1010 (Cal BP 3230 to 2960)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 1130 (Cal BP 3080)

1 Sigma calibrated result: (68% probability) Cal BC 1210 to 1060 (Cal BP 3160 to 3000)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-10.7:lab. mult=1)

Laboratory number: **Beta-206383**

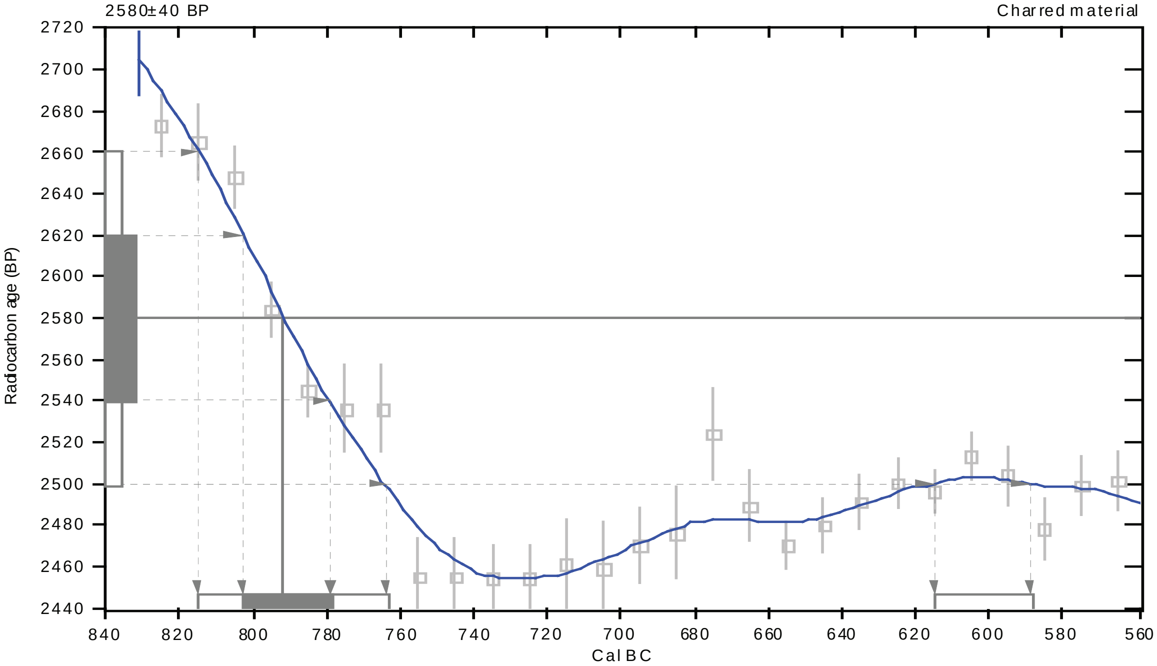
Conventional radiocarbon age: **2580±40 BP**

2 Sigma calibrated results: **Cal BC 820 to 760 (Cal BP 2760 to 2710) and**
(95% probability) **Cal BC 620 to 590 (Cal BP 2560 to 2540)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 790 (Cal BP 2740)

1 Sigma calibrated result: Cal BC 800 to 780 (Cal BP 2750 to 2730)
(68% probability)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

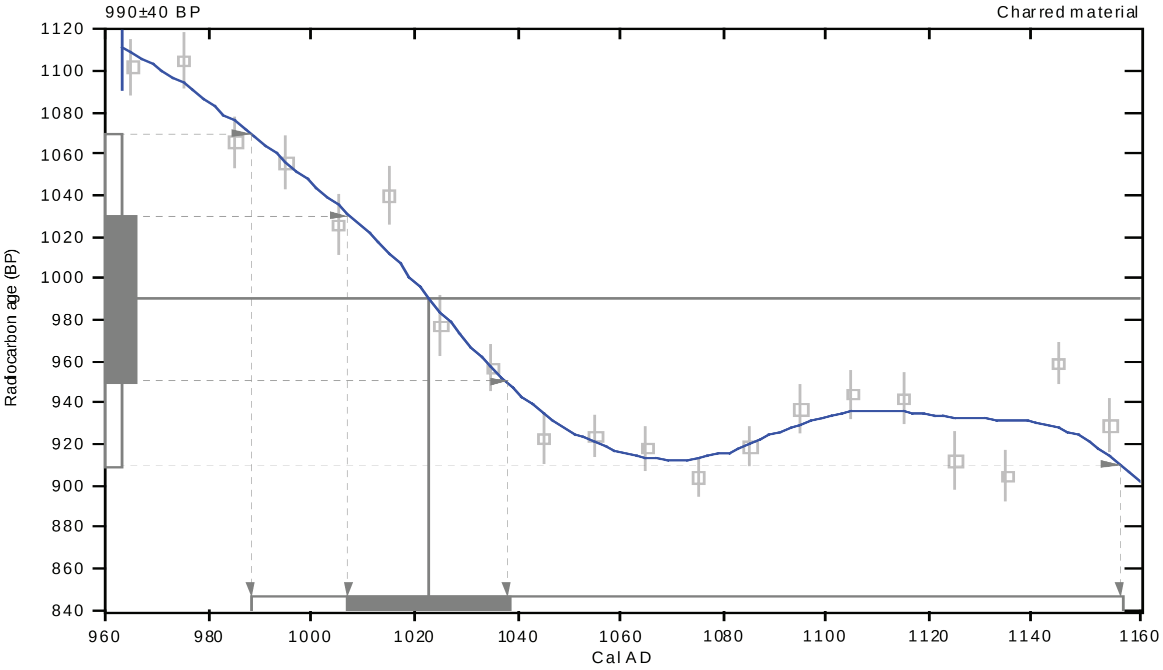
CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.8:lab. mult=1)

Laboratory number:	**Beta-206384**
Conventional radiocarbon age:	**990±40 BP**
2 Sigma calibrated result: **(95% probability)**	**Cal AD 990 to 1160 (Cal BP 960 to 790)**

Intercept data

Intercept of radiocarbon age with calibration curve:	Cal AD 1020 (Cal BP 930)
1 Sigma calibrated result: (68% probability)	Cal AD 1010 to 1040 (Cal BP 940 to 910)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-24.3:lab. mult=1)

Laboratory number: **Beta-206385**

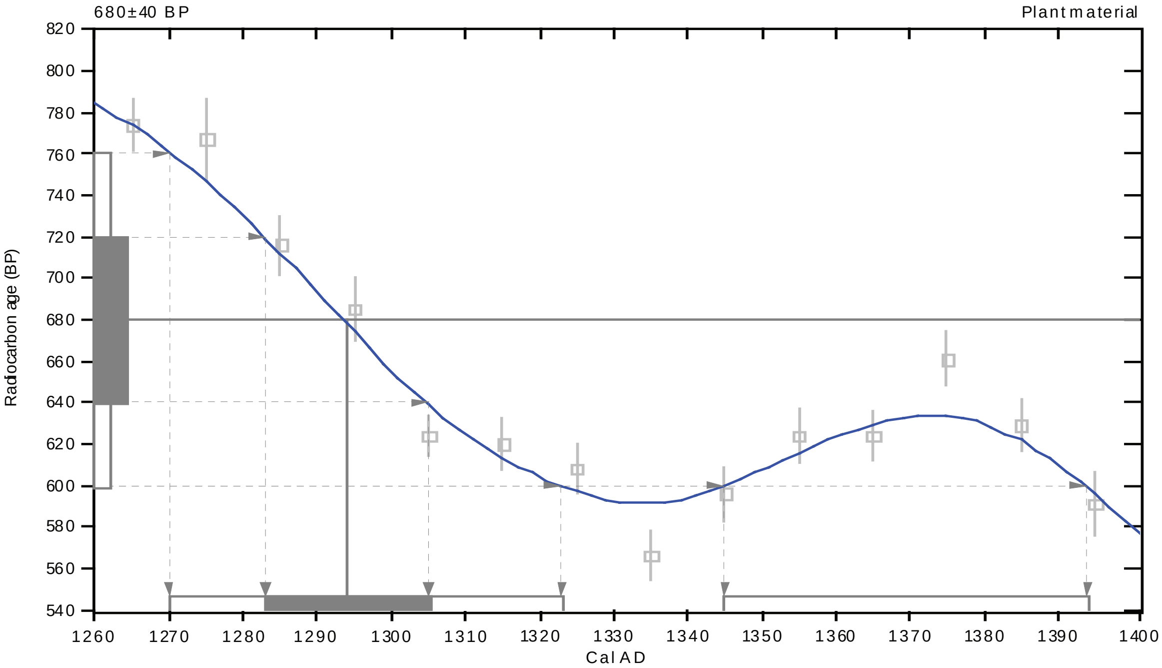
Conventional radiocarbon age: **680±40 BP**

2 Sigma calibrated results: **Cal AD 1270 to 1320 (Cal BP 680 to 630) and**
(95% probability) **Cal AD 1340 to 1390 (Cal BP 600 to 560)**

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 1290 (Cal BP 660)

1 Sigma calibrated result: Cal AD 1280 to 1300 (Cal BP 670 to 640)
(68% probability)



References:
Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-10.2:lab. mult=1)

Laboratory number: **Beta-206386**

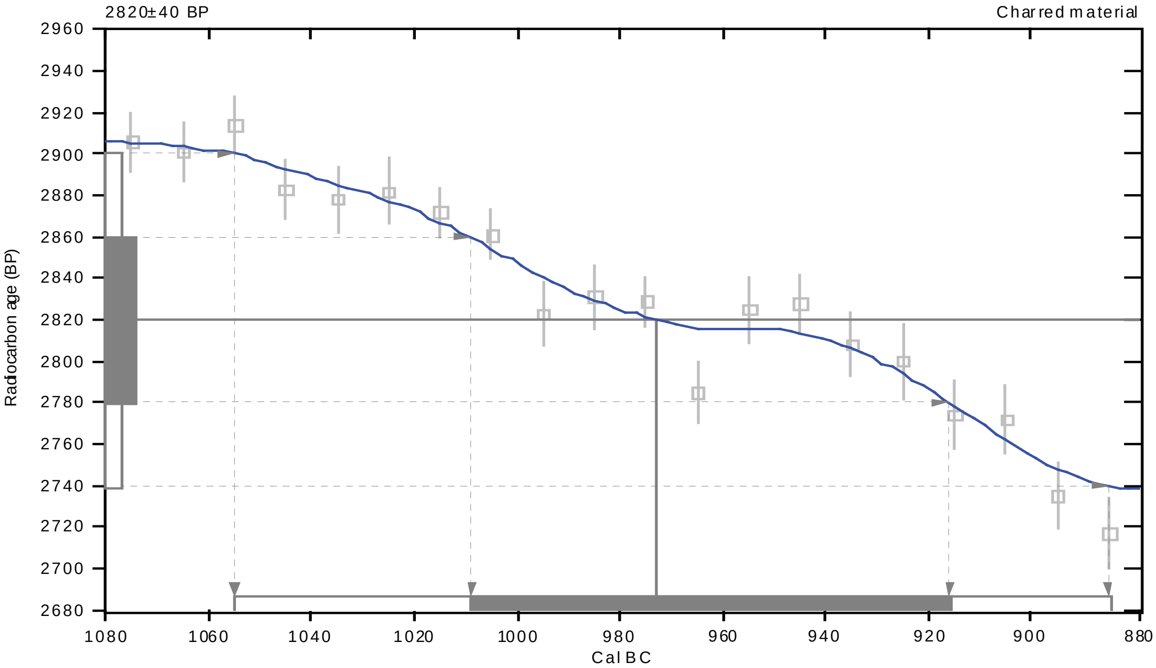
Conventional radiocarbon age: **2820±40 BP**

2 Sigma calibrated result: (95% probability) **Cal BC 1060 to 880 (Cal BP 3000 to 2840)**

Intercept data

Intercept of radiocarbon age with calibration curve: Cal BC 970 (Cal BP 2920)

1 Sigma calibrated result: (68% probability) Cal BC 1010 to 920 (Cal BP 2960 to 2870)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-20.5:lab. mult=1)

Laboratory number: **Beta-206387**

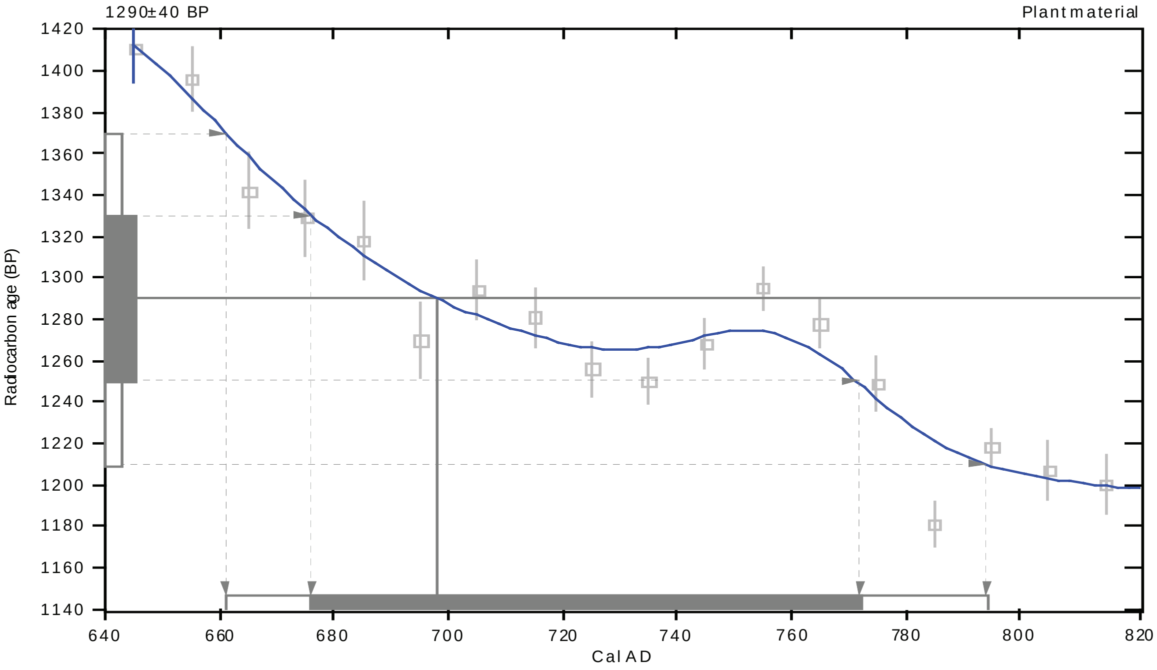
Conventional radiocarbon age: **1290±40 BP**

2 Sigma calibrated result: **Cal AD 660 to 790 (Cal BP 1290 to 1160)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal AD 700 (Cal BP 1250)

1 Sigma calibrated result: Cal AD 680 to 770 (Cal BP 1270 to 1180)
(68% probability)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

CALIBRATION OF RADIOCARBON AGE TO CALENDAR YEARS

(Variables: C13/C12=-23.3:lab. mult=1)

Laboratory number: **Beta-206388**

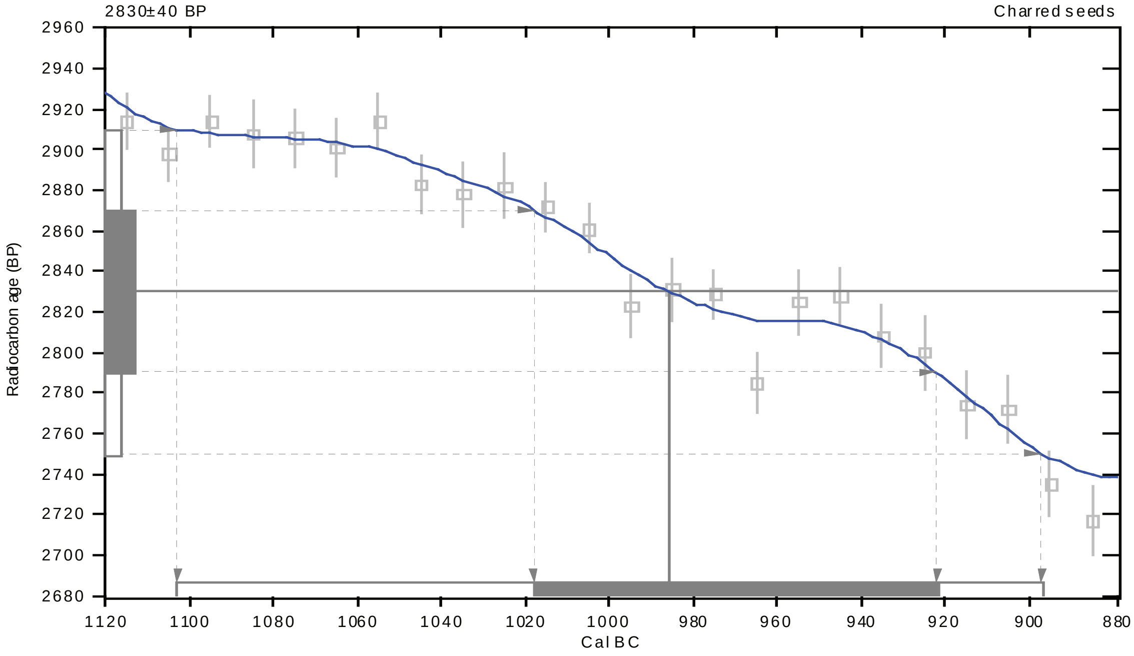
Conventional radiocarbon age: **2830±40 BP**

2 Sigma calibrated result: **Cal BC 1100 to 900 (Cal BP 3050 to 2850)**
(95% probability)

Intercept data

Intercept of radiocarbon age
with calibration curve: Cal BC 990 (Cal BP 2940)

1 Sigma calibrated result: Cal BC 1020 to 920 (Cal BP 2970 to 2870)
(68% probability)



References:

Database used
INTCAL98
Calibration Database
Editorial Comment
Stuiver, M., van der Plicht, H., 1998, Radiocarbon 40(3), pxii-xiii
INTCAL98 Radiocarbon Age Calibration
Stuiver, M., et. al., 1998, Radiocarbon 40(3), p1041-1083
Mathematics
A Simplified Approach to Calibrating C14 Dates
Talma, A. S., Vogel, J. C., 1993, Radiocarbon 35(2), p317-322

Beta Analytic Radiocarbon Dating Laboratory

4985 S.W. 74th Court, Miami, Florida 33155 • Tel: (305)667-5167 • Fax: (305)663-0964 • E-Mail: beta@radiocarbon.com

APPENDIX 2.C

Chronological Data for all Mescal Wash Features

Table 2.C.1. Combined Chronological Data for Features at Mescal Wash, by Locus

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
						Locus A				
200	structure	structure	all	A.D. 935–1040	AM, Ce	A.D. 935–1040, 1185–1315[a]	MFB	none	none	none
207	structure	structure	all	A.D. 935–1150	AM, Ce	A.D. 935–1390	MFB	none	none	none
220	burial	cremation, `secondary pit	all	none		none	none	none	none	none
288	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
289	nonfeature	nonfeature	probed	none		none	none	none	none	none
290	structure	structure	all	A.D. 1010–1150	AM, Ce	A.D. 1010–1290	MFB	none	none	none
1143	pit	indeterminate pit	partial	none		none	none	none	none	none
1144	pit	indeterminate pit	partial	none		none	none	none	none	none
1146	pit	roasting pit	partial	none		none	none	none	none	none
1149	pit	horno	partial	none		none	none	none	none	none
1150	pit	indeterminate pit	partial	none		none	none	none	none	none
1179	pit	indeterminate pit	partial	A.D. 700–950	Ce	none	MFA	none	none	none
1180	pit	indeterminate pit	all	A.D. 950–1150	Ce	none	MFB	none	none	none
1182	pit	indeterminate pit	partial	none		none	none	none	none	none
1184	pit	indeterminate pit	partial	none		none	none	none	none	none
1185	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
1186	pit	indeterminate pit	partial	none		none	none	none	none	none
1187	pit	indeterminate pit	partial	none		none	none	none	none	none
1188	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
1189	structure	structure	partial	A.D. 935–1040	AM, Ce	A.D. 935–1040, 1210–1565, 1635–1690	MFB	none	none	none
1195	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
1196	pit	indeterminate pit	partial	none		none	none	none	none	none
2143	midden	midden	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
2153	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
2157	structure	structure	all	A.D. 935–1040	AM, Ce	A.D. 935–1040, 1185–1215, 1235–1315[a]	MFB	none	MF	ET F 2173

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
2160	structure	structure	all	A.D. 935–1040	AM, Ce	A.D. 935–1040, 1185–1390[a]	MFB	none	none	none
2161	pit	roasting pit	all	none		none	none	none	none	none
2162	pit	roasting pit	all	none		none	none	none	none	none
2163	pit	indeterminate pit	partial	none		none	none	none	none	none
2165	pit	indeterminate pit	partial	none		none	none	none	none	none
2166	pit	indeterminate pit	partial	none		none	none	none	none	none
2168	pit	indeterminate pit	all	A.D. 950–1150	Ce	none	MFB	none	none	none
2169	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
2171	pit	indeterminate pit	partial	none		none	none	none	none	none
2172	pit	indeterminate pit	partial	none		none	none	none	none	none
2174	pit	indeterminate pit	partial	none		none	none	none	none	none
2177	pit	indeterminate pit	partial	none		none	none	none	none	none
2180	pit	indeterminate pit	partial	none		none	none	none	none	none
2183	pit	indeterminate pit	partial	none		none	none	none	none	none
2184	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
2185	pit	indeterminate pit	partial	none		none	none	none	none	none
2186	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
2187	nonfeature	nonfeature	partial	none		none	none	none	none	none
2188	pit	indeterminate pit	partial	none		none	none	none	none	none
2190	pit	indeterminate pit	partial	none		none	none	none	none	none
2192	structure	structure	all	A.D. 700–1150	Ce, PP	none	MFB	none	MF	ET F 6463
2195	structure	structure	all	A.D. 860–915, 935–990	AM	A.D. 585–740, 860–915, 935–990, 1535–1565	none	none	none	none
2197	pit	roasting pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
6463	pit	roasting pit	partial	A.D. 950–1150	Ce, SA	none	MFB	none	none	LT F 2192
8411	pit	indeterminate pit	all	none		none	none	none	none	none
Locus B										
364	structure	structure	partial	none		none	none	none	none	

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
						Locus C				
235	structure	structure	all	A.D. 1160–1690	AM, SA	A.D. 935–1090, 1160–1690	MFB	none	none	LT F 379, 6084
276	structure	structure	all	A.D. 650–1150	Ce	none	MFA	none	none	ET F 6015, 6019, 10,343, 10,367, 10,404
278	pit	roasting pit	partial	none		none	none	none	none	
320	burial	cremation, secondary pit	all	none		none	none	none	none	none
333	burial	cremation, secondary urn	all	none		none	none	none	none	none
376	structure	structure	partial	A.D. 835–1015	AM, AS, Ce	A.D. 585–740, 835–1015, 1310–1815	MFB	none	none	ET F 377
379	structure	structure	all	A.D.1010–1140	AM, Ce	A.D. 1010–1140, 1160–1265	MFB	none	none	LT F 6084; ET F 235
896	pit	unexcavated pit	partial	none		none	none	none	none	none
917	pit	roasting pit	partial	none		none	MFB	none	none	none
922	pit	roasting pit	partial	none		none	none	none	none	none
995	structure	structure	all	A.D. 935–1100	Ce, SA	none	MFB	none	none	ET F 6129, 6119, 9409, 9410
999	artifact concentration	artifact concentration	partial	none		none	MFB	none	none	none
1141	pit	fire pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
6006	animal burial		all	none		none	none	none	none	none
6007	burial	inhumation, extended	all	none		none	none	none	none	none
6010	structure	structure	partial	A.D. 700–950	Ce	none	MFA	none	none	LT F 6009
6020	pit	indeterminate pit	partial	none		none	none	none	none	none
6021	pit	indeterminate pit	partial	none		none	none	none	none	none
6026	pit	indeterminate pit	partial	none		none	none	none	none	ET 6027
6027	pit	indeterminate pit	partial	none		none	none	none	none	LT 6026, 6028
6028	pit	indeterminate pit	partial	none		none	none	none	none	ET 6027
6040	pit	roasting pit	partial	none		none	none	none	none	none

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
6045	burial	cremation, secondary pit	all	none		none	none	none	none	none
6074	burial	cremation, secondary pit	all	none		none	none	none	none	none
6081	pit	indeterminate pit	partial	none		none	none	none	none	none
6085	pit	roasting pit	partial	none		none	none	none	none	none
6086	pit	indeterminate pit	partial	none		none	none	none	none	none
6087	pit	indeterminate pit	partial	none		none	none	none	none	none
6088	pit	indeterminate pit	partial	none		none	none	none	none	none
6090	burial	cremation, secondary urn	all	none		none	none	none	none	none
6095	structure	structure	partial	A.D. 935–1040	AM, AS, Ce	A.D. 935–1040, 1185–1590, 1635–1690	MFB/LFA	none	none	none
6098	structure	structure	all	A.D. 935–1015	AM, Ce, SA	A.D. 935–1015, 1235–1415, 1535–1590 and A.D. 1010–1190	MFB	none	none	ET F 7330, 7457, 7458, 7461, 9327, 9328, 10,141
6099	pit	roasting pit	partial	none		none	none	none	none	none
6101	pit	indeterminate pit	all	none		none	none	none	none	LT 6100
6107	pit	indeterminate pit	all	none		none	none	none	none	none
6108	pit	indeterminate pit	all	none		none	none	none	none	none
6109	pit	indeterminate pit	partial	none		none	none	none	none	none
6114	pit	roasting pit	all	A.D. 950–1150	Ce, SA	none	MFB	none	none	LT F 995, 6129
6119	pit	unexcavated roasting pit	partial	A.D. 950–1450	SA	none	none	none	none	LT F 995
6123	burial	inhumation, extended	all	none		none	none	none	none	none
6129	structure	structure	all	A.D. 935–1015	AM, Ce	A.D. 635–665, 935–1015, 1535–1590, 1760–1815	MFA/MFB	none	none	LT F 995, 10,380; ET F 6112, 6114, 6115, 10138
6134	pit	indeterminate pit	partial	none		none	none	none	none	none
6135	pit	roasting pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	LT 6136
6136	pit	roasting pit	partial	<A.D. 1150	SA	none	none	none	none	ET 6135

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
6138	structure	structure	partial	A.D. 935–1315	AM	A.D. 935–1315	none	none	none	none
6139	structure	structure	partial	A.D. 700–1040	AS, SA	none	MFA	none	none	ET F 6153
6140	pit	indeterminate pit	partial	none		none	none	none	none	none
6141	pit	indeterminate pit	partial	none		none	none	none	none	none
6142	pit	indeterminate pit	partial	none		none	none	none	none	none
6143	pit	indeterminate pit	partial	none		none	none	none	none	none
6144	pit	indeterminate pit	partial	none		none	none	none	none	none
6145	pit	fire pit	partial	none		none	none	none	none	none
6146	pit	fire pit	partial	A.D. 950–1150	Ce, PP	none	MFB	none	Rincon	none
6147	pit	indeterminate pit	partial	none		none	none	none	none	none
6148	pit	indeterminate pit	partial	A.D. 950–1150	PP	none	none	none	Rincon	ET 6149
6149	pit	indeterminate pit	partial	A.D. 950–1450	SA	none	none	none	none	LT 6148
6150	pit	indeterminate pit	partial	none		none	none	none	none	none
6151	pit	indeterminate pit	partial	none		none	none	none	none	none
6152	pit	indeterminate pit	partial	none		none	none	none	none	none
6153	structure	structure	partial	A.D. 1010–1040	AM	A.D. 1010–1040, 1185–1215, 1235–1315	none	none	none	LT F 6139
6154	structure	structure	all	A.D. 935–1015	AM	A.D. 935–1015, 1310–1690	MFB	none	none	LT F 6156
6162	pit	indeterminate pit	all	A.D. 950–1150	Ce	none	MFB	none	none	none
6171	pit	indeterminate pit	partial	>A.D. 700	Ce	none	plain and painted	none	Empire	none
6182	pit	indeterminate pit	partial	none		none	none	none	none	LT F 6177, 6178
6187	pit	roasting pit	partial	none		none	none	none	none	none
6191	burial	inhumation, extended	all	>A.D. 700	Ce	none	MFA	none	none	none
7145	pit	indeterminate pit	partial	none		none	none	none	none	none
7153	pit	horno	partial	A.D. 985–1040	AM, Ce	A.D. 985–1040, 1185–1315	MFB	none	none	LT F 7165
7157	burial	cremation, primary	all	none		none	none	none	none	none
7163	pit	roasting pit	partial	none		none	none	none	none	none
7168	pit	indeterminate pit	partial	none		none	none	none	none	none

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
7170	burial	inhumation, disarticulated	all	A.D. 950–1150	Ce	none	MFB	none	none	none
7171	pit	indeterminate pit	all	none		none	none	none	none	none
7174	pit	indeterminate pit	partial	none		none	none	none	none	none
7180	pit	indeterminate pit	partial	none		none	none	none	none	none
7182	pit	indeterminate pit	partial	none		none	none	none	none	LT F 7192
7187	pit	indeterminate pit	partial	none		none	none	none	none	LT F 7185
7193	pit	indeterminate pit	partial	none		none	none	none	none	LT F 7198
7194	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	LT F 7198
7195	pit	hearth	all	none		none	none	none	none	LT F 7198
7196	pit	indeterminate pit	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
7201	structure	structure	partial	A.D. 935–1015	AM	A.D. 935–1015, 1310–1690	none	none	none	ET F 7191, 7192, 7202
7205	pit	indeterminate pit	partial	none		none	none	none	none	none
7330	animal burial	dog burial	all	>A.D. 935	SA	none	none	none	none	LT 6098
7335	burial	cremation, secondary pit	all	none		none	none	none	none	LT 6091, 7146
7456	burial	cremation, secondary pit	all	none		none	none	none	none	none
7457	burial	inhumation, flexed	all	A.D. 950–1150	Ce, SA	none	MFB	none	none	LT 6098
7458	burial	inhumation, disarticulated	all	A.D. 950–1150	Ce, SA	none	MFB	none	none	LT 6098
7461	structure	structure	all	A.D. 935–1040	AM, Ce	A.D. 935–1040, 1160–1315	MFB	none	none	LT F 6098; ET F 9487, 10,050, 10,133, 10,698
7472	burial	cremation, secondary urn	all	none		none	none	none	none	none
9327	pit	indeterminate pit	all	A.D. 950–1150	Ce, SA	none	MFB	none	none	LT 6098
9328	pit	indeterminate pit	all	A.D. 950–1150	Ce, SA	none	MFB	none	none	LT 6098
9409	pit	roasting pit	all	>A.D. 935	SA	none	none	none	none	LT F 995
9410	burial	inhumation, flexed	all	>A.D. 935	SA	none	none	none	none	LT F 995
9487	pit	roasting pit	all	>A.D. 935	SA	none	none	none	none	LT F 6098, 7461
10133	pit	indeterminate pit	all	>A.D. 935	SA	none	none	none	none	LT F 6098, 7461

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
10138	burial	cremation, secondary pit	all	>A.D. 935	SA	none	none	none	none	LT F 995, 6129
10343	pit	indeterminate pit	all	>A.D. 650	SA	none	none	none	none	LT F 276
10367	pit	indeterminate pit	all	>A.D. 650	SA	none	none	none	none	LT F 276
10380	pit	fire pit	partial	>A.D. 935	SA	none	none	none	none	ET 6129
10698	burial	inhumation, disarticulated	all	>A.D. 935	SA	none	none	none	none	LT F 6098, 7461
10707	burial	cremation, secondary pit	all	none		none	none	none	none	none
						Locus D				
336	burial	inhumation, extended	all	>200 B.C.	Ce	none	plain	none	none	none
411	pit	indeterminate pit	partial	1100–900 cal B.C.	C14	none	none	1100–900 cal B.C.	none	none
415	pit	roasting pit	all	none		none	none	none	none	none
432	pit	roasting pit	all	none		none	none	none	none	none
437	multiple features		partial	mixed		none	MFA	none	San Pedro	Encompasses: 5781, 5794, 5795, 5793, 3680, 3681, 8706, 3582, 3617, 3879, 4516
438	structure	structure	all	A.D. 735–865	AM, Ce, PP	A.D. 735–865, 935–990[a]	MFA	none	Rincon	LT F 5986, 7978, 9576
446	pit	roasting pit	all	none		none	none	none	none	none
448	structure	structure	partial	none		none	none	none	none	none
457	pit	roasting pit	all	>A.D. 500	Ce	none	plain and painted	none	none	none
464	burial	cremation, secondary pit	all	>200 B.C.	Ce	none	plain	none	none	none
491	pit	roasting pit	all	>A.D. 500	Ce	none	plain and painted	none	none	none
492	structure	structure	partial	A.D. 735–840	AM	A.D. 735–840	MFA	none	none	none
494	pit	roasting pit	all	none		none	none	none	none	none
561	burial	cremation, secondary pit	all	>200 B.C.	Ce	none	plain	none	none	none

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
562	burial	cremation, secondary pit	all	none		none	none	none	none	none
565	structure	structure	partial	A.D. 735–840	AM	A.D. 735–840	none	none	none	ET F 3973, 5819, 10,639, 10,640, 3975
572	pit	roasting pit	all	none		none	none	none	none	none
575	structure	structure	partial	A.D. 700–1150	AS	none	MFA	none	none	ET F 576
578	pit	indeterminate pit	all	>A.D. 500	Ce	none	plain, red, painted	none	LA	none
714	pit	roasting pit	partial	>A.D. 500	Ce	none	painted	none	none	ET 4551
723	pit	indeterminate pit	partial	>A.D. 500	Ce	none	plain and painted	none	none	none
724	pit	indeterminate pit	partial	>A.D. 500	Ce	none	FM	none	none	none
726	structure	structure	partial	>200 B.C.	Ce	none	plain	none	none	none
771	pit	roasting pit	all	none		none	none	none	none	none
784	multiple features		all	A.D. 700–1150	Ce, PP	none	MFA	none	Rincon & San Pedro	none
833	multiple features		partial	A.D. 700–1150	Ce, PP	none	MFA	none	Rincon	none
834	structure	structure	all	A.D. 685–915	AM, Ce	A.D. 685–915, 935–990	MFA	none	none	ET F 8887
1545	cache	cache	all	none		none	none	none	none	LT 799
1553	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
1555	pit	fire pit	partial	>200 B.C.	Ce	none	plain	none	none	none
1556	hearth	Hearth	partial	none		none	none	none	none	none
1571	structure	structure	all	A.D. 1–1150	AS, Ce	none	plain	none	none	none
1575	structure	structure	all	A.D. 1385–1690	AM, Ce, PP	A.D. 585–740, 910–1015, 1385–1690[a]	LFA/LFB	none	LF	LT 7827
1582	rock pile	rock cluster	all	none		none	none	none	none	none
1597	pit	roasting pit	partial	none		none	none	none	none	none
1794	pit	fire pit	partial	>200 B.C.	Ce	none	plain	none	none	none
1802	pit	indeterminate pit	partial	none		none	none	none	none	none
1808	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
1812	pit	indeterminate pit	partial	none		none	none	none	none	none

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
1815	structure	structure	all	1500 B.C.–A.D. 700	AS, PP	none	none	none	LA	none
1816	structure	structure	all	1500 B.C.–A.D. 700	AS	none	none	none	none	none
2650	pit	indeterminate pit	all	<A.D. 1050	SA	none	none	none	none	LT 3869
2670	pit	indeterminate pit	partial	>A.D. 700	SA	none	none	none	none	LT 3870
2679	burial	inhumation, extended	all	>A.D. 700	SA	none	none	none	none	ET 5647; LT 5612; UA 3817
2697	pit	borrow pit	all	>A.D. 685	SA	none	none	none	none	LT 3670, 3869
3027	pit	borrow pit	partial	200 B.C.–A.D. 865	Ce, SA	none	plain	none	none	ET 3868, 3679
3067	pit	roasting pit	all	>A.D. 835	SA	none	MFA	none	none	LT 3868, 3679
3097	pit	Indeterminate Pit	all	<A.D. 865	SA	none	none	none	none	ET 3868
3203	pit	indeterminate pit	partial	<A.D. 865	SA	none	none	none	none	ET 3868, 3679
3366	pit	roasting pit	all	>A.D. 700	SA	none	MFA	none	none	LT 3681
3426	pit	indeterminate pit	partial	>A.D. 500	Ce	none	Plain and painted	none	none	none
3433	pit	indeterminate pit	all	>A.D. 700	SA	none	none	none	none	LT 3681
3437	pit	indeterminate pit	all	>A.D. 835	SA	none	MFA	none	none	LT 3868, 3679
3501	multiple features		all	mixed	Ce, PP	none	MFB	none	LA & MF	
3528	burial	inhumation, disarticulated	all	<A.D. 865	SA	none	MFA	none	none	none
3545	structure	structure	all	A.D. 860–1015	AM, Ce, PP	A.D. 585–740, 860–1015, 1535–1615, 1760–1815[a]	MF	none	MF	LT F 4740, 5518; ET F 2898, 3588, 3878, 5514, 5515, 5519
3557	pit	indeterminate pit	partial	1060–880 B.C.	C14	none	none	1060–880 cal B.C.	none	none
3558	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
3564	burial	inhumation, extended	all	none		none	none	none	none	none
3569	structure	structure	all	A.D. 935–1015	AM, AS	A.D. 635–665, 935–1015, 1385–1615, 1635–1690	none	none	none	LT F 3671, 3869, 3870

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
3579	rock cluster/ hearth	rock cluster/hearth	partial	A.D. 950–1150	Ce	none	MFB	none	none	none
3582	structure	structure	all	A.D. 700–950	Ce, PP	none	MFA	none	MF	ET F 3617, 3879
3594	pit	fire pit	all	none		none	none	none	none	none
3595	multiple features		partial	A.D. 700–950	Ce	none	MFA	none	none	none
3596	structure		partial	>A.D. 500	Ce	none	MFA	none	none	ET 3634; 7691
3604	burial	cremation, secondary pit	all	none		none	none	none	none	none
3617	structure	structure	all	A.D. 700–950	Ce, PP, SA	none	MFA	none	MF & LF	LT F 3582, 3879, 4516
3624	pit	indeterminate pit	all	none		none	none	none	none	none
3631	pit	indeterminate pit	all	A.D. 1350–1500	Ce	none	LFB	none	none	none
3641	structure	structure	partial	A.D. 1–690	AM, AS, Ce	A.D. 585–690, 1760–1815[b]	plain	none	none	ET 3642
3642	pit	roasting pit	partial	>A.D. 1	SA	none	none	none	none	LT 3641
3654	non–feature		sampled	>A.D. 935	SA	none	none	none	none	LT 3663
3663	structure	structure	partial	A.D. 935–1040	AM, AS	A.D. 935–1040, 1160–1415	none	none	none	ET F 3654, 10,637, 10638
3668	pit	roasting pit	all	A.D. 835–915	AM, Ce, C14, PP	A.D. 835–915	MFA/MFB	cal A.D. 770–980	Rincon	none
3669	pit	roasting pit	all	>a.d 685	PP, SA	none	none	none	MF	LT 3670, 3869
3670	structure	structure	all	A.D. 685–990	AM, Ce, PP	A.D. 685–790, 835–990	MFA	none	MF	ET F 2697, 3669; UA F 3869
3672	rock pile	rock pile	sampled	none		none	none	none	none	none
3673	rock pile	rock cluster	sampled	>A.D. 1	SA	none	none	none	none	LT 3677
3677	structure	structure	partial	>A.D. 1	AS, Ce, PP	none	plain	none	LA	ET 3673
3679	structure	structure	all	A.D. 835–865	AM, Ce, PP	A.D. 835–865[a]	MFA	none	MF	LT F 3027, 3203, 3790, 3792, 3868, 4702; ET F 3067, 3437, 3875
3680	structure	structure	all	<A.D. 950	SA	none	FM	none	LA	ET F 3581, 3681

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
3681	structure	structure	all	A.D. 700–950	Ce	none	MFA	none	San Pedro	LT F 3680; ET F 3366, 3433, 3672, 3871; UA F 8607
3691	pit	indeterminate pit	probed	none		none	none	none	none	none
3692	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
3693	pit	indeterminate pit	all	none		none	none	none	none	none
3696	pit	roasting pit	partial	A.D. 835–915	AM, Ce, PP	A.D. 835–915	MFA	none	MF	none
3698	pit	indeterminate pit	sampled	none		none	none	none	none	none
3699	pit	roasting pit	sampled	none		none	none	none	none	none
3703	pit	indeterminate pit	probed	none		none	none	none	none	none
3704	burial	cremation, primary	all	none		none	none	none	none	none
3710	structure	structure	all	A.D. 685–915	AM, Ce	A.D. 685–790, 835–915	MFA	none	none	none
3711	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
3723	pit	indeterminate pit	probed	none		none	none	none	none	none
3724	pit	indeterminate pit	probed	none		none	none	none	none	none
3727	pit	indeterminate pit	partial	none		none	none	none	none	none
3728	pit	indeterminate pit	partial	none		none	none	none	none	none
3737	multiple features		partial	mixed	Ce	none	MFB	none	none	(contains F 10,729)
3748	multiple features		partial	A.D. 785–950	Ce, PP, SA	none	MFA	none	LA & MF	ET 4802–4806, 4808, 4811, 3815, 3791, LT 4801, 4807, 4809, 4810, 7558, 7559
3756	pit	roasting pit	all	A.D. 685–740	AM, SA	A.D. 685–740, 860–915	MFB	none	none	ET 7558
3790	pit	indeterminate pit	partial	A.D. 500–865	SA	none	none	none	none	ET 3679; LT 3868
3792	pit	indeterminate pit	all	A.D. 500–865	SA	none	none	none	none	ET 3679; LT 3868
3796	nonfeature		partial	none		none	none	none	none	none
3817	structure	structure	all	A.D. 700–1015	AS, Ce, PP, SA	none	MFA	none	MF	ET F 3874, 4716; UA F 2679, 5612, 5647, 3818

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
3818	pit	horno	partial	A.D. 935–1015	AM, Ce	A.D. 935–1015, 1210–1690	MFA	none	none	none
3854	nonfeature		all	nonfeature		none	none	none	none	none
3868	structure	structure	all	A.D. 600–865	AS, SA	none	none	none	none	LT F 3027, 4702; ET F 3548, 3551, 3679, 3790, 3792; Abuts F 3097
3869	structure	structure	all	A.D. 700–1050	Ce, SA	none	MFB	none	none	LT F 2650; ET F 2697, 3569, 3669, 3870; Abuts F 3670
3870	pit	borrow pit	partial	A.D. 700–1050	Ce, PP, SA	none	MFA	none	MF	ET 3643, 2670
3871	pit	indeterminate pit	all	>A.D. 700	SA	none	none	none	none	LT 3681
3872	pit	indeterminate pit	all	>A.D. 700	SA	none	none	none	none	LT 3681
3875	burial	cremation, secondary pit	all	>A.D. 835	SA	none	none	none	none	LT 3679, 3868
3876	pit	indeterminate pit	partial	none		none	none	none	none	none
3878	pit	roasting pit	all	>A.D. 860	Ce, SA	none	plain and painted	none	none	LT 3545, 5518
3879	structure	structure	all	A.D. 700–950	Ce, PP, SA	none	MFA	none	MF	LT F 3582; ET F 3617, 4516
3895	pit	indeterminate pit	all	A.D. 700–950	Ce	none	MFA	none	none	none
3897	pit	indeterminate pit	all	none		none	none	none	none	none
3921	structure	structure	partial	none		none	none	none	none	none
3926	pit	indeterminate pit	probed	none		none	none	none	none	none
3938	pit	indeterminate pit	probed	none		none	none	none	none	none
3939	pit	indeterminate pit	probed	none		none	none	none	none	none
3942	pit	indeterminate pit	all	none		none	none	none	none	none
3943	burial	inhumation, flexed	all	none		none	none	none	none	none
3945	pit	indeterminate pit	probed	none		none	none	none	none	none
3946	pit	indeterminate pit	probed	none		none	none	none	none	none
3947	pit	indeterminate pit	probed	none		none	none	none	none	none
3949	pit	indeterminate pit	probed	none		none	none	none	none	none
3950	pit	indeterminate pit	probed	none		none	none	none	none	none

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
3951	pit	indeterminate pit	probed	none		none	none	none	none	none
3952	pit	indeterminate pit	probed	none		none	none	none	none	none
3953	pit	indeterminate pit	all	none		none	none	none	none	none
3954	pit	indeterminate pit	all	none		none	none	none	none	none
3956	pit	indeterminate pit	probed	none		none	none	none	none	none
3957	pit	indeterminate pit	probed	none		none	none	none	none	none
3958	pit	indeterminate pit	probed	none		none	none	none	none	none
3959	pit	indeterminate pit	probed	none		none	none	none	none	none
3960	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
3963	pit	roasting pit	partial	>200 B.C.	Ce	none	plain	none	none	none
3964	pit	indeterminate pit	all	none		none	none	none	none	none
3965	pit	indeterminate pit	all	none		none	none	none	none	none
3966	pit	indeterminate pit	all	none		none	none	none	none	none
3967	pit	indeterminate pit	all	none		none	none	none	none	none
3968	pit	indeterminate pit	partial	A.D. 700–950	Ce	none	MFA	none	none	none
3976	pit	indeterminate pit	partial	1280–1010 cal B.C.	C14	none	none	1280–1010 cal B.C.	San Pedro	none
3977	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
3983	pit	indeterminate pit	all	1050–900 cal B.C.	C14	none	none	1140–920 cal B.C. AND 1040–850 cal B.C.	San Pedro	none
4003	structure	structure	partial	>200 B.C.	Ce	none	plain	none	none	none
4033	pit	indeterminate pit	probed	none		none	none	none	none	none
4035	pit	indeterminate pit	probed	none		none	none	none	none	none
4043	multiple features		partial	mixed		none	MFA	none	none	none
4044	pit	indeterminate pit	partial	none		none	none	none	none	none
4045	pit	indeterminate pit	all	none		none	none	none	none	none
4046	posthole	indeterminate pit	partial	none		none	none	none	none	none
4047	pit	indeterminate pit	all	none		none	none	none	none	none
4048	pit	indeterminate pit	all	none		none	none	none	none	none
4049	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4050	pit	roasting pit	partial	>200 B.C.	Ce	none	plain	none	none	none

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
4051	pit	indeterminate pit	all	none		none	none	none	none	none
4053	pit	roasting pit	partial	>200 B.C.	SA	none	none	none	none	LT 5809
4054	pit	indeterminate pit	all	none		none	none	none	none	UA 5089
4055	pit	indeterminate pit	probed	none		none	none	none	none	none
4057	burial	cremation, secondary urn	all	none		none	none	none	none	none
4058	pit	indeterminate pit	partial	none		none	none	none	none	ET 7687
4059	pit	indeterminate pit	all	none		none	none	none	none	none
4063	pit	indeterminate pit	probed	none		none	none	none	none	none
4069	burial	cremation, primary	all	>200 B.C.	AM, Ce	no date[b]	plain	none	none	none
4076	pit	indeterminate pit	probed	none		none	none	none	none	none
4091	pit	indeterminate pit	probed	none		none	none	none	none	none
4097	pit	borrow pit	partial	>A.D. 500	Ce	none	MF	none	none	none
4105	pit	indeterminate pit	all	<A.D. 840	SA	none	MFA	none	none	ET 7559
4108	pit	indeterminate pit	probed	none		none	none	none	none	none
4119	pit	indeterminate pit	probed	none		none	none	none	none	none
4120	pit	roasting pit	all	>a.d 500	Ce	none	painted	none	none	none
4121	pit	indeterminate pit	probed	none		none	none	none	none	none
4128	pit	indeterminate pit	probed	none		none	none	none	none	none
4143	pit	indeterminate pit	probed	none		none	none	none	none	none
4149	pit	indeterminate pit	all	>200 B.C.	SA	none	none	none	none	LT 11251
4164	pit	indeterminate pit	probed	none		none	none	none	none	none
4193	pit	indeterminate pit	probed	none		none	none	none	none	none
4196	pit	indeterminate pit	probed	none		none	none	none	none	none
4220	pit	Horno	partial	>A.D. 500	Ce	none	MFA	none	none	none
4221	burial	cremation, primary	all	<A.D. 585–1015	AM	A.D. 585–790, 835–1015, 1385–1815	none	none	none	none
4229	pit	indeterminate pit	probed	none		none	none	none	none	none
4230	pit	indeterminate pit	probed	none		none	none	none	none	none
4295	pit	indeterminate pit	partial	none		none	none	none	none	none

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
4299	multiple features		partial	mixed		none	none	none	none	none
4300	pit	indeterminate pit	probed	none		none	none	none	none	none
4310	pit	indeterminate pit	partial	none		none	none	none	none	none
4312	pit	indeterminate pit	partial	1500 B.C.–A.D. 300	PP	none	none	none	San Pedro	none
4326	pit	indeterminate pit	partial	200 B.C.–A.D. 300	Ce, PP	none	plain	none	1 arrowpoint; 2 San Pedro dartpoints	none
4333	structure	structure	partial	A.D. 685–1015	AM, Ce	A.D. 685–790, 835–1015, 1535–1615	MFA	none	none	none
4369	pit	indeterminate pit	all	none		none	none	none	none	none
4441	structure	structure	partial	none		none	none	none	none	none
4462	structure	structure	partial	>200 B.C.	Ce	none	none	none	none	none
4516	structure	structure	all	A.D. 700–950	SA	none	none	none	none	LT F 3879; ET F 3617
4556	pit	indeterminate pit	probed	none		none	none	none	none	none
4560	pit	indeterminate pit	probed	none		none	none	none	none	none
4561	pit	indeterminate pit	probed	>A.D. 500	Ce	none	MFA	none	none	none
4571	pit	indeterminate pit	partial	>A.D. 500	Ce	none	plain and painted	none	none	none
4631	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4635	pit	indeterminate pit	all	>200 B.C.	Ce	none	plain	none	MF	none
4642	structure	structure	partial	A.D. 500–915	AM, Ce	A.D. 585–740, 835–915, 1535–1590, 1760–1890	MFA	none	none	none
4649	pit	indeterminate pit	all	>A.D. 500	Ce	none	painted	none	none	none
4650	pit	indeterminate pit	partial	none		none	none	none	none	none
4660	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4682	structure	structure	all	A.D. 825–1015	AM, Ce	off curve, near A.D. 900	MFA	none	none	ET F 5616, 4684

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
4683	structure	structure	all	A.D. 1385–1690	AM, Ce, PP	A.D. 635–690, 910–1015, 1385–1690	LFB	none	LF	none
4684	structure	structure	all	A.D. 1310–1690	AM, Ce, PP	A.D. 585–1015, 1310–1690	LFB	none	LF	LT F 4682, 5616
4702	pit	roasting pit	partial	A.D. 600–865	AM, Ce, SA	none, near A.D. 850	plain and red	none	none	ET 3679, 3868; LT 10645
4716	pit	indeterminate pit	all	>A.D. 700	SA	none	none	none	none	LT 3817
4725	multiple features		all	mixed	Ce	none	MFA	none	none	(Composed of F 7942 and 7943)
4728	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4729	structure	structure	all	A.D. 1340–1390	AM, Ce, C14	A.D. 935–1015, 1310–1690	LFB	cal A.D. 1270–1320, 1340–1390	LA	LT F 5513, 7664, 7943
4730	pit	indeterminate pit	partial	none		none	none	none	none	none
4731	pit	indeterminate pit	partial	none		none	none	none	none	none
4732	pit	indeterminate pit	partial	none		none	none	none	none	none
4733	structure	structure	all	>A.D. 500	Ce	none	MFA	none	none	none
4735	pit	indeterminate pit	partial	>A.D. 500	Ce	none	MFA	none	none	none
4739	burial	cremation, secondary pit	all	none		none	none	none	none	none
4740	burial	inhumation, flexed	all	<A.D. 1015	SA	none	none	none	none	ET 3545, 5518
4750	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4753	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4757	pit	indeterminate pit	partial	>200 B.C.	Ce	none	MFA	none	none	none
4759	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4768	structure	structure	all	A.D. 1010–1090	AM, Ce, PP	A.D. 1010–1040, 1060–1090, 1160–1190, 1235–1265[a]	MFB	none	MF	LT F 8655
4780	pit	indeterminate pit	partial	none		none	none	none	none	none
4793	pit	indeterminate pit	partial	none		none	none	none	none	none
4794	burial	cremation, secondary pit	all	none		none	none	none	none	none
4798	burial	cremation, secondary pit	all	none		none	none	none	none	none

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
4800	pit	modern fence post	partial	none		none	none	none	none	none
4849	pit	indeterminate pit	partial	820–760, 620–590 B.C.	C14	none	none	820–760, 620–590 cal B.C.	none	none
4850	burial	cremation, secondary urn	all	none		none	none	none	none	none
4857	pit	indeterminate pit	partial	none		none	none	none	none	none
4859	nonfeature	roasting pit		>A.D. 500	Ce	none	painted	none	none	none
4867	animal burial	modern dog burial	partial	none		none	none	none	none	none
4871	pit	roasting pit	partial	A.D. 990–1160	C14, Ce	off curve, near A.D. 850	MFA	cal A.D. 990–1160	none	none
4882	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4886	burial	inhumation, extended	all	none		none	none	none	none	none
4887	pit	indeterminate pit	all	>200 B.C.	Ce	none	plain	none	none	none
4888	pit	indeterminate pit	all	none		none	none	none	none	none
4895	multiple features		partial	mixed	Ce	none	MFA, MFB, or LFB	none	none	(Composed of 9729, 9867, 11,390)
4896	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4902	pit	roasting pit	partial	>200 B.C.	AM, Ce	A.D. 1835–1890[b]	plain	none	none	none
4909	pit	indeterminate pit	partial	none		none	none	none	none	none
4912	structure	structure	all	200 B.C.–A.D. 700	AS, Ce	none	plain	none	none	none
4931	pit	roasting pit	partial	A.D. 985–1315	AM	A.D. 985–1040, 1060–1090, 1160–1315	none	none	none	none
4932	pit	indeterminate pit	partial	none		none	none	none	none	none
4935	structure	structure	all	>200 B.C.	Ce	none	plain	none	none	none
4939	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4943	pit	indeterminate pit	partial	none		none	none	none	none	none
4944	disturbance		partial	none		none	none	none	none	none
4945	pit	indeterminate pit	partial	none		none	none	none	none	none
4954	pit	roasting pit	partial	none		none	none	none	none	none
4966	pit	indeterminate pit	partial	none		none	none	none	none	none
4973	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
4976	pit	indeterminate pit	partial	none		none	none	none	none	none
4984	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4985	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
4996	pit	indeterminate pit	partial	none		none	none	none	none	none
4997	nonfeature		partial	none		none	none	none	none	LT 11327, 11328
5504	pit	indeterminate pit	partial	none		none	none	none	none	none
5505	pit	indeterminate pit	partial	1110–900 cal B.C.	C14, PP	none	none	1110–900 cal B.C.	San Pedro	LT 5506
5512	burial	inhumation, flexed	all	>A.D. 735	SA	none	none	none	none	LT 7879, 7880
5513	structure	structure	all	A.D. 500–1390	Ce, SA	none	painted	none	none	LT F 7663; ET F 4729, 5866, 7560
5518	structure		partial	A.D. 700–1015	AS, Ce, PP, SA	none	painted	none	MF	LT F 4740; ET F 2989, 3545, 3878, 5514, 5515, 5519
5520	pit	fire pit	all	>A.D. 735	SA	none	none	none	none	LT 7879, 7880
5568	pit	roasting pit	partial	>200 B.C.	Ce	none	plain	none	none	ET 4558
5612	pit	roasting pit	all	A.D. 650–950	Ce, PP	none	MFA	none	MF	LT 3817, ET 2679
5616	structure	structure	partial	A.D. 500–1310	SA	none	none	none	none	LT F 4682; ET F 4684
5619	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
5624	pit	indeterminate pit	partial	none		none	none	none	none	none
5647	pit	indeterminate pit	all	>A.D. 700	SA	none	none	none	none	LT 2679, 3817
5766	pit	indeterminate pit	partial	>A.D. 935	SA	none	MFA	none	none	LT 3737, 10729
5781	structure	fire pit	all	A.D. 660–940	AM, Ce	A.D. 660–940	MFA/MFB	none	none	ET F 5793-5795
5793	pit	borrow pit	partial	>A.D. 660	SA	none	none	none	none	LT 5781
5794	structure	structure	partial	A.D. 910–1015	AM, SA	A.D. 585–690, 910–1015, 1335–1890	none	none	none	LT F 5781; ET F 5795
5795	structure		partial	A.D. 910–1150	Ce, SA	none	MFA/MFB	none	none	LT F 5781, 5794
5809	pit	indeterminate pit	all	200 B.C.–A.D. 300	PP	none	plain	none	3 San Pedro	ET 4053
5980	pit	indeterminate pit	partial	>200 B.C.	Ce	none	plain	none	none	none
5982	pit	indeterminate pit	partial	none		none	none	none	none	ET 10612
5983	pit	indeterminate pit	partial	none		none	none	none	none	none

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
5986	structure	structure	all	A.D. 700–865	Ce, SA	none	MFA	none	none	ET F 438; UA F 7978
5992	burial	cremation, secondary pit	all	none		none	none	none	none	none
5994	structure	structure	partial	A.D. 650–950	AS, Ce	none	MFA	none	none	none
7501	pit	cache	all	>200 B.C.	Ce	none	plain	none	none	none
7558	structure	structure	all	A.D. 710–740	AM, SA	A.D. 710–740, 835–915	none	none	none	LT F 3756; ET F 7559
7559	structure	structure	all	A.D. 785–840	AM	A.D. 785–840	none	none	none	LT F 4105, 7558; ET F 3748
7560	pit	roasting pit	all	>A.D. 500	SA	none	none	none	none	LT 5513
7664	pit	Borrow Pit	partial	200 B.C.–A.D. 1390	Ce, SA	none	plain	none	none	ET 4729
7697	multiple features		all	mixed	Ce, PP	none	MFA	none	MF	(Composed of F 438, 5986, 7879)
7742	pit	indeterminate pit	partial	>A.D. 735	SA	none	none	none	none	LT 7879, 7880
7827	pit	roasting pit	partial	cal A.D. 660–790	C14	none	none	cal A.D. 660–790	none	ET 1575
7833	burial	inhumation, extended	all	>A.D. 500	Ce	none	painted	none	none	none
7847	burial	cremation, secondary pit	all	none		none	none	none	none	none
7879	structure	structure	all	<A.D. 865	SA	none	none	none	none	ET F 5512, 5520, 5978, 7737–7740, 7742, 7880
7880	structure	structure	all	A.D. 735–865	AM	A.D. 735–865	none	none	none	LT F 7879; ET F 5512, 5520, 5978, 7737–7740, 7742
7940	pit	indeterminate pit	sampled	>A.D. 950	SA	none	none	none	none	LT 7942, 7943
7942	structure	structure	all	A.D. 700–925	AM, AS, Ce	off curve, near A.D. 700 and 900	MFA	none	none	LT F 7943, ET F 7940
7943	structure	structure	all	A.D. 700–925	Ce, PP, SA	none	MFA or LFB	none	Rincon	ET F 4729, 7942
7978	structure	structure	all	A.D. 700–865	AS, SA	none	MFA	none	none	ET F 438; UA F 5986
8607	structure	structure	partial	none		none	none	none	none	UA F 3681
8643	structure	structure	partial	A.D. 685–915	AS, SA	none	none	none	none	ET F 8644
8644	structure	structure	partial	A.D. 685–915	AM	A.D. 685–915	none	none	none	LT F 8643

continued on next page

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
8655	structure	structure	all	A.D. 825–1090	AM, Ce, PP, SA	no date, near A.D. 850	MFA	none	Rincon	ET F 4768
8798	pit	roasting pit	partial	200 B.C.–A.D. 865	Ce, SA	no date[b]	plain	none	none	ET 8841
8841	structure	structure	partial	A.D. 835–865	AM, Ce	A.D. 835–865	MFA	none	none	LT F 8798, 8842
8842	structure	structure	partial	A.D. 735–840	AM, SA	A.D. 735–840	none	none	none	LT F 8798; ET F 8841
8887	pit	indeterminate pit	partial	>A.D. 685	Ce, SA	none	MFA	none	none	LT 834
9729	structure	structure	partial	A.D. 500–840	Ce, SA	none	MFA	none	none	ET F 9867, 11,390
9867	structure	structure	partial	A.D. 760–840	AM	A.D. 760–840	none	none	none	LT F 9729, ET F 11,390
10507	pit	roasting pit	all	A.D. 600–1000	Ce, PP	no date[b]	MFA	none	MF	LT 10692
10560	structure	structure	partial	A.D. 735–840	AM	A.D. 735–840	none	none	none	ET F 10561
10561	structure	structure	partial	A.D. 835–990	AM, SA	A.D. 685–765, 835–990, 1535–1590	none	none	none	LT F 10560
10587	pit	indeterminate pit	partial	none		none	none	none	none	none
10612	pit	indeterminate pit	sampled	none		none	none	none	none	LTLT 5982
10645	burial	inhumation, flexed	all	1200 B.C.–A.D. 600	PP, SA	none	none	none	San Pedro	ETET 4702
10674	burial	cremation, secondary pit	all	none		none	none	none	none	none
10692	pit	fire pit	all	<A.D. 600	SA	none	none	none	none	ETET 10507
10711	burial	cremation, secondary pit	all	none		none	none	none	none	none
10720	pit	indeterminate pit	all	none		none	none	none	none	none
10729	structure	structure	partial	A.D. 935–1015	AM, AS, Ce, PP	A.D. 935–1015, 1310–1690	MFB	none	MF	ET F 5000, 5766
10781	structure	structure	partial	A.D. 935–1015	AM, AS, SA	A.D. 585–690, 935–1015, 1535–1590, 1760–1815	none	none	none	LT F 10,780; ET F 10,782
10782	structure	structure	partial	A.D. 935–1015	AM, AS, Ce	A.D. 935–1015, 1335–1390	none	none	none	LT F 10,780, 10,781
11251	structure	structure	all	200 B.C.–A.D. 700	AS, Ce	none	plain	none	none	ET F 4149
11342	pit	indeterminate pit	partial	A.D. 760–840	AM, Ce	A.D. 760–840	MFB	none	none	none

Feature No.	Final Interpretation	Feature Type	Excavation LOE	Final Date Range (6/12/06)	Method	Archaeomagnetic Date Ranges	Ceramic Date	Calibrated Radiocarbon Date	Projectile Point Date	Stratigraphic Associations
11390	structure	structure	partial	>A.D. 760	SA	none	none	none	none	LT F 9729, 9867
						Locus E				
380	burial	cremation, secondary pit	all	none		none	none	none	none	
381	burial	cremation, secondary pit	all	none		none	none	none	none	
						Locus F				
652	structure	structure	partial	none		none	none	none	none	
672	trash mound	trash mound	partial	none		none	none	none	none	

Key: AM = Archaeomagnetic dating; AS = Architectural style; Ce = Ceramic dating; C14 = Radiocarbon; PP = Projectile point typology; SA = Stratigraphic Association; MFA = Middle Formative A (A.D. 650–950); MFB = Middle Formative B (A.D. 950–1150); LFA = Late Formative A (A.D. 1150–1300); LFB = Late Formative B (A.D. 1300–1450); FM = (A.D. 650–1450); Empire (ca. 1200–800 B.C); San Pedro (ca. 1200–800 B.C.); LA = Late Archaic (ca. 1550 B.C.–A.D.200); MF = Middle Formative (A.D. 650–1150); LF = Late Formative (A.D. 1150–1350); Rincon (A.D. 950–1150); ET = Earlier than; LT = Later than; UA = Undetermined association.

[a] Composite archaeomagnetic date ranges.

[b] Samples that predate the curve.

Table 2.C.2. Date List for Mescal Wash Features, by Locus

Feature No.	Feature Type	Date Range
	Locus A	
200	structure	A.D. 935–1040
207	structure	A.D. 935–1150
288	pit	A.D. 950–1150
290	structure	A.D. 1010–1150
1179	pit	A.D. 700–950
1180	pit	A.D. 950–1150
1185	pit	A.D. 950–1150
1188	pit	A.D. 950–1150
1189	structure	A.D. 935–1040
1195	pit	A.D. 950–1150
2143	midden	A.D. 950–1150
2153	pit	A.D. 950–1150
2157	structure	A.D. 935–1040
2160	structure	A.D. 935–1040
2168	pit	A.D. 950–1150
2169	pit	A.D. 950–1150
2184	pit	A.D. 950–1150
2186	pit	A.D. 950–1150
2192	structure	A.D. 700–1150
2195	structure	A.D. 860–990
2197	pit	A.D. 950–1150
6463	pit	A.D. 950–1150
	Locus C	
235	structure	A.D. 1160–1690
276	structure	A.D. 650–1150
376	structure	A.D. 835–1015
379	structure	A.D. 1010–1140
995	structure	A.D. 935–1100
1141	pit	A.D. 950–1150
6010	structure	A.D. 700–950
6095	structure	A.D. 935–1040
6098	structure	A.D. 935–1015
6114	pit	A.D. 950–1150
6119	pit	A.D. 950–1450
6129	structure	A.D. 935–1015
6135	pit	A.D. 950–1150
6136	pit	2000 B.C.–A.D. 1150
6138	structure	A.D. 935–1315
6139	structure	A.D. 700–1040
6146	pit	A.D. 950–1150
6148	pit	A.D. 950–1150
6149	pit	A.D. 950–1450
6153	structure	A.D. 1010–1040
6154	structure	A.D. 935–1015

continued on next page

Feature No.	Feature Type	Date Range
6162	pit	A.D. 950–1150
6171	pit	A.D. 700–2000
6191	burial	A.D. 700–2000
7153	pit	A.D. 985–1040
7170	burial	A.D. 950–1150
7194	pit	A.D. 950–1150
7196	pit	A.D. 950–1150
7201	structure	A.D. 935–1015
7330	animal burial	A.D. 935–2000
7457	burial	A.D. 950–1150
7458	burial	A.D. 950–1150
7461	structure	A.D. 935–1040
9327	pit	A.D. 950–1150
9328	pit	A.D. 950–1150
9409	pit	A.D. 935–2000
9410	burial	A.D. 935–2000
9487	pit	A.D. 935–2000
10133	pit	A.D. 935–2000
10138	burial	A.D. 935–2000
10343	pit	A.D. 650–2000
10367	pit	A.D. 650–2000
10380	pit	A.D. 935–2000
10698	burial	A.D. 935–2000
	Locus D	
336	burial	A.D. 1–2000
411	pit	1100–900 B.C.
438	structure	A.D. 735–865
457	pit	A.D. 500–2000
464	burial	A.D. 1–2000
491	pit	A.D. 500–2000
492	structure	A.D. 735–840
561	burial	A.D. 1–2000
565	structure	A.D. 735–840
575	structure	A.D. 700–1150
578	pit	A.D. 500–2000
714	pit	A.D. 500–2000
723	pit	A.D. 500–2000
724	pit	A.D. 500–2000
726	structure	A.D. 1–2000
784	multiple features	A.D. 700–1150
833	multiple features	A.D. 700–950
834	structure	A.D. 685–915
1553	pit	A.D. 1–2000
1555	pit	A.D. 1–2000
1571	structure	A.D. 1–1150
1575	structure	A.D. 1385–1690

Feature No.	Feature Type	Date Range
1794	pit	A.D. 1–2000
1808	pit	A.D. 1–2000
1815	structure	1500 B.C.–A.D. 700
1816	structure	1500 B.C.–A.D. 700
2650	pit	2000 B.C.–A.D. 1050
2670	pit	A.D. 700–2000
2679	burial	A.D. 700–2000
2697	pit	A.D. 685–2000
3027	pit	A.D. 1–865
3067	pit	A.D. 835–2000
3097	pit	2000 B.C.–A.D. 865
3203	pit	2000 B.C.–A.D. 865
3366	pit	A.D. 700–2000
3426	pit	A.D. 500–2000
3433	pit	A.D. 700–2000
3437	pit	A.D. 835–2000
3528	burial	2000 B.C.–A.D. 865
3545	structure	A.D. 860–1015
3557	pit	1060–880 B.C.
3558	pit	A.D. 1–2000
3569	structure	A.D. 935–1015
3579	rock cluster/hearth	A.D. 950–1150
3582	structure	A.D. 700–950
3595	multiple features	A.D. 700–950
3596	structure	A.D. 500–2000
3617	structure	A.D. 700–950
3631	pit	A.D. 1350–1500
3641	structure	A.D. 1–690
3642	pit	A.D. 1–2000
3654	nonfeature	A.D. 935–2000
3663	structure	A.D. 935–1040
3667	nonfeature	A.D. 700–950
3668	pit	A.D. 835–915
3669	pit	A.D. 685–2000
3670	structure	A.D. 685–990
3673	rock pile	A.D. 1–2000
3677	structure	A.D. 1–2000
3679	structure	A.D. 835–865
3680	structure	2000 B.C.–A.D. 950
3681	structure	A.D. 700–950
3692	pit	A.D. 1–2000
3696	pit	A.D. 835–915
3710	structure	A.D. 685–915
3711	pit	A.D. 1–2000
3748	multiple features	A.D. 785–950
3756	pit	A.D. 685–740
3790	pit	A.D. 500–865

continued on next page

Feature No.	Feature Type	Date Range
3792	pit	A.D. 500–865
3817	structure	A.D. 700–1015
3818	pit	A.D. 935–1015
3868	structure	A.D. 600–865
3869	structure	A.D. 700–1050
3870	pit	A.D. 700–1050
3871	pit	A.D. 700–2000
3872	pit	A.D. 700–2000
3875	burial	A.D. 835–2000
3878	pit	A.D. 860–2000
3879	structure	A.D. 700–950
3895	pit	A.D. 700–950
3960	pit	A.D. 1–2000
3963	pit	A.D. 1–2000
3968	pit	A.D. 700–950
3976	pit	1280–1010 B.C.
3977	pit	A.D. 1–2000
3983	pit	1070–900 B.C.
4003	structure	A.D. 1–2000
4049	pit	A.D. 1–2000
4050	pit	A.D. 1–2000
4053	pit	A.D. 1–2000
4069	burial	A.D. 1–2000
4097	pit	A.D. 500–2000
4105	pit	2000 B.C.–A.D. 840
4120	pit	A.D. 500–2000
4149	pit	A.D. 1–2000
4220	pit	A.D. 500–2000
4221	burial	A.D. 585–1015
4312	pit	1500 B.C.–A.D. 300
4326	pit	A.D. 1–300
4333	structure	A.D. 685–1015
4462	structure	A.D. 1–2000
4516	structure	A.D. 700–950
4561	pit	A.D. 500–2000
4571	pit	A.D. 500–2000
4631	pit	A.D. 1–2000
4635	pit	A.D. 1–2000
4642	structure	A.D. 500–915
4649	pit	A.D. 500–2000
4660	pit	A.D. 1–2000
4682	structure	A.D. 825–1015
4683	structure	A.D. 1385–1690
4684	structure	A.D. 1310–1690
4702	pit	A.D. 600–865
4716	pit	A.D. 700–2000
4728	pit	A.D. 1–2000

Feature No.	Feature Type	Date Range
4729	structure	A.D. 1340–1390
4733	structure	A.D. 500–2000
4735	pit	A.D. 500–2000
4740	burial	2000 B.C.–A.D. 1015
4750	pit	A.D. 1–2000
4753	pit	A.D. 1–2000
4757	pit	A.D. 1–2000
4759	pit	A.D. 1–2000
4768	structure	A.D. 1010–1090
4849	pit	820–590 B.C.
4871	pit	A.D. 990–1160
4882	pit	A.D. 1–2000
4887	pit	A.D. 1–2000
4896	pit	A.D. 1–2000
4902	pit	A.D. 1–2000
4912	structure	A.D. 1–700
4931	pit	A.D. 985–1315
4935	structure	A.D. 1–2000
4939	pit	A.D. 1–2000
4973	pit	A.D. 1–2000
4984	pit	A.D. 1–2000
4985	pit	A.D. 1–2000
5505	pit	1110–900 B.C.
5512	burial	A.D. 735–2000
5513	structure	A.D. 500–1390
5518	structure	A.D. 700–1015
5520	pit	A.D. 735–2000
5568	pit	A.D. 1–2000
5612	pit	A.D. 650–950
5616	structure	A.D. 500–1310
5619	pit	A.D. 1–2000
5647	pit	A.D. 700–2000
5766	pit	A.D. 935–2000
5781	structure	A.D. 660–940
5793	pit	A.D. 660–2000
5794	structure	A.D. 910–1015
5795	structure	A.D. 910–1150
5809	pit	A.D. 1–300
5980	pit	A.D. 1–2000
5986	structure	A.D. 700–865
5994	structure	A.D. 650–950
7501	pit	A.D. 1–2000
7558	structure	A.D. 710–740
7559	structure	A.D. 785–840
7560	pit	A.D. 500–2000
7664	pit	A.D. 1–1390
7742	pit	A.D. 735–2000

continued on next page

Feature No.	Feature Type	Date Range
7827	pit	A.D. 660–790
7833	burial	A.D. 500–2000
7879	structure	2000 B.C.–A.D. 865
7880	structure	A.D. 735–865
7940	pit	A.D. 950–2000
7942	structure	A.D. 700–925
7943	structure	A.D. 700–925
7978	structure	A.D. 700–865
8643	structure	A.D. 700–915
8644	structure	A.D. 685–915
8655	structure	A.D. 825–1090
8798	pit	A.D. 1–865
8841	structure	A.D. 835–865
8842	structure	A.D. 735–840
8887	pit	A.D. 685–2000
9729	structure	A.D. 500–840
9867	structure	A.D. 760–840
10507	pit	A.D. 600–1000
10560	structure	A.D. 735–840
10561	structure	A.D. 835–990
10645	burial	1200 B.C.–A.D. 600
10692	pit	2000 B.C.–A.D. 600
10729	structure	A.D. 935–1015
10781	structure	A.D. 935–1015
10782	structure	A.D. 935–1015
11251	structure	A.D. 1–700
11342	pit	A.D. 760–840
11390	structure	A.D. 760–2000

APPENDIX 2.D

Mescal Wash Chronology

Table 2.D.1. Mescal Wash Chronology

Feature	290	1189	207	2195	235	7558	7559	3569	3756	3545	11342	4683	4729	3696	3710	4871	4902	4931	6138	7201	7880	379	376	6095	6154	6098	7461	8842	7153	565	10560	10782	3641	3663	7942	9867	8655	492	3818	4702	10507	3670	10781	10729	10561	6129	6153	438	1575	3679	4682	4768	200	2157	2160
290	**1.00**	**0.14**	**0.57**	0.00	**0.14**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.38**	**0.68**	0.00	0.00	**0.69**	0.00	**0.11**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.09**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.50**	0.00	0.00	0.00	0.00	**0.79**	**0.24**	**0.55**	**0.11**
1189	**0.14**	**1.00**	**0.45**	0.00	**0.56**	0.00	0.00	**0.07**	0.00	0.00	0.00	0.00	**0.13**	0.00	0.00	0.00	0.00	**0.23**	**0.15**	**0.43**	0.00	**0.07**	**0.06**	**0.77**	**0.51**	**0.38**	0.00	0.00	**0.06**	0.00	0.00	**0.53**	0.00	**0.37**	0.00	0.00	0.00	0.00	**0.59**	0.00	0.00	0.00	0.00	**0.10**	0.00	0.00	**0.27**	0.00	0.00	0.00	0.00	**0.08**	**0.32**	**0.33**	**0.44**
207	**0.57**	**0.45**	**1.00**	0.00	**0.63**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.97**	**0.82**	**0.09**	0.00	**0.60**	0.00	**0.65**	**0.10**	**0.34**	**0.33**	0.00	**0.40**	0.00	0.00	0.00	0.00	**0.63**	0.00	0.00	0.00	0.00	**0.26**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.94**	0.00	0.00	0.00	0.00	**0.65**	**0.99**	**0.91**	**0.63**
2195	0.00	0.00	0.00	**1.00**	0.00	**0.09**	0.00	0.00	**0.60**	**0.76**	0.00	0.00	0.00	**0.12**	**0.19**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.45**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.40**	0.00	**0.52**	0.00	0.00	0.00	0.00	0.00	**0.06**	**0.12**	**0.25**	0.00	**0.28**	0.00	0.00	0.00	**0.27**	0.00	**0.20**	0.00	0.00	0.00	0.00
235	**0.14**	**0.56**	**0.63**	0.00	**1.00**	0.00	0.00	**0.10**	0.00	0.00	0.00	0.00	**0.23**	0.00	0.00	0.00	0.00	**0.50**	**0.31**	**0.50**	0.00	**0.17**	**0.12**	**0.88**	**0.40**	**0.98**	**0.45**	0.00	**0.59**	0.00	0.00	**0.14**	0.00	**0.97**	0.00	0.00	0.00	0.00	**0.76**	0.00	0.00	0.00	0.00	**0.31**	0.00	0.00	**0.37**	0.00	**0.07**	0.00	0.00	**0.17**	**0.58**	**0.37**	**0.98**
7558	0.00	0.00	0.00	**0.09**	0.00	**1.00**	0.00	0.00	**0.20**	**0.06**	0.00	0.00	0.00	**0.59**	**0.89**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.13**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.10**	0.00	0.00	0.00	0.00	**0.10**	0.00	**0.41**	0.00	0.00	**0.37**	0.00	0.00	0.00	0.00	**0.08**	**0.15**	0.00	0.00	0.00	0.00
7559	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	**0.70**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	0.00	0.00	**0.50**	0.00	0.00	0.00	0.00	**0.22**	0.00	**0.27**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
3569	0.00	**0.07**	0.00	0.00	**0.10**	0.00	0.00	**1.00**	0.00	**0.10**	0.00	**0.50**	**0.68**	0.00	0.00	0.00	0.00	0.00	0.00	**0.33**	0.00	0.00	**0.49**	0.00	**0.59**	0.00	0.00	0.00	0.00	0.00	0.00	**0.13**	0.00	0.00	0.00	0.00	0.00	0.00	**0.39**	0.00	0.00	0.00	**0.10**	**0.31**	0.00	**0.20**	0.00	0.00	**0.29**	0.00	0.00	0.00	0.00	0.00	0.00
3756	0.00	0.00	0.00	**0.60**	0.00	**0.20**	0.00	0.00	**1.00**	**0.30**	0.00	0.00	0.00	**0.30**	**0.45**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.28**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	**0.17**	0.00	0.00	**0.25**	0.00	0.00	0.00	0.00	0.00	**0.28**	0.00	0.00	0.00	0.00
3545	0.00	0.00	0.00	**0.76**	0.00	**0.06**	0.00	**0.10**	**0.30**	**1.00**	0.00	**0.30**	0.00	0.00	**0.09**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.78**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.68**	0.00	**0.25**	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	**0.66**	0.00	**0.25**	**0.11**	0.00	0.00	**0.76**	0.00	**0.13**	0.00	0.00	0.00	0.00
11342	0.00	0.00	0.00	0.00	0.00	0.00	**0.70**	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	**0.07**	0.00	0.00	0.00	0.00	0.00	**0.20**	0.00	0.00	0.00	0.00	0.00	0.00	**0.27**	0.00	**0.11**	**0.56**	0.00	0.00	0.00	0.00	**0.78**	**0.39**	**0.32**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	0.00	**0.22**	0.00	0.00	0.00	0.00	0.00
4683	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.50**	0.00	**0.30**	0.00	**1.00**	**0.41**	0.00	0.00	0.00	0.00	0.00	0.00	**0.10**	0.00	0.00	**0.84**	0.00	**0.20**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.20**	0.00	0.00	0.00	**0.17**	**0.25**	0.00	**0.11**	0.00	0.00	**0.83**	0.00	0.00	0.00	0.00	0.00	0.00
4729	0.00	**0.13**	0.00	0.00	**0.23**	0.00	0.00	**0.68**	0.00	0.00	0.00	**0.41**	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	**0.65**	0.00	0.00	**0.32**	**0.10**	**0.67**	**0.08**	0.00	0.00	0.00	0.00	0.00	**0.11**	0.00	**0.06**	0.00	0.00	0.00	0.00	**0.69**	0.00	0.00	0.00	0.00	**0.92**	0.00	**0.05**	0.00	0.00	**0.22**	0.00	0.00	0.00	0.00	0.00	0.00
3696	0.00	0.00	0.00	**0.12**	0.00	**0.59**	0.00	0.00	**0.30**	0.00	0.00	0.00	0.00	**1.00**	**0.95**	0.00	0.00	0.00	0.00	0.00	**0.07**	0.00	**0.09**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.24**	0.00	**0.09**	0.00	0.00	**0.76**	**0.16**	**0.17**	0.00	0.00	**0.17**	0.00	0.00	0.00	0.00	**0.15**	**0.50**	0.00	0.00	0.00	0.00
3710	0.00	0.00	0.00	**0.19**	0.00	**0.89**	0.00	0.00	**0.45**	**0.09**	**0.07**	0.00	0.00	**0.95**	**1.00**	0.00	0.00	0.00	0.00	0.00	**0.19**	0.00	**0.09**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.42**	**0.12**	**0.21**	0.00	0.00	**0.64**	**0.17**	**0.37**	0.00	0.00	**0.39**	0.00	0.00	**0.17**	0.00	**0.42**	**0.45**	0.00	0.00	0.00	0.00
4871	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4902	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4931	**0.38**	**0.23**	**0.97**	0.00	**0.50**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	**0.81**	0.00	0.00	**0.43**	0.00	**0.33**	0.00	**0.09**	**0.18**	0.00	**0.15**	0.00	0.00	0.00	0.00	**0.43**	0.00	0.00	0.00	0.00	**0.12**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.78**	0.00	0.00	0.00	0.00	**0.40**	**0.91**	**0.73**	**0.37**
6138	**0.68**	**0.15**	**0.82**	0.00	**0.31**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.81**	**1.00**	0.00	0.00	**0.90**	0.00	**0.18**	0.00	0.00	**0.13**	0.00	**0.10**	0.00	0.00	0.00	0.00	**0.22**	0.00	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.73**	0.00	0.00	0.00	0.00	**0.91**	**0.57**	**0.68**	**0.17**
7201	0.00	**0.43**	**0.09**	0.00	**0.50**	0.00	0.00	**0.33**	0.00	0.00	0.00	**0.10**	**0.65**	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	**0.13**	**0.37**	**0.90**	**0.28**	0.00	0.00	0.00	0.00	0.00	**0.39**	0.00	**0.20**	0.00	0.00	0.00	0.00	**0.95**	0.00	0.00	0.00	0.00	**0.49**	0.00	0.00	0.00	0.00	**0.05**	0.00	0.00	0.00	0.00	0.00	**0.20**
7880	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.20**	0.00	0.00	**0.07**	**0.19**	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	**0.60**	0.00	**0.30**	**0.49**	0.00	0.00	0.00	0.00	**0.34**	**0.08**	**0.59**	0.00	0.00	0.00	**0.36**	0.00	0.00	**0.10**	0.00	0.00	**0.81**	0.00	**0.31**	0.00	0.00	0.00	0.00	0.00
379	**0.69**	**0.07**	**0.60**	0.00	**0.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.43**	**0.90**	0.00	0.00	**1.00**	0.00	**0.07**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.07**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.37**	0.00	0.00	0.00	0.00	**0.88**	**0.18**	**0.34**	0.00
376	0.00	**0.06**	0.00	**0.45**	**0.12**	**0.13**	0.00	**0.49**	**0.28**	**0.78**	0.00	**0.84**	**0.32**	**0.09**	**0.09**	0.00	0.00	0.00	0.00	**0.13**	0.00	0.00	**1.00**	0.00	**0.24**	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	**0.40**	0.00	**0.26**	0.00	0.00	0.00	**0.26**	0.00	0.00	**0.23**	**0.49**	**0.38**	**0.36**	**0.24**	0.00	0.00	**1.00**	0.00	**0.10**	0.00	0.00	0.00	0.00
6095	**0.11**	**0.77**	**0.65**	0.00	**0.88**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.10**	0.00	0.00	0.00	0.00	**0.33**	**0.18**	**0.37**	0.00	**0.07**	0.00	**1.00**	**0.34**	**0.74**	**0.09**	0.00	**0.18**	0.00	0.00	**0.18**	0.00	**0.78**	0.00	0.00	0.00	0.00	**0.71**	0.00	0.00	0.00	0.00	**0.06**	0.00	0.00	**0.23**	0.00	0.00	0.00	0.00	**0.07**	**0.47**	**0.31**	**0.90**
6154	0.00	**0.51**	**0.10**	0.00	**0.40**	0.00	0.00	**0.59**	0.00	0.00	0.00	**0.20**	**0.67**	0.00	0.00	0.00	0.00	0.00	0.00	**0.90**	0.00	0.00	**0.24**	**0.34**	**1.00**	**0.19**	0.00	0.00	0.00	0.00	0.00	**0.68**	0.00	**0.16**	0.00	0.00	0.00	0.00	**0.83**	0.00	0.00	0.00	0.00	**0.53**	0.00	**0.17**	0.00	0.00	**0.12**	0.00	0.00	0.00	0.00	0.00	**0.25**
6098	0.00	**0.38**	**0.34**	0.00	**0.98**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.08**	0.00	0.00	0.00	0.00	**0.09**	0.00	**0.28**	0.00	0.00	**0.06**	**0.74**	**0.19**	**1.00**	**0.06**	0.00	**0.08**	0.00	0.00	0.00	0.00	**0.83**	0.00	0.00	0.00	0.00	**0.73**	0.00	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.13**	0.00	**0.86**
7461	0.00	0.00	**0.33**	0.00	**0.45**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.18**	**0.13**	0.00	0.00	0.00	0.00	**0.09**	0.00	**0.06**	**1.00**	0.00	**0.84**	0.00	0.00	0.00	0.00	**0.36**	0.00	0.00	0.00	0.00	**0.08**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	0.00	**0.21**
8842	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	0.00	0.00	0.00	**0.27**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.60**	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	**0.79**	**0.83**	0.00	0.00	0.00	0.00	**0.28**	0.00	**0.94**	0.00	0.00	0.00	**0.11**	0.00	0.00	0.00	0.00	0.00	**0.57**	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00
7153	0.00	**0.06**	**0.40**	0.00	**0.59**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.15**	**0.10**	0.00	0.00	0.00	0.00	**0.18**	0.00	**0.08**	**0.84**	0.00	**1.00**	0.00	0.00	0.00	0.00	**0.52**	0.00	0.00	0.00	0.00	**0.12**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.09**	0.00	**0.32**
565	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.30**	0.00	0.00	0.00	0.00	0.00	0.00	**0.79**	0.00	**1.00**	**0.70**	0.00	0.00	0.00	0.00	0.00	0.00	**0.98**	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	**0.45**	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10560	0.00	0.00	0.00	0.00	0.00	0.00	**0.50**	0.00	0.00	0.00	**0.56**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.49**	0.00	0.00	0.00	0.00	0.00	0.00	**0.83**	0.00	**0.70**	**1.00**	0.00	0.00	0.00	0.00	**0.49**	**0.09**	**0.88**	0.00	0.00	0.00	**0.07**	0.00	0.00	0.00	0.00	0.00	**0.37**	0.00	**0.11**	0.00	0.00	0.00	0.00	0.00
10782	0.00	**0.53**	0.00	0.00	**0.14**	0.00	0.00	**0.13**	0.00	0.00	0.00	0.00	**0.11**	0.00	0.00	0.00	0.00	0.00	0.00	**0.39**	0.00	0.00	0.00	**0.18**	**0.68**	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	**0.42**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**
3641	0.00	0.00	0.00	**0.40**	0.00	0.00	0.00	0.00	0.00	**0.68**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.40**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.71**	0.00	0.00	0.00	0.00	0.00	**0.16**	0.00	0.00	0.00	0.00	0.00	0.00
3663	**0.09**	**0.37**	**0.63**	0.00	**0.97**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	**0.43**	**0.22**	**0.20**	0.00	**0.07**	0.00	**0.78**	**0.16**	**0.83**	**0.36**	0.00	**0.52**	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	**0.51**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.23**	0.00	0.00	0.00	0.00	**0.06**	**0.46**	**0.21**	**0.98**
7942	0.00	0.00	0.00	**0.52**	0.00	**0.10**	0.00	0.00	**1.00**	**0.25**	0.00	0.00	0.00	**0.24**	**0.42**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.26**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	**0.14**	0.00	0.00	**0.25**	0.00	0.00	0.00	0.00	0.00	**0.24**	0.00	0.00	0.00	0.00
9867	0.00	0.00	0.00	0.00	0.00	0.00	**0.22**	0.00	0.00	0.00	**0.78**	0.00	0.00	0.00	**0.12**	0.00	0.00	0.00	0.00	0.00	**0.34**	0.00	0.00	0.00	0.00	0.00	0.00	**0.28**	0.00	0.00	**0.49**	0.00	0.00	0.00	0.00	**1.00**	**0.49**	**0.30**	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	**0.16**	0.00	**0.40**	0.00	0.00	0.00	0.00	0.00
8655	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.39**	0.00	0.00	**0.09**	**0.21**	0.00	0.00	0.00	0.00	0.00	**0.08**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.09**	0.00	0.00	0.00	0.00	**0.49**	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.47**	0.00	0.00	0.00	0.00	0.00
492	0.00	0.00	0.00	0.00	0.00	0.00	**0.27**	0.00	0.00	0.00	**0.32**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.59**	0.00	0.00	0.00	0.00	0.00	0.00	**0.94**	0.00	**0.98**	**0.88**	0.00	0.00	0.00	0.00	**0.30**	0.00	**1.00**	0.00	0.00	0.00	**0.12**	0.00	0.00	0.00	0.00	0.00	**0.58**	0.00	**0.08**	0.00	0.00	0.00	0.00	0.00
3818	0.00	**0.59**	**0.26**	0.00	**0.76**	0.00	0.00	**0.39**	0.00	0.00	0.00	**0.20**	**0.69**	0.00	0.00	0.00	0.00	**0.12**	**0.06**	**0.95**	0.00	0.00	**0.26**	**0.71**	**0.83**	**0.73**	**0.08**	0.00	**0.12**	0.00	0.00	**0.42**	0.00	**0.51**	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	**0.69**	0.00	0.00	**0.09**	0.00	**0.15**	0.00	0.00	0.00	**0.17**	**0.10**	**0.55**
4702	0.00	0.00	0.00	0.00	0.00	**0.10**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.76**	**0.64**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	**0.15**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.48**	0.00	0.00	0.00	0.00
10507	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.16**	**0.17**	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.15**	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.81**	0.00	0.00	0.00	0.00
3670	0.00	0.00	0.00	**0.12**	0.00	**0.41**	0.00	0.00	**0.17**	**0.11**	0.00	0.00	0.00	**0.17**	**0.37**	0.00	0.00	0.00	0.00	0.00	**0.36**	0.00	**0.23**	0.00	0.00	0.00	0.00	**0.11**	0.00	**0.06**	**0.07**	0.00	0.00	0.00	**0.14**	**0.06**	0.00	**0.12**	0.00	0.00	0.00	**1.00**	0.00	0.00	**0.85**	0.00	0.00	**0.53**	**0.07**	**0.13**	**0.06**	0.00	0.00	0.00	0.00
10781	0.00	0.00	0.00	**0.25**	0.00	0.00	0.00	**0.10**	0.00	**0.66**	0.00	**0.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.49**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.71**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	**0.38**	0.00	0.00	**0.36**	0.00	0.00	0.00	0.00	0.00	0.00

continued on next page

Feature	290	1189	207	2195	235	7558	7559	3569	3756	3545	11342	4683	4729	3696	3710	4871	4902	4931	6138	7201	7880	379	376	6095	6154	6098	7461	8842	7153	565	10560	10782	3641	3663	7942	9867	8655	492	3818	4702	10507	3670	10781	10729	10561	6129	6153	438	1575	3679	4682	4768	200	2157	2160
10729	0.00	**0.10**	0.00	0.00	**0.31**	0.00	0.00	**0.31**	0.00	0.00	0.00	**0.25**	**0.92**	0.00	0.00	0.00	0.00	0.00	0.00	**0.49**	0.00	0.00	**0.38**	**0.06**	**0.53**	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.69**	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	**0.14**	0.00	0.00	0.00	0.00	0.00	0.00
10561	0.00	0.00	0.00	**0.28**	0.00	**0.37**	0.00	0.00	**0.25**	**0.25**	0.00	0.00	0.00	**0.17**	**0.39**	0.00	0.00	0.00	0.00	0.00	**0.10**	0.00	**0.36**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.25**	0.00	0.00	0.00	0.00	0.00	0.00	**0.85**	0.00	0.00	**1.00**	0.00	0.00	**0.15**	**0.15**	0.00	**0.06**	0.00	0.00	0.00	0.00
6129	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.20**	0.00	**0.11**	0.00	**0.11**	**0.05**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.24**	0.00	**0.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.38**	0.00	0.00	**1.00**	0.00	0.00	**0.13**	0.00	0.00	0.00	0.00	0.00	0.00
6153	**0.50**	**0.27**	**0.94**	0.00	**0.37**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.78**	**0.73**	0.00	0.00	**0.37**	0.00	**0.23**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.23**	0.00	0.00	0.00	0.00	**0.09**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	**0.44**	**0.75**	**0.98**	**0.20**
438	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.11**	0.00	0.00	0.00	**0.17**	0.00	0.00	0.00	0.00	0.00	**0.81**	0.00	0.00	0.00	0.00	0.00	0.00	**0.57**	0.00	**0.45**	**0.37**	0.00	0.00	0.00	0.00	**0.16**	0.00	**0.58**	0.00	0.00	0.00	**0.53**	0.00	0.00	**0.15**	0.00	0.00	**1.00**	0.00	**0.13**	0.00	0.00	0.00	0.00	0.00
1575	0.00	0.00	0.00	**0.27**	**0.07**	0.00	0.00	**0.29**	0.00	**0.76**	0.00	**0.83**	**0.22**	0.00	0.00	0.00	0.00	0.00	0.00	**0.05**	0.00	0.00	**1.00**	0.00	**0.12**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.16**	0.00	0.00	0.00	0.00	0.00	**0.15**	0.00	0.00	**0.07**	**0.36**	**0.14**	**0.15**	**0.13**	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00	0.00
3679	0.00	0.00	0.00	0.00	0.00	**0.08**	0.00	0.00	0.00	0.00	**0.22**	0.00	0.00	**0.15**	**0.42**	0.00	0.00	0.00	0.00	0.00	**0.31**	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**	0.00	0.00	**0.11**	0.00	0.00	0.00	0.00	**0.40**	**0.47**	**0.08**	0.00	0.00	0.00	**0.13**	0.00	0.00	0.00	0.00	0.00	**0.13**	0.00	**1.00**	0.00	0.00	0.00	0.00	0.00
4682	0.00	0.00	0.00	**0.20**	0.00	**0.15**	0.00	0.00	**0.28**	**0.13**	0.00	0.00	0.00	**0.50**	**0.45**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.10**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.24**	0.00	0.00	0.00	0.00	**0.48**	**0.81**	**0.06**	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	**1.00**	0.00	0.00	0.00	0.00
4768	**0.79**	**0.08**	**0.65**	0.00	**0.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.40**	**0.91**	0.00	0.00	**0.88**	0.00	**0.07**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.06**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.44**	0.00	0.00	0.00	0.00	**1.00**	**0.18**	**0.45**	0.00
200	**0.24**	**0.32**	**0.99**	0.00	**0.58**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.91**	**0.57**	0.00	0.00	**0.18**	0.00	**0.47**	0.00	**0.13**	**0.11**	0.00	**0.09**	0.00	0.00	0.00	0.00	**0.46**	0.00	0.00	0.00	0.00	**0.17**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.75**	0.00	0.00	0.00	0.00	**0.18**	**1.00**	**0.71**	**0.48**
2157	**0.55**	**0.33**	**0.91**	0.00	**0.37**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.73**	**0.68**	0.00	0.00	**0.34**	0.00	**0.31**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.21**	0.00	0.00	0.00	0.00	**0.10**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.98**	0.00	0.00	0.00	0.00	**0.45**	**0.71**	**1.00**	**0.22**
2160	**0.11**	**0.44**	**0.63**	0.00	**0.98**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.37**	**0.17**	**0.20**	0.00	0.00	0.00	**0.90**	**0.25**	**0.86**	**0.21**	0.00	**0.32**	0.00	0.00	**0.06**	0.00	**0.98**	0.00	0.00	0.00	0.00	**0.55**	0.00	0.00	0.00	0.00	0.00	0.00	0.00	**0.20**	0.00	0.00	0.00	0.00	0.00	**0.48**	**0.22**	**1.00**

APPENDIX 3.A

Ceramics from the Phase 1 Investigations at Mescal Wash

Data-Collection Procedures

A total of 2,954 ceramic sherds were collected and subjected to typological analysis during the Phase 1 testing program at Mescal Wash (Table 3.A.1). Several hundred sherds per locus were recovered in Loci A, C, D, E, and F, which provided a robust sample for making general interpretations of chronology and cultural affiliation, but only 57 were recovered in Locus B, an insufficient amount for analysis. Formal and paste attributes were not recorded for sherds recovered during Phase 1 testing; rather, typological information was collected, to infer chronological information from temporally diagnostic painted wares and types and to obtain information required to make decisions about the Phase 2 data recovery.

The type- and ware-coding procedures were based on a hierarchical classification system. Sherds and vessels were initially sorted into plain wares, red wares, and painted wares. Within these broad classes, more-detailed ware and typological classifications were made, based on selected attributes, such as design elements and motifs (for painted sherds) and paste inclusions (for plain and red wares).

We employed Heckman et al.'s (2000) typological system to classify painted sherds and to link them with specific regional pottery-making traditions (e.g., the Hohokam Buff Ware tradition, the Dragoon brown ware tradition, etc.). The painted sherds were classified according to the various prehistoric period painted-pottery traditions in the southern deserts of the Southwest, mainly the Hohokam Buff Ware tradition (centered in the Phoenix Basin), the Tucson Basin brown ware tradition, the Dragoon brown ware tradition, and the San Simon brown ware tradition (see Heckman et al. 2000). Painted sherds associated with other regional traditions were recovered in low frequencies, including the Mimbres, Trincheras, and Roosevelt Red Ware traditions. In some cases, we added categories to accommodate sherds that could not be assigned to specific types (e.g., "Indeterminate red-on-buff" for Hohokam buff wares). We also devised "split categories" for painted sherds for which we were unable to distinguish between two possible ware traditions (e.g., "Dragoon or San Simon Red-on-brown" and "Tucson Basin or Dragoon Red-on-brown"). Painted sherds and vessels composed 20 percent of the Phase 1 collection (598 sherds) (see Table 3.A.1). The approximate date ranges for the temporally diagnostic painted-pottery ware and type classes are listed in Table 3.A.2.

Our typological system for unpainted sherds was modified from a system developed by Deaver (1984) for analysis of ceramic collections from Hohokam sites in the Santa Rita Mountains (see Heckman 2001). All plain ware and red ware sherds were classified into one of four categories (Types I–IV). Types I and II are both characterized by a paste matrix composed of sand particles (typically quartz) with minor amounts of mica. These two types are distinguished on the basis of surface treatment. No Type I sherds were identified during the Phase 1 testing. Type III pastes contain abundant coarse micaceous-schist and rock inclusions, and Type IV pastes contain large particles of foliated-rock inclusions, such as phyllite or micaceous materials (for details, see Garraty and Heckman, Chapter 3 of this volume). Unpainted plain ware and red ware sherds and vessels composed 79 percent of the Phase 1 collection (2,331 sherds). Of the unpainted wares, the overwhelming majority of sherds were from plain ware vessels (96 percent, or 2,231 sherds); red ware sherds composed 4 percent of unpainted sherds (100 sherds).

General Results

Phoenix Basin (Hohokam) buff wares were the most frequent painted-ware class (82 sherds) in the Phase 1 collection. They composed 14 percent of the painted sherds

Table 3.A.1. Ceramic Ware and Type Distribution per Locus

Type	Locus A	Locus B	Locus C	Locus D	Locus E	Locus F	Nonlocus	Total
Hohokam Buff Ware (Phoenix Basin)								
Snaketown Red-on-buff	—	—	—	1	—	—	1	2
Snaketown or Gila Butte Red-on-buff	—	—	—	1	—	—	—	1
Gila Butte Red-on-buff	—	—	—	2	—	—	—	2
Gila Butte or Santa Cruz Red-on-buff	—	—	3	1	—	—	1	5
Santa Cruz Red-on-buff	—	—	1	5	—	—	3	9
Santa Cruz or Sacaton Red-on-buff	—	—	—	1	—	—	—	1
Sacaton Red-on-buff	2	—	2	—	—	—	—	4
Indeterminate Hohokam Buff Ware	4	—	13	28	9	—	4	58
Total Hohokam Buff Ware	6	—	19	39	9	—	9	82
Percent per locus (column)	1.7	—	3.6	4.4	2.6	—	1.9	2.8
Tucson Basin Brown Ware								
Cañada del Oro Red-on-brown	—	—	1	1	—	—	—	2
Rillito Red-on-brown	—	—	—	35[a]	—	5	5	45[a]
Rillito or Rincon Red-on-brown	—	—	2	—	—	—	2	4
Rincon Red-on-brown	1	—	1	1	—	—	—	3
Indeterminate Tucson Basin Red-on-brown	4	—	—	4	—	—	—	8
Santa Cruz (brown paste)	—	1	2	—	—	—	2	5
Total Tucson Basin brown ware	5	1	6	41	—	5	9	67
Percent per locus (column)	1.5	1.8	1.1	4.6	—	1.5	1.9	2.3
Dragoon Brown Ware								
Dragoon Red-on-brown (ca. pre-A.D. 950)	2	—	2	2	1	1	2	10
Dragoon Red-on-brown (ca. post-A.D. 950)	13	—	11	1	2	—	4	31
Total Dragoon brown ware	15	—	13	3	3	1	6	41
Percent per locus (column)	4.4	—	2.5	0.3	0.9	0.3	1.3	1.4
San Simon Brown Ware								
Dos Cabezas Red-on-brown	—	—	—	2	—	—	—	2
Dos Cabezas or Pinaleño Red-on-brown	—	—	—	1	—	—	—	1
Galiuro Red-on-brown	—	—	3	4	—	—	3	10
Cerros Red-on-white (Galiuro style)	—	—	—	1	—	—	1	2
Encinas Red-on-brown	—	—	1	—	—	—	1	2
Indeterminate San Simon Red-on-brown	—	—	2	1	—	—	—	3
Total San Simon brown ware	—	—	6	9	—	—	5	20
Percent per locus (column)	—	—	1.1	0.8	—	—	1.1	0.7
Other Decorated Wares								
Mimbres Black-on-white	—	—	3	—	—	—	—	3
Trincheras Purple-on-red (specular)	—	—	3	1	—	—	2	6
Rio Rico Polychrome	—	—	1	—	—	—	—	1
Gila Polychrome	—	—	—	1	8	—	7	16
Total other decorated wares	—	—	7	2	8	—	9	26
Percent per locus (column)	—	—	1.3	0.2	2.3	—	1.9	0.9
Split and Indeterminate Decorated Categories								
Gila Butte Red-on-buff or Cañada del Oro Red-on-brown	—	—	1	—	—	—	—	1

Type	Locus A	Locus B	Locus C	Locus D	Locus E	Locus F	Nonlocus	Total
Gila Butte Red-on-buff or Cañada del Oro Red-on-brown (incised)	—	—	—	2	—	—	—	2
Tucson Basin or Dragoon Red-on-brown (pre-A.D. 950)	6	—	9	2	4	2	—	23
Tucson Basin or Dragoon Red-on-brown (post-A.D. 950)	5	2	—	—	—	—	6	13
Dragoon or San Simon Red-on-brown (pre-A.D. 950)	—	—	7	5	1	—	7	20
Dragoon or San Simon Red-on-brown (post-A.D. 950)	2	—	1	1	2	—	—	6
Indeterminate Red-on-brown	83	5	71	63	39	6	30	297
Total split and indeterminate decorated categories	96	7	89	73	46	8	43	362
Percent per locus (column)	28.0	12.3	17.0	8.3	13.3	2.4	9.2	12.3
Plain Ware								
Type II (sand)	88	32	176	342	121	174	185	1,118
Type III (micaceous)	101	12	183	343	143	138	177	1,097
Type IV (phyllite)	—	1	1	1	2	4	7	16
Total plain ware	189	45	360	686	266	316	369	2,231
Percent per locus (column)	55.1	78.9	69.0	77.7	76.7	94.3	79.0	75.5
Red Ware								
Type II (sand)	25	4	19	13	7	5	16	89
Type III (micaceous)	5	—	2	3	—	—	—	10
Type IV (phyllite)	—	—	—	—	—	—	1	1
Total red ware	30	4	21	16	7	5	17	100
Percent per locus (column)	8.7	7.0	4.0	1.8	2.0	1.5	3.6	3.4
Too Small for Analysis								
Unidentified	2	—	1	14	8	—	—	25
Total	343	57	522	883	347	335	467	2,954

[a] Thirty-three sherds were from the same vessel.

Table 3.A.2. Painted-Pottery Wares, Types, and Date Ranges

Type or Ware Category	Date Range	Total
Tucson Basin Brown Ware		
Cañada del Oro Red-on-brown	A.D. 750–850	2
Rillito Red-on-brown	A.D. 850–950	45 (13)[a]
Rillito or Rincon Red-on-brown	A.D. 850–1150	4
Rincon Red-on-brown	A.D. 950–1150	3
Santa Cruz (brown paste)	A.D. 850–950	5
Total		59 (27)[a]
Hohokam Buff Ware (Phoenix Basin)		
Snaketown Red-on-buff	A.D. 700–800	2
Snaketown or Gila Butte Red-on-buff	A.D. 700–850	1
Gila Butte Red-on-buff	A.D. 750–850	2
Gila Butte or Santa Cruz Red-on-buff	A.D. 750–950	5
Santa Cruz Red-on-buff	A.D. 850–950	9

continued on next page

Type or Ware Category	Date Range	Total
Santa Cruz or Sacaton Red-on-buff	A.D. 850–1100	1
Sacaton Red-on-buff	A.D. 950–1150	4
Total		24
	Dragoon Brown Ware	
Dragoon Red-on-brown (ca. pre-A.D. 950)	A.D. 650–950	10
Dragoon Red-on-brown (ca. post-A.D. 950)	A.D. 950–1100	31
Total		41
	San Simon Brown Ware	
Dos Cabezas Red-on-brown	A.D. 650–750	2
Dos Cabezas or Pinaleño Red-on-brown	A.D. 700–800	1
Galiuro Red-on-brown	A.D. 700–950	10
Cerros Red-on-white	A.D. 950–1150	2
Encinas Red-on-brown	A.D. 950–1150	2
Total		17
	Low-Frequency Decorated Types	
Mimbres Black-on-white	A.D. 900–1150	3
Trincheras Purple-on-red (specular)	A.D. 700–1150	6
Rio Rico polychrome	A.D. 950–1150	1
Gila Polychrome	A.D. 1320–1450	16
Total		26
	Split and Indeterminate Categories	
Gila Butte Red-on-buff or Cañada del Oro Red-on-brown	A.D. 750–850	1
Gila Butte Red-on-buff or Cañada del Oro Red-on-brown (incised)	A.D. 750–850	2
Tucson Basin or Dragoon Red-on-brown (pre-A.D. 950)	A.D. 650–950	23
Tucson Basin or Dragoon Red-on-brown (post-A.D. 950)	A.D. 950–1300	13
Dragoon or San Simon Red-on-brown (pre-A.D. 950)	A.D. 650–950	20
Dragoon or San Simon Red-on-brown (post-A.D. 950)	A.D. 950–1150	6
Total		65

Note: From Heckman et al. (2000).a Thirty-three sherds were from the same vessel; the count in parentheses indicates the probable vessel count.

[a] Thirty-three sherds were from the same vessel; the count in parentheses indicates the probable vessel count.

and 3 percent of the entire collection. Tucson Basin brown wares were the second-most-frequent painted-ware class (67 sherds). In total sherd counts, they composed 11.2 percent of painted sherds and 2.3 percent of the entire collection, although 33 of the 67 sherds were from a single vessel, and therefore only 35 vessels were represented in the sherd collection. Assuming all other sherds were from separate vessels, the adjusted frequency of Tucson Basin brown wares declined to 5.9 percent of painted wares and 1.2 percent of all wares. Dragoon brown wares also were prevalent, constituting 6.9 percent of painted sherds and 1.4 percent of the entire collection.

Excluding indeterminate cases and split categories, the bulk of the painted sherds could be attributed to the Hohokam Buff Ware (Phoenix Basin), Tucson Basin brown ware, and Dragoon brown ware traditions. These painted-pottery traditions peaked during the Middle Formative period (A.D. 750–1150), which underscores the scope of habitation at Mescal Wash during this span. This result also suggests that the inhabitants of Mescal

Wash were most closely affiliated with the Tucson and Phoenix Basin Hohokam and the Dragoon Mogollon culture areas. The site inhabitants may have established social ties with populations in these areas. Another possibility is that the site was inhabited by migrants or colonists from these areas.

The trend in painted-pottery proportions generally accords with the results derived from the Phase 2 data recovery collection. One striking difference concerns the proportions of sherds attributed to the Tucson Basin and Phoenix Basin traditions. In the Phase 2 collection, Tucson Basin brown wares outnumbered Hohokam buff wares by a considerable margin (roughly 2.5 to 1) (see Garraty and Heckman, Chapter 3, this volume). This was not the case with the Phase 1 collection, in which Hohokam buff wares outnumbered Tucson Basin brown wares by almost 2.5 to 1, using the inferred vessel count for Tucson Basin brown wares (see above), but this result is probably misleading, given the very high frequency of indeterminate red-on-brown sherds (297 sherds). A substantial portion of these were probably related to the Tucson Basin tradition; therefore, the ratio of these wares to Hohokam buff wares is probably higher than the 2.5-to-1 ratio derived from the identifiable wares and types listed in Table 3.A.1.

Lower-frequency painted wares included San Simon brown wares (20 sherds, or 3.3 percent of painted sherds and 0.6 percent of all sherds), Roosevelt Red Ware (16 sherds, or 2.7 percent of painted sherds and 0.5 percent of all sherds), Trincheras pottery (6 sherds), Mimbres Black-on-white (3 sherds), and 1 Rio Rico Polychrome sherd. These low frequencies suggest sporadic social interaction or exchange with populations in these areas. The presence of Roosevelt Red Ware sherds (all Gila Polychrome) indicates a Late Formative period phase component in Loci D and E, where these sherds were recovered.

Plain wares composed the bulk of the collection (79 percent), most of which had sand or micaceous-schist inclusions (Types II and III, respectively) that either were added as temper during construction or naturally occurred in the clays used to manufacture plain ware pottery. A similar number of plain ware sherds with mica-schist (1,097 sherds) and sand (1,118 sherds) inclusions were recovered, suggesting local manufacture of plain wares of both types. In contrast, only 9 sherds with phyllite-schist inclusions (Type IV) were recovered, which implies that these types were imports made with nonlocal clays and tempers, although compositional analysis would be required to corroborate this hypothesis. These results are substantially different from the plain ware types recorded during the Phase 2 data recovery. In the Phase 2 collection, Type II plain wares outnumbered Type III sherds by about 3.4 to 1. The reason for this discrepancy is not clear, especially in light of the relatively similar proportions of painted wares. The low proportion of Type IV sherds in the Phase 1 collection is consistent with the Phase 2 results.

For red wares, Type II sand-tempered sherds outnumbered the Type III mica-schist-tempered sherds by about 9 to 1. Only 1 phyllite-tempered red ware sherd was recovered. These data suggest that potters in the areas used sand temper (or naturally sandy clays) for making red ware vessels. This pattern is broadly consistent with the Phase 2 results, in which Type II red wares outnumbered Type III red wares by 27 to 1. As in Phase 1, only 1 Type IV red ware sherd was recovered during the Phase 2 excavations.

Locus A

A total of 343 sherds were recovered in Locus A, including 219 unpainted sherds (63.8 percent), 122 painted sherds (35.6 percent), and 2 sherds (0.6 percent) that were too small for analysis (see Table 3.A.1). Unpainted wares included 189 plain ware sherds and 30 red ware sherds, which is the highest proportion of red wares among the loci. Type III plain wares (mica schist) slightly outnumbered Type II plain wares (sand), which is consistent with the site-wide results (except Loci B and F). No phyllite-tempered Type IV plain wares were recovered. For red wares, Type II sherds (25 sherds) outnumbered Type III sherds (5 sherds) by 5 to 1, a ratio that is roughly consistent among the loci.

Among the painted sherds identified by regional tradition, Dragoon brown wares were the most frequent (15 sherds); they composed 58 percent of painted sherds attributable to a specific regional tradition (a total of 26 sherds) and 12 percent of all painted sherds (i.e., including indeterminate and split categories). The second-most-frequent painted-ware category was Phoenix Basin (Hohokam) buff wares (6 sherds), which composed 23 percent of painted sherds attributable to a specific regional tradition and 5 percent of all painted sherds. Tucson Basin brown wares (5 sherds) composed only 19 percent of painted sherds attributable to a specific regional tradition and 4 percent of all painted sherds. The relatively low frequency of Tucson Basin wares was surprising, given the site's proximity to the Tucson Basin, but 83 indeterminate red-on-brown sherds were recovered from Locus A, and probably, many of these sherds were from Tucson Basin brown ware vessels. No San Simon brown wares or additional painted wares were recovered during Phase 1 testing in Locus A.

Temporally diagnostic sherds included 13 Dragoon Red-on-brown sherds that likely postdate A.D. 950, 2 Sacaton Red-on-buff sherds (ca. A.D. 950–1150), 1 Rincon Red-on-brown sherd (A.D. 950–1150), and 1 Dragoon Red-on-brown sherd that likely predates A.D. 950. These results suggest a date range during the second half of the Middle Formative period, roughly A.D. 950–1150, although the presence of 2 possibly early Dragoon-style sherds could indicate an earlier component, during the first half of the Middle Formative period (ca. A.D. 750–950).

Locus B

Only 57 sherds were recovered during Phase 1 testing in Locus B, including 49 unpainted sherds and 8 painted sherds (see Table 3.A.1). Unpainted wares included 45 plain ware sherds and 4 red ware sherds. For the plain ware sherds, Type II sherds (32 sherds) out-numbered Type III sherds (12 sherds). One phyllite-tempered Type IV sherd was also recovered. All four of the red ware sherds were sand-tempered. The painted wares include 5 indeterminate red-on-brown sherds, 2 Tucson Basin or Dragoon Red-on-brown elaborated sherds (post-A.D. 950), and 1 Santa Cruz (brown paste) sherd (A.D. 850–950). No chronological information could be gleaned from this small collection.

Locus C

A total of 522 sherds were recovered during Phase 1 testing in Locus C, including 381 unpainted sherds (73.0 percent), 140 painted sherds (26.8 percent), and 1 sherd (0.2 percent) that was considered too small for analysis (see Table 3.A.1). Unpainted wares included 360 plain ware sherds and 21 red ware sherds. Among the plain wares, the frequency of Type II sherds with sand inclusions and Type III sherds with mica-schist inclusions were virtually equal (176 and 183 sherds, respectively), a trend observed also on a site-wide scale. One phyllite-tempered Type IV plain ware was recovered. For red wares, Type II sherds (19 sherds) outnumbered Type III sherds (2 sherds) by almost 9 to 1.

Among the painted sherds identified by regional tradition, Phoenix Basin (Hohokam) buff wares were the most frequent (19 sherds); they composed 37 percent of painted sherds attributable to a specific regional tradition (a total of 51 sherds) and 14 percent of all painted sherds (i.e., including indeterminate and split categories). The second-most-frequent painted-ware category was Dragoon brown wares (13 sherds), which composed 25 percent of painted sherds attributable to a specific regional tradition and 9 percent of all painted sherds. An equal number of Tucson Basin and San Simon brown ware sherds were recovered (6 sherds apiece), which is surprising, given the abundance of Tucson Basin wares in the larger Phase 2 collection. These wares composed only 8 percent of painted sherds attributable to a specific regional tradition and 4 percent of all painted sherds, but additional Tucson Basin brown ware vessels may have been represented among the 83 indeterminate red-on-brown sherds. Additional low-frequency painted sherds recovered in Locus C included 3 Mimbres Black-on-white sherds, 3 Trincheras Purple-on-red sherds, and 1 Rio Rico Polychrome sherd.

A sizable collection of 36 temporally diagnostic painted sherds were recovered in Locus C. The temporally diagnostic Hohokam Buff wares included 3 Gila Butte or Santa Cruz Red-on-buff sherds (A.D. 750–950), 1 Santa Cruz Red-on-buff sherd (A.D. 850–950), and 2 Sacaton Red-on-buff sherds (A.D. 950–1150). Most of the Dragoon brown wares were types likely made after A.D. 950 (11 sherds), but 2 sherds from the earlier Dragoon-style vessels (pre-A.D. 950) also were recovered. Six Tucson Basin brown ware sherds were recovered in Locus C, including 1 Cañada del Oro Red-on-brown (A.D. 750–850), 1 Rincon Red-on-brown (A.D. 950–1150), 2 Rillito or Rincon Red-on-brown (A.D. 850–1150), and 2 Santa Cruz (A.D. 850–950). Among the San Simon brown wares, 3 Galiuro Red-on-brown sherds (A.D. 700–950) and 1 Encinas Red-on-brown sherd (A.D. 950–1150) was recovered. The low-frequency painted sherds also were diagnostic; these included 3 Mimbres Black-on-white sherds (A.D. 900–1150), 3 Trincheras Purple-on-red sherds with specular paint (A.D. 700–1150), and 1 Rio Rico Polychrome sherd (A.D. 950–1150). These 36 temporally diagnostic sherds suggest an occupation span in the Middle Formative period (A.D. 750–1150), although most of these sherds dated to the latter half of this period, roughly A.D. 950–1150.

Locus D

A total of 833 sherds were recovered during Phase 1 testing in Locus D, including 702 unpainted sherds (79.5 percent), 167 painted sherds (19.0 percent), and 14 sherds (1.5 percent) considered too small for analysis (see Table 3.A.1), but the painted-sherd collection from Locus D included 33 sherds from the same vessel (a Rillito Red-on-brown vessel) and therefore represents no more than 135 vessels. Unpainted wares included 686 plain ware sherds and 16 red ware sherds. Among the plain wares, the frequency of Type II sherds with sand inclusions and Type III sherds with mica-schist inclusions were nearly equal (342 and 343 sherds, respectively), a trend observed also on a site-wide scale. One phyllite-tempered Type IV plain ware sherd was recovered. For red wares, Type II sherds (13 sherds) outnumbered Type III sherds (3 sherds) by more than 4 to 1, another ratio that is roughly consistent within the larger project area.

Among the painted sherds identified by regional tradition, Tucson Basin brown wares were the most frequent (41 sherds) and composed 46 percent of painted sherds attributable to a specific regional tradition (a total of 94 sherds) and 25 percent of all painted sherds (i.e., including indeterminate and split categories), but 33 of these sherds derived from a single vessel; therefore, the probable number of vessels represented in this collection was 13. By this calculation, the proportion of Tucson Basin brown wares was considerably lower than that of Phoenix Basin (Hohokam) buff wares (39 sherds), which composed 41 percent of painted sherds attributable to a specific regional tradition and 23 percent of all painted sherds. If we assume that each sherd was from a separate vessel, the Phoenix Basin buff wares outnumbered the Tucson Basin brown wares by 3 to 1. Smaller numbers of painted sherds associated with the San Simon (9 sherds) and Dragoon (3 sherds) traditions in the Mogollon region were recovered. One Gila Polychrome sherd and 1 Trincheras Purple-on-red sherd also were recovered. Seventy-three additional painted sherds could not be clearly assigned to one of the regional traditions, most of which (63 sherds) were indeterminate red-on-brown.

Twenty-nine temporally diagnostic painted sherds were recovered in Locus D. The temporally diagnostic Hohokam buff wares included 1 Snaketown or Gila Butte Red-on-buff sherd (A.D. 700–850), 2 Gila Butte Red-on-buff sherds (A.D. 750–850), 1 Gila Butte or Santa Cruz Red-on-buff sherd (A.D. 750–950), 2 Santa Cruz Red-on-buff sherds (A.D. 850–950), 2 Santa Cruz or Sacaton Red-on-buff sherd (A.D. 850–1150), and 1 Snaketown Red-on-buff sherd (A.D. 700–800). Five temporally diagnostic Tucson Basin brown ware specimens were recovered (counting the 33 sherds from a single Rillito Red-on-brown vessel as 1 specimen). These included 1 Cañada del Oro Red-on-brown sherd (A.D. 750–850), 3 Rillito Red-on-brown specimens (A.D. 850–950), and 1 Rincon Red-on-brown sherd (A.D. 950–1150). The 8 San Simon brown wares included 2 Dos Cabezas Red-on-brown sherds (A.D. 650–750), 1 Dos Cabezas or Pinaleño Red-on-brown sherd (A.D. 700–800), 4 Galiuro Red-on-brown sherds (A.D. 700–950), and 1 Cerros Red-on-white sherd (A.D. 950–1150). Finally, the 3 Dragoon brown wares included 2 sherds from vessels that were likely made before A.D. 950 and 1 sherd from a vessel that was likely made after A.D. 950. One Roosevelt Red Ware, a Gila Polychrome sherd (A.D. 1320–1450), and 1 Trincheras Red-on-purple sherd (A.D. 700–1150) were also recovered.

In all, the temporally diagnostic painted-sherd collection from Locus D suggests a principal occupation during the first half of the Middle Formative period, about A.D. 750–950, although the presence of a Dos Cabezas Red-on-brown sherd could suggest a slightly earlier component (ca. A.D. 650–750), and the Rillito Red-on-brown and Santa Cruz or Sacaton Red-on-buff sherds could indicate a slightly later component, during the latter half of the Middle Formative period (ca. A.D. 950–1150). The presence of a Roosevelt Red Ware sherd indicates at least a small Late Formative period component (A.D. 1320–1450). The Phase 2 excavations in Locus D corroborated these temporal patterns, suggesting a largely early Middle Formative period occupation, with smaller Early Formative, late Middle Formative, and Late Formative period components (see Chapter 2, this volume).

Locus E

A total of 347 sherds were recovered from Locus E, including 273 unpainted sherds (79 percent), 66 painted sherds (19 percent), and 8 sherds that were too small for analysis (2 percent). Unpainted wares include 266 plain ware sherds and 7 red ware sherds. Among the plain wares, mica-schist tempered Type III sherds (143 sherds, 54 percent) are slightly more prevalent than sand-tempered Type II sherds (121 sherds, 45 percent). Two phyllite-tempered Type IV sherds (1 percent) also were recovered. This trend contrasts with most of the other loci (except Locus F), in which Types II and III sherds were generally equally frequent. All 7 red wares sherds were classified as Type II.

Only 27 painted sherds could be identified by regional tradition, including 9 Phoenix Basin (Hohokam) Red-on-buff sherds, 3 Dragoon or San Simon Red-on-brown ware sherds, 2 Dragoon Elaborated, 1 Dragoon Fine, 4 Dragoon Fine or Tucson Basin, and 8 Gila polychrome sherds. No Tucson Basin brown wares were identified, but these may be present among the 39 indeterminate red-on-brown sherds. None of the Hohokam buff wares were temporally diagnostic. However, the 3 Dragoon brown wares include 2 sherds from vessels (Elaborated) that were likely made after A.D. 950 and 1 (Fine) likely made prior to A.D. 950. The presence of Gila Polychrome (A.D. 1320–1450) indicates a Late Formative B period component, which is consistent with the presence of adobe architecture within the locus. Overall, the small number of temporally diagnostic painted sherds suggests a multicomponent occupation spanning the Middle and Late Formative periods. This multicomponent assemblage might explain the variable proportions of plain wares types relative to the other loci.

Locus F

A total of 335 sherds were recovered during Phase I testing in Locus F, including 321 unpainted sherds (96 percent) and 14 painted sherds (4 percent). The very low percentage of painted sherds in Locus F is an aberration among the site loci; in the other loci, painted sherds comprise between 18 and 36 percent of the total collections. The predominance of unpainted sherds might suggest a unique temporal association or function among the loci. The prehistoric occupants of Locus F may have conducted a limited array of activities that required few painted pottery vessels, such as storage or cooking.

Unpainted wares include 316 plain ware sherds and 5 red ware sherds. Among the plain wares, sand-tempered Type II sherds (174 sherds, 55 percent) are slightly more prevalent than mica-schist tempered Type III (138 sherds, 44 percent). Four Type IV phyllite-tempered sherds were recovered. This trend contrasts with most of the other loci (except Locus E), in which Types II and III sherds were generally equally frequent. All five red ware sherds were classified as Type II.

Painted sherds include 5 Rillito Red-on-brown (A.D. 850–950), 1 Dragoon Fine Red-on-brown, 2 Tucson Basin or Dragoon Fine Red-on-brown, and 6 indeterminate red-on-brown sherds. The Rillito Red-on-brown sherd suggests occupation during the first half of the Middle Formative period. The sample of painted sherds is far too small for making a robust inference about temporal association, however.

APPENDIX 3.B

Ceramic Artifacts from Burial Features

A total of 48 human burials (30 cremations and 18 inhumations) were investigated during Phase 1 and Phase 2 investigations (Vanderpot 2001; Vanderpot and Altschul 2000, 2007). This appendix presents brief descriptions of the ceramic artifacts recovered from these burial features during the Phase 1 and Phase 2 excavations. The burial ceramics are presented separately from the discussion of the nonburial ceramics in Chapter 3 of this volume for several reasons. First, all burial ceramics were recorded during fieldwork but were immediately turned over for repatriation. Therefore, they were not analyzed in the laboratory with the rest of the collection and, consequently, were not included in the ceramics database used for the analyses presented in Chapter 3. The in-field recording relied on paper records with detailed written descriptions and illustrations; the postfieldwork recording was more systematic and involved a larger number of metric, ordinal, and categorical attributes that were entered directly into the database by the ceramic analysts (see Appendix 3.C).

Second, the in-field recording relied on a different set of criteria and recorded attributes than did the postfieldwork recording. Unlike the treatment of the nonburial ceramics, which will be stored and made available for future investigations, SRI analysts were required to record as much information as possible about the burial ceramics within a relatively short period of time. For example, most of the ceramics from these features (mostly whole or reconstructible vessels) were illustrated in profile, and any salient decorative elements were separately illustrated (photographs were not permitted).

Overview of Burial Ceramics

Slightly less than one-quarter of the burials from Mescal Wash (11 of 48, or 23 percent) included ceramic artifacts that were clearly (and probably intentionally) interred as parts of the mortuary deposits (Table 3.B.1). Among the 11 burial features with ceramic inclusions, 7 were recorded in Locus D, and 4 were recorded in Locus C, which is consistent with the denser and more-abundant concentration of features in Locus D relative to the other loci. The burial ceramics mostly consisted of intact or reconstructible vessels that were used as containers for cremated remains (burial urns) or were deposited as offerings placed in the burial pits during the mortuary interments. These 11 features minimally included 14 vessels. Eight of the 11 burials each included a single vessel that was unambiguously associated with the mortuary deposit; 3 others each included all or portions of 2 distinct ceramic vessels (Features 3604, 4221, and 6090).

For each of the remaining 37 features, either no ceramic artifacts were recovered in the feature matrix or a small number of sherds or vessel fragments were recovered in the fill and *probably* were not interred during the mortuary event. Many of these "unassociated" sherds may have been translocated into the feature matrix long after the interment event, as a result of bioturbation or later construction episodes. In other cases, scattered sherds may have been inadvertently included in the soil fill used to cover the mortuary remains (but see Chapter 11, this volume); similarly, some sherds or vessel fragments may have been from preexisting features into which the burial pits intruded (e.g., Feature 5512). These unassociated sherds are not reported in this appendix, given their low probability of having been interred as parts of the mortuary events (or as postinterment offerings). Rather, as explained in Chapter 3 of this volume, they were included in the larger, nonburial-ceramic collection used for the statistical analyses presented in that chapter. In the remainder of this appendix, we focus only on the 11 burial features with associated ceramic artifacts.

Table 3.B.1. Overview of Ceramic Inclusions in Burial Features

Feature	Locus	Description	Ceramic Inclusions
220	A	secondary cremation	no ceramic artifacts
320	C	secondary cremation	crushed plain ware bowl inverted and placed as cap on funnel-shaped burial pit
333	C	secondary cremation, urn burial	Sacaton Red-on-buff jar inverted over cremated remains; likely former jar with neck from which neck was removed, with refurbished rim at break of neck-body juncture
336	D	inhumation	sherds in fill; partial plain ware vessel in fill might be offering related to human remains; small clay ball in rodent burrow
380	E	secondary cremation	sherds in fill; no ceramic burial items
381	E	secondary cremation	no ceramic artifacts
464	D	secondary cremation	1 sherd in fill; no ceramic burial items
561	D	secondary cremation	red ware bowl inverted and placed as cap on top of pit
562	D	secondary cremation	sherds in fill; no ceramic burial items
2679	D	inhumation	sherds in fill; no ceramic burial items
3528	D	inhumation	sherds in fill; no ceramic burial items
3564	D	inhumation	sherds in fill; Dragoon Red-on-brown (elaborated) bowl with flared rim situated adjacent to skull
3604	D	secondary cremation	a small Dragoon Red-on-brown bowl (San Simon style) placed upright over calcined bones; a second, fragmented Dragoon Red-on-brown bowl also placed above remains
3704	D	primary cremation	sherds in fill; no ceramic burial items
3875	D	secondary cremation	sherds in fill; no ceramic burial items
3943	D	inhumation	no ceramic artifacts
4057	D	secondary cremation, urn burial	plain ware jar inverted and placed over remains
4069	D	primary cremation	incomplete plain ware vessel (no rim) recovered near cremated remains
4221	D	primary cremation	cluster of plain ware sherds (including rims) that included the remains of two vessels recovered in burial pit
4739	D	secondary cremation	no ceramic artifacts
4740	D	inhumation	sherds in fill; no ceramic burial items
4794	D	secondary cremation	no ceramic artifacts
4798	D	primary cremation	no ceramic artifacts
4850	D	secondary cremation, urn burial	broken plain ware jar inverted and placed over remains
4886	D	inhumation	no ceramic artifacts
5512	D	inhumation	sherds in fill; neckless jar found at base of pit but likely associated with structure (Feature 189) into which the burial pit intruded
5992	D	secondary cremation	no ceramic artifacts
6007	C	inhumation	sherds in fill; no ceramic burial items
6045	C	secondary cremation	no ceramic artifacts
6074	C	secondary cremation	sherds in fill; no ceramic artifacts
6090	C	secondary cremation, urn burial	Rincon Red-on-brown jar with neck with Gila shoulder contained the remains; plain ware bowl inverted and placed as a cover over the urn
6123	C	inhumation	no ceramic artifacts
6191	C	inhumation	sherds in fill; no ceramic burial items
7170	C	inhumation	sherds in fill; no ceramic burial items
7335	C	secondary cremation	sherds in fill; no ceramic burial items
7456	C	secondary cremation	sherds in fill; no ceramic burial items

Feature	Locus	Description	Ceramic Inclusions
7457	C	inhumation	sherds in fill; no ceramic burial items
7458	C	inhumation	sherds in fill; no ceramic burial items
7472	C	secondary cremation, urn burial	Dragoon Red-on-brown (elaborated) jar contained the remains; upper portion of vessel (and any lid that may have been present) removed by backhoe
7833	D	inhumation	sherds in fill; no ceramic burial items
7847	D	secondary cremation	no ceramic artifacts
9410	C	inhumation	sherds in fill; no ceramic burial items
10138	C	secondary cremation	sherds in fill; no ceramic burial items
10645	D	inhumation	no ceramic artifacts
10674	D	secondary cremation	no ceramic artifacts
10698	C	inhumation	no ceramic artifacts
10707	C	secondary cremation	no ceramic artifacts
10711	D	secondary cremation	no ceramic artifacts

Burial-Ceramic Descriptions

Feature 320

Feature 320 consisted of a secondary cremation, much of which was removed by the backhoe during the excavation of Trench 237 in Locus C during the Phase 1 investigations in 2000. Once the feature was recognized, the SRI field crew screened the trench back dirt from the vicinity of the remains. The cremated remains were placed in a funnel-shaped pit that was capped with an inverted Type III plain ware bowl (see Chapter 3 of this volume for type descriptions). The vessel was heavily fragmented by the backhoe at the time of discovery and was later reconstructed by SRI ceramic analysts. This feature was an example of a "secondary pit cremation with capping vessel," one of four types of secondary cremation features defined in Chapter 11 of this volume.

The bowl exhibited a rounded, convex profile with an outflaring rim, a rounded rim tip, and a flattened base (Figure 3.B.1). The rim diameter was 23 cm, with a height of 10.5 cm; thickness ranged from about 6 to 9 mm. The interior surface was smudged and poorly smoothed (with visible finger marks); the more-oxidized exterior surface exhibited a light-brown to tan color, a well-smoothed surface, and soot stains around the base, possibly from exposure to fire. Both surfaces exhibited a pronounced micaceous sheen. Temper inclusions mainly consisted of very fine to coarse mica fragments and a small density of subangular-quartz fragments. The paste ranged from brown to gray, with a pronounced dark-gray core. The shape and presence of soot stains suggest that the vessel had functioned as a cooking pit prior to its use as a capping vessel for the cremated remains in Feature 320.

Feature 333

This secondary cremation was initially discovered during the excavation of Trench 234 in Locus C and was more fully exposed during mechanical stripping in the southeast area of Stripping Unit 5190. Trench 234 partially cut through the feature matrix. The feature consisted of secondary cremated remains covered with an inverted red-on-buff jar. Additional sherds also were recovered in the fill that probably were not deposited during the interment episode. This feature, with an inverted vessel placed over the human remains, was an example of one of two types of secondary urn cremations—and, more generally, one of the four types of secondary cremations described in Chapter 11 of this volume; the other type of secondary urn cremation is in an upright position with the human remains placed inside the vessel (often with a lid).

The inverted vessel (Vessel No. 7075) was readily identified as Sacaton Red-on-buff, a Phoenix Basin decorative style that was prominent during the Middle Formative B (Sedentary) period. It included red painted designs on the exterior surface only and is illustrated in Figure 3.B.2. The red painted designs were applied to the exterior surface with mineral-based paint, which was generally thin and eroded over much of the surface; the interior surface was not cleaned or analyzed, but it did not contain any visible evidence of painted decoration. Roughly 12 percent of the painted sherds recovered in Locus C were classified as Phoenix Basin–style painted wares (see Chapter 3, this volume); so, the recovery of a Phoenix Basin–style painted vessel in a burial context in this locus is not surprising.

The exterior surface was slipped with a fugitive and very-light-brown or tan clay slip. The vessel possessed a porous, orange paste, as is typical of Hohokam buff wares, with poorly sorted, subangular sand inclusions and no visible carbon core. According to Abbott (2007), buff ware

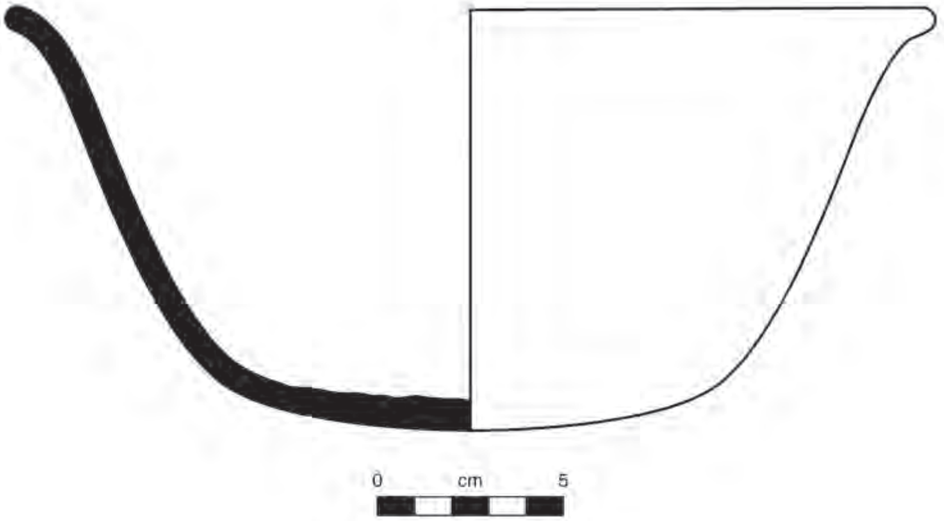


Figure 3.B.1. Profile of a plain ware capping vessel (bowl), Feature 320.

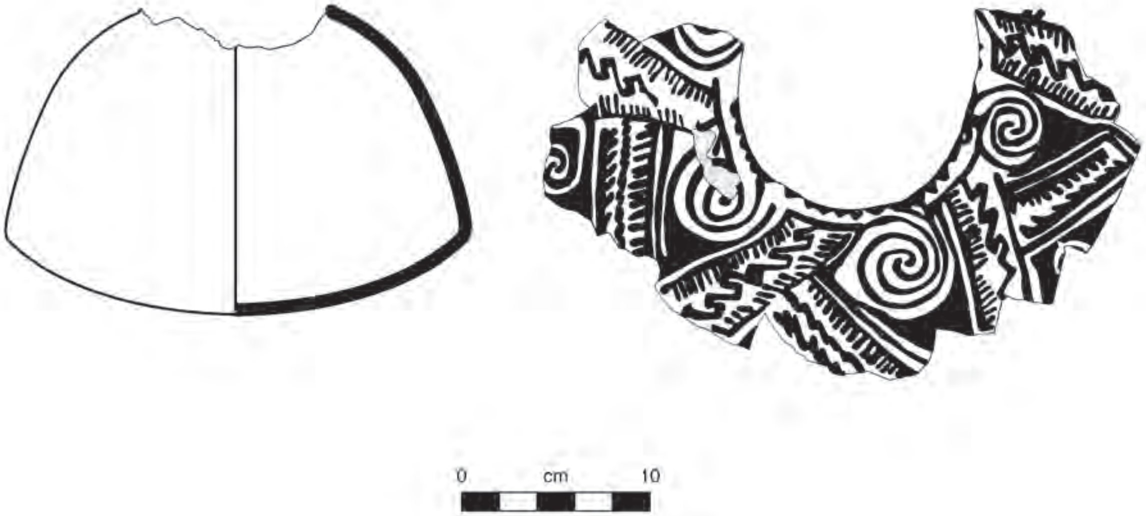


Figure 3.B.2. Profile and illustration of a Sacaton Red-on-buff capping vessel (jar with neck removed), Feature 333.

manufacturers created vessels with light-red or orange, porous pastes by mixing caliche into the raw clays prior to forming. Abbott further argued that these light pastes are emblematic of buff wares manufactured in the middle Gila Basin. If so, the vessel recovered in Feature 333 might have been manufactured by potters residing in the middle Gila Valley and brought to the Mescal Wash site by traders or migrants to the region.

The vessel was originally constructed as a jar with neck, with a rounded base and a well-defined Gila shoulder, a common formal attribute of Sacaton Red-on-buff vessels. The neck of the jar had broken off at some point prior to deposition, and a refurbished rim had been fashioned at the former body-neck juncture; the breakage juncture appeared to have been worked by rounding and smoothing. So, the refurbished vessel could be described as a neckless jar (see Figure 3.B.2). The vessel orifice at the body-neck juncture was 10 cm, with a maximum diameter of 24 cm at the shoulder. Wall thickness varied from 4.1 to 5 mm. The original function of this vessel is not certain, but no soot stains related to cooking were observed on the exterior. Unfortunately, the analyst was unable to inspect the uncleaned interior to detect evidence of abrasion or other potential indicators of function. Visible indentations on the surface suggested construction using a paddle-and-anvil technique.

Feature 561

This secondary pit cremation was exposed during mechanical stripping (Stripping Unit 500) in Locus D during the Phase 1 excavations. The feature consisted of a visible pit outline that contained cremated remains; the pit appeared to have been capped with an inverted Type II red ware bowl, although the vessel was largely fragmented at the time of discovery. Additional sherds were recovered in the fill, but these were not likely part of the original burial interment. The vessel was subsequently reconstructed by SRI ceramic analysts prior to being submitted for repatriation.

The upright red ware bowl exhibited a rounded, convex profile and a slightly flattened base, with a recurved rim and a rounded lip (Figure 3.B.3). Roughly 60 percent of the vessel was recovered. The rim diameter was 15 cm, with a slightly higher diameter maximum about halfway up the vessel sidewall, just below the incipient inward recurving in the upper sidewall. The vessel height was 9.8 cm. Breakage along coil junctures suggested coil construction. The exterior and interior surfaces exhibited a thin, reddish-orange slip with visible wiping and polishing marks. The interior surface showed marks made by smoothing the clay with a finger to smooth over the coil junctures; irregular wiping marks also were visible. The exterior surface, in contrast, revealed finely spaced polishing marks in a horizontal pattern in the upper 2 cm of the vessel below the rim; these overlay a vertical pattern in the middle and lower portions of the vessel. A small amount of light sooting was visible in some areas of the vessel, but with no discernable pattern; these marks might suggest that the vessel was used over a fire. The paste was reddish-orange in color, suggesting an oxidized firing atmosphere, with fine sand inclusions and occasional small biotite-mica fragments.

Feature 3564

This inhumation was found within the fill of a structure (Feature 430) in Locus D during the Phase 2 investigations. The body of an adult was found in an extended and supine position, with the head to the east. The body was probably placed in a shallow pit within the fill, but no pit outline was visible. A complete Dragoon Red-on-brown bowl with elaborated design (Heckman 2000b) was situated directly adjacent and to the left of the interred individual's skull; the placement and completeness of the vessel suggested that it was deliberately placed next to the buried individual

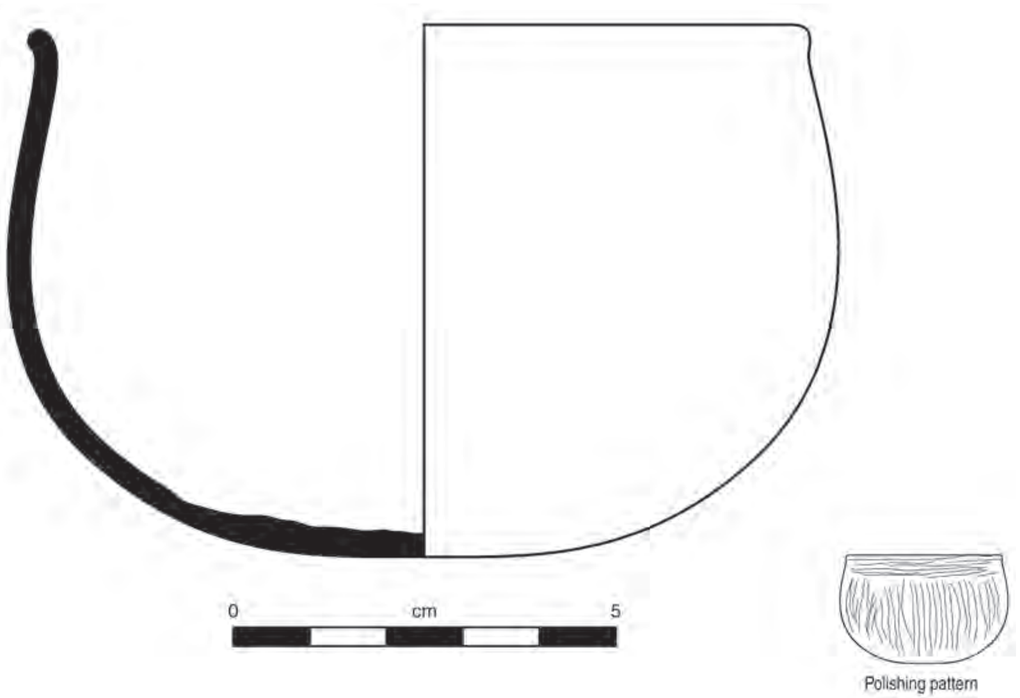


Figure 3.B.3. Profile and polishing pattern of a red ware capping vessel (bowl), Feature 561.

during the interment episode. Additional sherds and other debris were recovered from the structure fill. It is very likely that these were trash deposits that were unrelated to the burial event. A bifacial flaked stone tool also may have been part of the mortuary deposit.

The bowl was likely placed next to the inhumation as an offering and might have contained solid or liquid contents at the time of interment. The bowl was a Dragoon Red-on-brown artifact that exhibited what Heckman (2000b:51) referred to as elaborated designs, which were prevalent during a roughly 450-year span from about A.D. 950 to 1400, although additional chronological evidence from the site suggested a probable Middle Formative period date (A.D. 950–1150). Like many Dragoon elaborated-style designs, the vessel interred in Feature 3564 exhibited a quartered design field. A double-line cross pattern defined the four quarters on the interior surface, which contained alternating checkerboard and curvilinear patterns (Figure 3.B.4). The Dragoon tradition derives from the San Pedro Valley to the east of Mescal Wash, but we are unable to infer whether the vessel was made locally or imported from the San Pedro Valley. The design was rendered using a dark-red fugitive paint (10R 3/3) over a thin but well-adhering, tan slip (10YR 7/4). The painted design extended onto the vessel lip.

Both the interior and exterior surfaces had been tool-polished to achieve a modest luster; horizontal polishing striations were visible over much of the vessel. Scrape marks and coil junctures were visible on the surface in many areas, suggesting a coiling construction technique and use of a scraping tool to thin the vessel walls. The paste was brown in color, with a well-defined carbon core and fine sand inclusions.

The bowl exhibited a rounded, convex profile with a rounded base, a slightly flared rim, and a rounded rim tip (see Figure 3.B.4). The rim diameter was 16 cm, with wall thickness ranging from 3.4 to 5.4 mm. Light to moderate abrasion was observed on the interior base and rim and might have resulted from tool abrasion (e.g., from the use of mixing implements) or from having been used as a container for an acidic substance (e.g., alcoholic beverages, such as agave wine). The abrasion evidence indicated a possible function as a food-processing (without using heat) vessel, a serving container, or both and may also provide insights into possible material contents inside the vessel at the time of the interment. Elaborated decoration is emblematic of serving vessels, which is the most likely interpretation of function for this vessel.

Feature 3604

This secondary pit cremation (one of the four secondary cremation types defined in Chapter 11 of this volume) was discovered during Phase 2 mechanical stripping (Stripping Unit 1881) in Locus D. Portions of two Dragoon-style red-on-brown bowls were found in association with cremated remains. One largely intact and complete bowl was

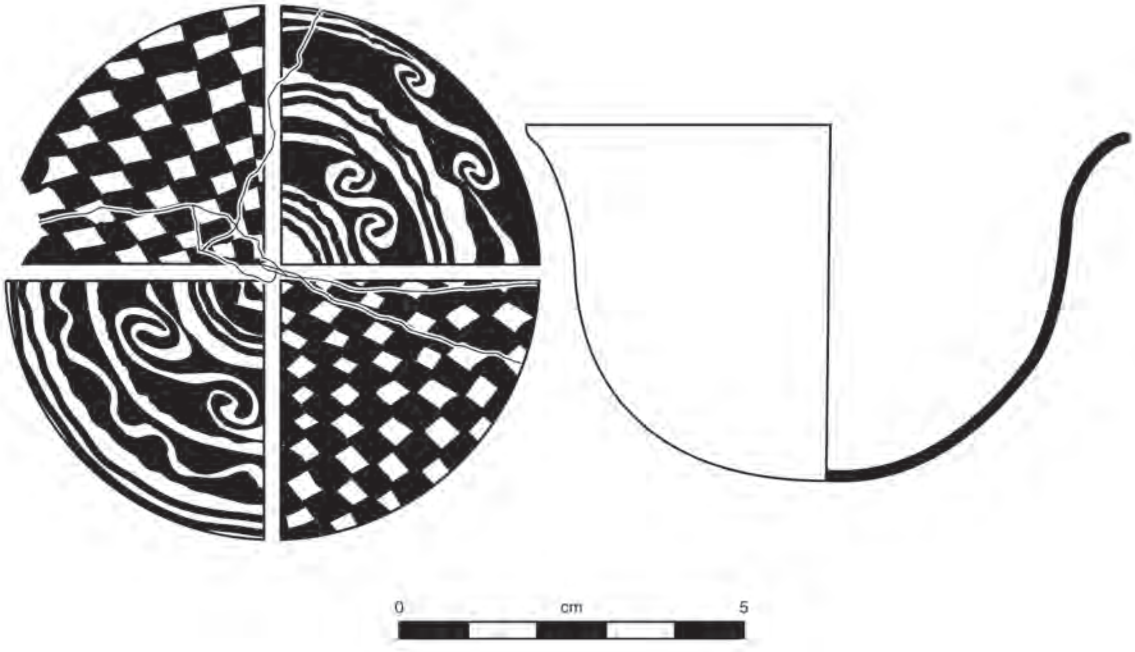


Figure 3.B.4. Illustration and profile of a Dragoon Red-on-brown (elaborated) offering vessel (bowl), Feature 3564.

placed upright over the calcined remains; reconstructible fragments of a second bowl also were placed over the remains (ca. 15 percent complete). The latter fragments might seem, on the surface, to be the remaining fragments of a disturbed vessel, but the fragmented state and low level of completeness suggested that the bowl had been deliberately interred with the burial as fragments, rather than as a whole vessel.

The intact bowl (Vessel No. 10795) was identified as a fine-line Dragoon-style type, which was mostly manufactured and distributed in portions of southeastern Arizona (Heckman 2000b; Sayles 1945). Dragoon fine-line red-on-brown pottery was manufactured over a roughly 200-year span from A.D. 750–950, which corresponds to the Middle Formative A period. This date range is consistent with the predominately Middle Formative A period span of occupation in Locus D. The red painted design on the interior surface was thin, extremely fugitive, and easily removed, and so, the design elements were not illustrated prior to repatriation, but the analyst described a five-pointed-star pattern surrounded by nested chevrons (for illustrations of vessels with similar star-shaped designs, see Heckman 2000b:52–53). The painted design extended onto the rim. No painting was evident on the exterior surface, nor did the analysts observe evidence for a slip.

The intact bowl could be described as miniature, with a rim diameter of 9 cm and a height of 3.5 cm. The vessel exhibited a convex, rounded profile, with a rounded base (conforming to the trajectory of the sidewalls), a direct rim, and a tapered rim tip (Figure 3.B.5). Wall thickness ranged from 5.1 to 7.4 mm. The presence of finger indentations and a bumpy, uneven exterior surface suggested that it was hand-modeled. The interior surface was smoothed but not polished. The paste was brown and contained fine sand inclusions. A small patch of gray, silica-rich residue was observed on the interior surface and could have been residue from a burned resin (e.g., copal) or other aromatic materials. If so, this could suggest that the small vessel functioned as an incense burner.

The second partial vessel was identified as a fragment from a Dragoon-style fine-line red-on-brown bowl (Vessel No. 10803). This vessel fragment (Figure 3.B.6) was not illustrated but was described as having decorative attributes similar to those of the whole vessel discussed above, including a five-pointed-star motif, but with crosshatching and triangular shapes surrounding the star pattern. Decoration was present on the interior only and was rendered with thin, fugitive red paint, similar to that described above for the intact Dragoon-style red-on-brown bowl. The painted design extended onto the rim. The surface did not appear to have been polished, but the surfaces were better smoothed than those of the intact bowl discussed above and exhibited a zonal polishing pattern between the painted lines; so, tool-polishing appeared to have occurred after the decorative red paint was applied. The exterior surface exhibited an irregular and inconsistent polishing pattern.

The bowl from which these fragments derived was estimated to have a rim diameter of approximately 20 cm and a convex, rounded profile, with a direct rim and a tapered rim tip. Wall thickness ranged from 3.5 to 4.4 cm.

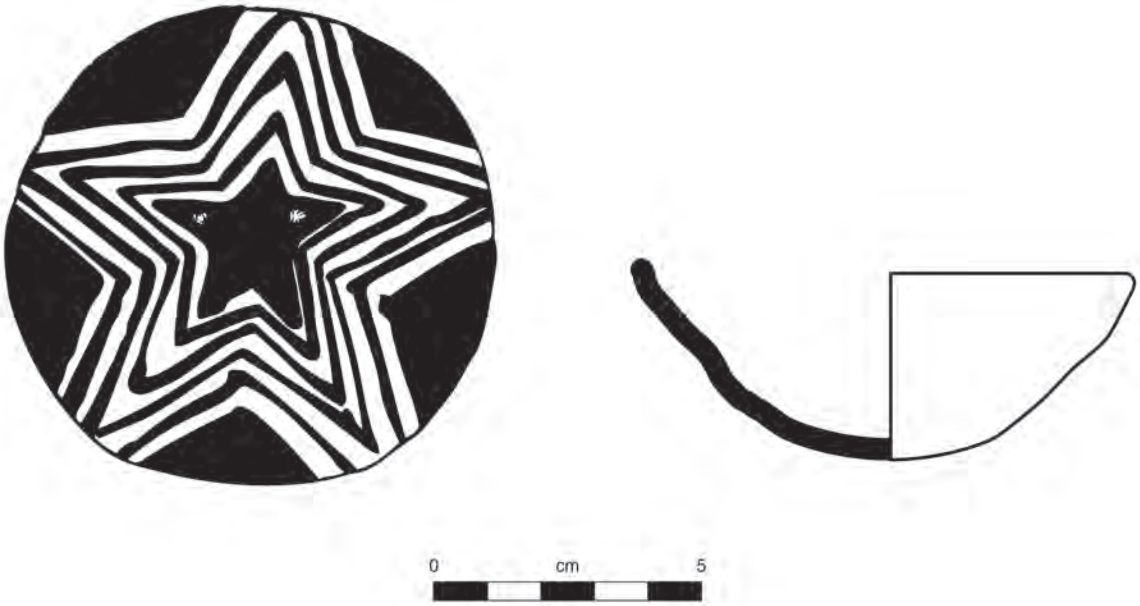


Figure 3.B.5. Illustration and profile of an intact Dragoon Red-on-brown (fine line) offering or capping vessel (bowl), Feature 3604.

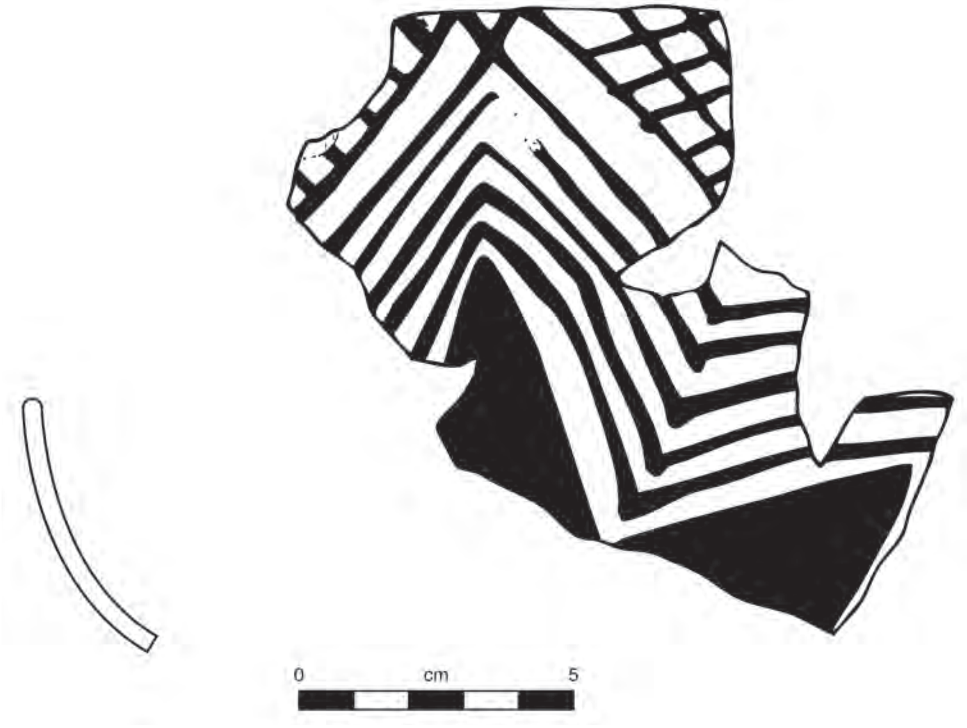


Figure 3.B.6. Profile and illustration of a rim sherd from a Dragoon Red-on-brown (fine line) offering or capping vessel (bowl), Feature 3604.

The vessel shape appeared to have been similar to that of the intact bowl described above, but this bowl was considerably larger in size. No evidence of surface modification was observed. The paste color and inclusions were virtually identical to that of the smaller bowl. All indications were that the larger and smaller bowls were very similar in vessel form, paste, and decorative attributes but differed in size and in the extent of surface smoothing and polishing. Perhaps the smaller vessel was meant to have been nested inside the larger vessel. They also might have been parts of a larger ceramic tool kit, perhaps related to ritual activities, such as the burning of incense. This inference provides potential insights into the identity and social roles of the interred individual.

Feature 4057

Feature 4057 contained a secondary urn cremation discovered during mechanical stripping in Locus D that contained the remains of a young child. An inverted Type III plain ware jar was placed over a portion of the human remains during the interment (see Chapter 11, this volume). Two shell-bracelet fragments also were recovered in association with the burial. Additional sherds (unrelated to the plain ware jar) were found within the feature fill, but these specimens likely were not part of the mortuary interment. The jar was heavily fragmented by the backhoe at the time of discovery, but analysts were able to completely reconstruct it.

The vessel body exhibited a convex, rounded profile, with a rounded base, a slightly outflaring rim, and a tapered rim tip (Figure 3.B.7).The neck was broad and did not possess a well-defined neck-body juncture; the rim diameter of 11 cm was only slightly smaller than the maximum diameter (13 cm). The vessel height was roughly 11.5 cm, with wall thickness ranging from 5 to 7.4 cm. The interior surface was smoothed, but the exterior surface was unfinished. Both surfaces exhibited a micaceous sheen, but neither was slipped or polished. Large indentations (likely finger impressions) on the surface suggested that the vessel was hand-modeled. The vessel paste was gray, with a pronounced core ranging in color from gray to pink. Paste inclusions included dense and poorly sorted mica and sand fragments.

Feature 4069

This primary cremation was discovered during mechanical stripping in Locus D during Phase 1 investigations and contained heavily calcined human remains associated

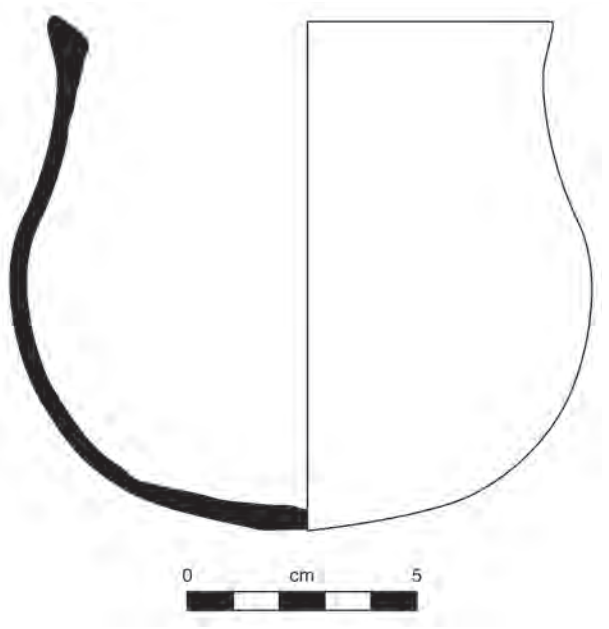


Figure 3.B.7. Profile of a plain ware capping vessel (jar with neck), Feature 4057.

with oxidized soil, charcoal, and ash. The oxidized pit was circular in shape, with straight walls and a flat base. The remains appeared to have been burned in situ and interred along with possible pyrotechnic materials, including wood fragments that might have derived from the funerary pyre or support posts. It also contained a partial plain ware vessel; an ochre-stained, carved-stone censer; and a calcined awl. The sherd fragments were from a Type III plain ware vessel with micaceous paste, but no rim was present, and therefore, the vessel form and function were not inferable. Because of their fragmentary state and functional ambiguity, these sherds were not subjected to further analysis.

Feature 4221

Feature 4221 was a primary cremation exposed during mechanical stripping in Locus D during Phase 1 investigations. The feature matrix consisted of dense, abundant, oxidized soil, ash, and charcoal, with calcined bone in the lower portion of the pit. Postholes observed along the edges of the pit may have supported a pyre during the cremation ceremony. A cluster of sherds, including several rims, was found within the feature matrix in the eastern portion of the pit. Additional sherds, lithic flakes, and faunal bone also were recovered in the feature matrix but were unlikely associated with the cremated remains. Rodent disturbance was evident within the feature matrix; therefore, the latter materials probably can be attributed to the effects of bioturbation. In contrast, the sherds clustered in the eastern portion of the pit were heavily warped and blackened, suggesting that they were subjected to the crematory fire and interred with the cremated remains during the mortuary ritual. These sherds were not illustrated or subjected to detailed analysis, because of their heavy fragmentation and blackened surfaces, but a cursory examination revealed that some sherds derived from a Type II plain ware jar with a tall, slightly outflaring neck. The other sherds were from a Type II plain ware hemispherical bowl.

Feature 4850

This feature is defined in Chapter 11 of this volume as a secondary urn cremation with an inverted vessel that was discovered during Phase 2 mechanical stripping (Stripping Unit 3035) in Locus D. Like several other secondary cremations exposed in the area, an inverted vessel was placed over the cremated human remains. The vessel, a Type II plain ware jar with neck, was heavily fragmented at the time of discovery; the backhoe had crushed the base of the inverted vessel during stripping. No offerings or additional artifacts were recovered in the fill.

Despite fragmentation, the Type II plain ware jar was fully reconstructed by the SRI laboratory staff. The jar profile exhibited a convex, rounded (globular) profile; a restricted orifice; a rounded base; and a short neck, with a slightly outflaring rim and a tapered rim tip (Figure 3.B.8). The rim orifice was 8.3 cm, with a maximum diameter of 24 cm along the center horizontal axis of the vessel body. Wall thickness ranged from 4 to 7 mm. Extensive blackening on both the interior and exterior surfaces likely resulted from exposure to the high-temperature cremated remains. The interior surface was unfinished; surface treatment on the exterior was indeterminate. Indentations on the surface suggested construction using a paddle-and-anvil technique. The paste was brown, with a light core on the interior surface, possibly from exposure to heat from the cremated remains, and medium-sized sand inclusions.

Feature 6090

Feature 6090 has been interpreted as a secondary urn cremation with an upright vessel that contained the human remains (see Chapter 11, this volume). The cremated remains were placed inside a Rincon Red-on-brown vessel (cremation urn), which was capped with a plain ware bowl that functioned as a lid. The feature was discovered when a backhoe exposed the covering vessel during Phase 2 mechanical stripping in Locus C. No additional artifacts or mortuary offerings were recovered in the burial fill.

The cremation vessel probably was originally a Rincon Red-on-brown jar with neck, with a painted exterior surface and an unpainted interior surface, but the removal of

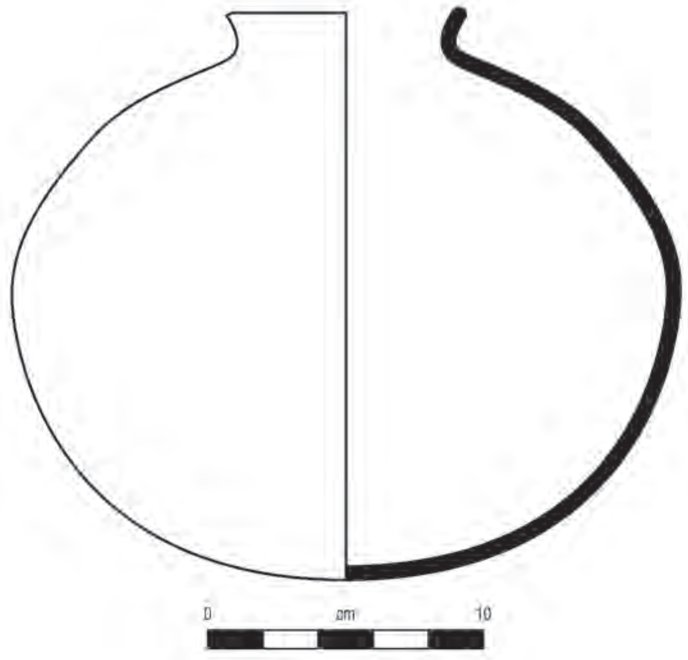


Figure 3.B.8. Profile of a plain ware capping vessel (jar with neck), Feature 4850.

the upper portion of the vessel prevented a firm identification of the form. The red paint was fugitive, and extensive blackening and soot accumulation on the vessel exterior (from exposure to heat and smoke) obscured visibility of the design, preventing detailed inferences regarding decorative motifs and surface treatment. The top portion of the vessel had been removed (Figure 3.B.9); therefore, it was not possible to examine the rim profile or assess the presence/absence of a neck, but the trajectory of the body suggested a restricted orifice. The vessel body exhibited a Gila shoulder and a rounded base. It is likely that the vessel was initially constructed as a jar with neck, which is typical of vessels with Gila shoulders. Slight rounding of the breakage plane on some sherds suggested the possibility that the vessel had been used with a refurbished rim after the original rim had broken off; this refurbished form is perhaps best described as a carinated bowl. The refurbished vessel probably had been used for some time prior to its use as a cremation urn.

The vessel exhibited large indentations, likely finger impressions, which suggested hand-modeled construction, although the base may have been formed using a convex mold. A smoothed-over joining line was visible along the shoulder. The exterior surface showed evidence of having been polished using a hard tool, but the interior was unfinished. The paste was brown, with no carbon core and a medium density of sand inclusions. A small amount of biotite mica also was visible, but not enough to create a micaceous sheen.

The covering vessel, a Type II hemispherical bowl, was severely crushed by the backhoe during stripping operations; only ca. 60 percent of the vessel was reconstructible. The bowl exhibited a convex, rounded profile, with a direct rim and a subrectangular rim tip (Figure 3.B.10). The basal sherds were missing but presumably also exhibited a rounded profile and no inflections. Wall thickness varied from 4.5 to 6.0 mm. The interior surface was heavily blackened, as a result of exposure to the heated cremated remains; surface-treatment attributes could not be recorded. The exterior surface was smoothed, with a slight micaceous sheen. The paste was mostly brown but was very dark along the blackened interior surface. Paste inclusions were mostly sand and mica particles at medium density.

Feature 7472

This secondary urn cremation with an upright vessel consisted of cremated remains placed inside a Dragoon Red-on-brown jar with a hemispherical body shape. This feature was discovered during Phase 2 mechanical stripping (Stripping Unit 5190) in Locus C. Bone flecks were visible within the fill of the vessel at the time of discovery. The cremation urn was contained within a pit, and no additional offerings or artifacts were recovered within the pit matrix.

The cremation urn, a Dragoon Red-on-brown vessel with elaborated design (see above), was heavily fragmented and only 65 percent reconstructible (Figure 3.B.11). Much of the upper portion of the vessel, including the rim, was missing. The design on the exterior surface was rendered using a thick, well-adhering red paint over a thin, fugitive white slip; despite the thickness, the red painted design was heavily eroded, possibly as a result of exposure to intense heat during the cremation ceremony. (Interior-surface attributes were not recorded, because the cremated remains were not removed prior to repatriation.) The interpretation of Dragoon elaborated-style decoration was based on the presence of triangular scrolls in the visible design field, which is typical of these wares (Heckman 2000b:51).

Although the upper portion of the vessel was missing, enough of the body was present at the time of inspection to indicate a restricted orifice. This vessel was probably the lower portion of a jar with neck, based on the frequent occurrence of Dragoon Red-on-brown vessels in this form, but we cannot rule out that it could have been a neckless jar. The lower body exhibited a globular, convex shape, with a rounded base, and was 14.4 cm at its maximum extent. The paste was orange in color, with no carbon core and a medium density of sand inclusions.

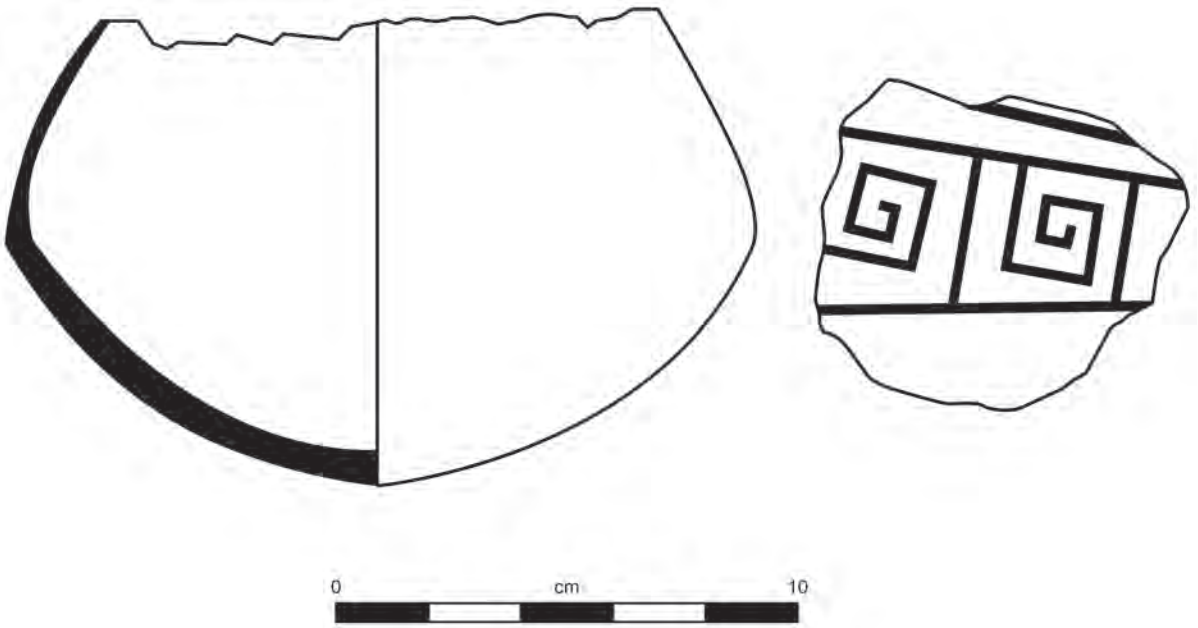


Figure 3.B.9. Profile and partial illustration of a Rincon Red-on-brown cremation urn (indeterminate bowl or jar), Feature 6090.

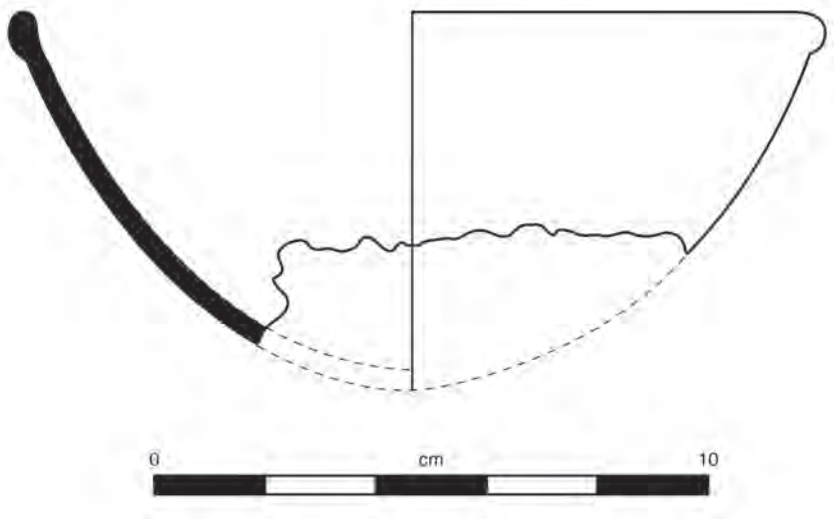


Figure 3.B.10. Profile of a plain ware capping vessel (bowl), Feature 6090.

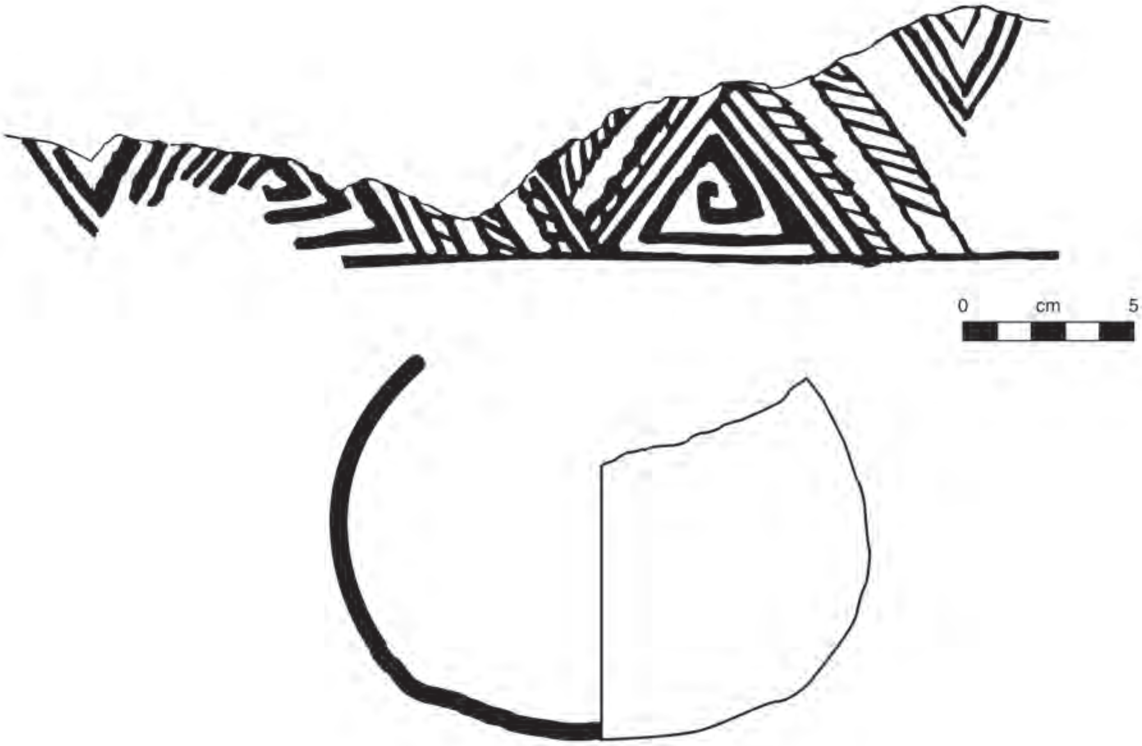


Figure 3.B.11. Illustration and profile of a Dragoon Red-on-brown (elaborated) cremation urn (jar), Feature 7472.

Summary and Discussion

As noted, a total of 14 ceramic artifacts were recorded in 11 burial features during Phase 1 and 2 excavations at the Mescal Wash site, most of which were whole or reconstructible vessels. All of the burial ceramics were analyzed soon after they were recovered and were submitted for repatriation immediately after their recovery. The level of analytical effort varied among the burial ceramics according to vessel completeness and attribute visibility; many attributes could not be recorded because of blackening of the surface or the presence of cremated remains within the vessel.

As shown in Table 3.B.2 (see discussion in Chapter 11, this volume), burial vessels were recovered in at least three distinct contexts: (1) as capping vessels that overlay cremated remains; (2) as containers for cremated remains; and (3) as offerings situated adjacent to human remains. Two of the vessels appeared to have been placed in an inverted position (open side down), as capping devices atop the burial pits (n = 2), both of which we define in Chapter 11 as secondary pit cremations with capping vessels.

Ceramic vessels also were used as cremation urns. In three features, whole or reconstructible vessels were placed directly over the cremated human remains (n = 3); in two other features, the urns were placed in an upright position, to function as containers for the cremated human remains, one of which included a lid (inverted bowl). As discussed in Chapter 11, all of the cremation urns (both inverted and upright) were jar forms with either short necks or removed necks; jar forms probably ensured secure containment of the remains. The presence of short necks, as well as the removal of necks, likely facilitated placement of the smoldering human remains in the vessel.

Four, or possibly five, additional burial vessels were included as offerings and placed adjacent to human remains, possibly as containers for perishable substances (e.g., food or liquids). In the case of Feature 336, an adult inhumation in Locus D, a partial vessel was recovered from the fill overlying the human remains. Prior to discovery, the feature had been disturbed by a backhoe trench; therefore, it was indeterminate whether the vessel was directly associated with the human remains.

The number of painted vessels from burial contexts was too small to infer correlations between burial practices and decorative styles or regional cultural traditions (e.g., the Phoenix Basin buff ware tradition or the Dragoon brown ware tradition). Five of the features with burial vessels contained only unpainted plain wares, and one contained a partial red ware vessel. Inferences of cultural association

Table 3.B.2. Recovery Contexts for Ceramics Recovered from Burial Features

Context	Count	Feature Nos.
Vessel used to cap cremated remains	2	320 and 561
Vessel used as cremation urn	5	333, 4057, 4850, 6090, and 7472
Vessel included as offering	4 (5)	3564, 3604, 4069, and 4221 (possibly also 336)

were not possible for these cases, because we are currently unable to infer culture associations based on nondecorative attributes. The five burial features with painted vessels were associated with four decorated traditions: the Phoenix Basin buff ware tradition (Feature 333), the Tucson Basin Red-on-brown tradition (Feature 6090), and the Dragoon Red-on-brown tradition (Features 3564, 3604, and 7472). It is worth noting that the three cremation-urn burials were each associated with Phoenix Basin–, Tucson Basin–, and Dragoon-style painted wares, precluding any correlation between this mortuary practice and a specific cultural tradition.

None of the features with burial ceramics were subjected to chronometric analysis, but approximate date ranges could be inferred for the burials with temporally diagnostic painted types. Features 333 and 6090 were both secondary urn cremations in Locus C that were associated with, respectively, Sacaton Red-on-buff and Rincon Red-on-brown vessels and were likely interred during the Middle Formative B period (ca. A.D. 950–1150). The burials that contained Dragoon-style red-on-brown vessels with elaborated decoration (Features 3564 and 3604 in Locus D and Feature 7472 in Locus C) suggested a wider date range of A.D. 950–1400 but were both presumably interred during the Middle Formative period, given the other lines of evidence that suggested peak occupation of the site during that time span.

References Cited

Abbott, David R.
2007 The Process, Location, and History of Hohokam Buff Ware Production: Some Experimental and Analytical Results. *Journal of Archaeological Science* 35:388–397.

Heckman, Robert A.
2000 Dragoon Tradition. In *Painted Pottery of Southeastern Arizona*, edited by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 43–62. Technical Series 77. Statistical Research, Tucson.

Sayles, Edwin B.
1945 *Material Culture*. The San Simon Branch: Excavations at Cave Creek and in the San Simon Valley, vol. I. Medallion Papers No. 34. Gila Pueblo, Globe, Arizona.

Vanderpot, Rein
2001 *Preliminary Report of Phase I Archaeological Investigations and Phase II Data Recovery Plan, Mescal Wash Site (AZ EE:2:51 [ASM]), Pima County, Arizona*. Technical Report 00-51. Statistical Research, Tucson.

Vanderpot, Rein, and Jeffrey H. Altschul
2000 *Preliminary Report of Phase 2 Archaeological Investigations, Mescal Wash Site (AZ EE:2:51 [ASM]), Pima County, Arizona*. Technical Report 01-57. Statistical Research, Tucson.

2007 The Mescal Wash: A Persistent Place in Southeastern Arizona. In *Hinterlands and Regional Dynamics in the Ancient Southwest*, edited by Alan P. Sullivan III and James M. Bayman, pp. 50–69. University of Arizona Press, Tucson.

APPENDIX 3.C

Ceramic-Attribute Recording

This appendix outlines the ceramic attributes and associated variables that were the focus of our ceramic analyses. The attribute recording for the project ceramics consisted of three stages, as explained in Chapter 3 of this volume. Stage 1 corresponds to the initial sort; Stages 2 and 3 represent the detailed attribute recording of the painted rims and bodies, the unpainted rims, and the complete and partial vessels (Table 3.C.1). All of the attributes, if applicable and observable, were recorded on all vessels and rims.

Basic Characteristics and Unique Identifiers for Vessels

Ceramic Unit Categories

These categories refer to two levels of detail recorded for the basic ceramic artifact type (see Table 3.C.1). On a general level, (CeramicUnit), we record whether the artifact is a vessel, sherd, or modeled artifact. The more detailed attribute field (CeramicUnitSpecific) distinguishes among whole vessels, fragmented (i.e., reconstructible) vessels, body sherds, rims, handles, figurines, clay bells, and indeterminate ceramic artifacts. These data were recorded in a database using a lookup table (LUT) with a list of options.

Ware or Type Classes

This suite of attributes includes the various ware and type classes needed to characterize the ceramic data (see Table 3.C.1). The most general level of recording (WareDes) focuses on the regional ware class—for example, Phoenix Basin Hohokam, Tucson Basin Hohokam, Roosevelt Red Ware, San Simon, Trincheras, and so on. On a more detailed level, the database was set up to record various well-established painted types within these broad regional categories (CeramicTypeColt). Examples include Sacaton Red-on-buff, Rillito Red-on-brown, Galiuro Red-on-brown, Gila Polychrome, and so on. Some sherds were not readily or satisfactorily accommodated by the established types. For these cases, we developed various "in-house" types based on various salient attributes. Most of the plain wares were recorded using this field (Type I, Type II, etc.) (see Chapter 3, this volume). Also, some painted wares associated with the Dragoon tradition were recorded using the typology developed by Heckman (2000b). This field also included the various indeterminate and split categories for ambiguous painted sherds, which are described in Chapter 3 of this volume. All of these variables were recorded using LUT listings.

Formal Attributes

Percent Complete

This refers to the analyst's qualitative estimate as to what proportion of the vessel was represented.

Vessel Class

This general form category was used to indicate whether or not the vessel form was restricted or unrestricted. Anna Shepard (1976:228) has provided the following definitions:

Table 3.C.1. Field Names and Variable Types Recorded during the Three Phases of Analysis

Field Name	Variable Type	All Painted (Bodies and Rims) and Unpainted Rims	All Painted and Unpainted Rims	Vessels and Very Large Rims
Project information				
CATNUM	unique sequential identifier (ceramic data only)	X	X	X
ID	unique identifier auto fill (all data)	X	X	X
ProvenienceNumber	relational link with X, Y, Z data	X	X	X
Project	project name	X	X	X
Phase	project phase (Phase 1 or Phase 2)	X	X	X
Analyst	individual recording attributes	X	X	X
CeramicPhase	phase of analysis (project specific)	X	X	X
SITENAME	Arizona State Museum (ASM) number	X	X	X
Date	date recorded	X	X	X
Typological information				
Count	number of items in analyzed unit	X	X	X
CeramicUnit	general artifact category (LUT)	X	X	X
CeramicUnitSpecific	specific artifact category (LUT)	X	X	X
WareDes	general regional ware class (LUT)	X	X	X
CeramicTypeColt	established ceramic type (LUT)	X	X	X
TypeX	analytical ceramic type (LUT)	X	X	X
Vessel form and metric attributes				
VesselClass	general vessel form (LUT)		X	X
VesselForm	specific vessel form (LUT) (see Figure 3.C.1)		X	X
Thickness	Wall thickness (mm)		X	
RimForm	see Figure 3.C.2		X	X
RimOrificeDia	measured number (cm)		X	X
RimOrificePer	estimated percentage of rim arc present		X	
RimApertureDia	measured number (cm)		X	X
RimAperturePer	estimated percentage of aperture arc present		X	
RimMinHigh	height of rim sherd or partial vessel when oriented to horizontal (cm)		X	X
RimTotalHigh	for complete vessels or vessel profiles = height of vessel (cm)			X
RimWallAngle	see Figure 3.C.3		X	X

Field Name	Variable Type	All Painted (Bodies and Rims) and Unpainted Rims	All Painted and Unpainted Rims	Vessels and Very Large Rims
CompletenessOfVessel	estimated percent			X
ProjVesselNum	unique sequential number (project specific)			X
Modification or Reworking				
Modifications	presence/absence of a modified sherd (LUT)	X	X	X
ModUseWareMemo	evidence of use wear on surface (LUT)	X	X	X
ModSoot	visible surface soot (LUT)	X	X	X
ModRepair	evidence of repair (LUT)	X	X	X
ModStain	evidence of surface staining (LUT)	X	X	X
Refurbish	evidence of refurbishing (LUT)	X	X	X
Reuse	evidence of reuse (LUT)	X	X	X
Recycle	evidence of recycling (LUT)	X	X	X
Detailed Formal Analyses				
Countour Metrics	see Figure 3.C.4			X
BraunFunctionGeneral	general Braun functional category			X
BraunGroupSize	vessel size class			X
BraunFunctionSpecific	detailed Braun functional category			X
General comments				
GeneralComments	narrative memo field	X	X	X

Key: LUT = Lookup table.

"The restricted orifice is generally defined as having a diameter less than the maximum vessel diameter; the unrestricted [orifice], as having the maximum vessel diameter." In most cases, jars are restricted vessels, and bowls are unrestricted vessels.

Vessel Form

This category contains the field codes for more-specific formal categories than the previous one. General vessel shapes include bowl, jar with neck, neckless jar, scoop, effigy, ladle, or eccentric. (The latter two categories are included in SRI's ceramics database but were not used for this project.) Figure 3.C.1 provides examples of the various vessel forms.

Thickness

The thickness of the vessel walls was measured to the nearest tenth of a millimeter (i.e., the millimeter value, to one decimal point). The "body" measurement is best, because it usually represents more of an average thickness when compared with the rim or base, as these are often thicker than most of the rest of a vessel or sherd.

Rim Form

The following rim-form categories were recorded using an LUT:

Direct:

> A rim treatment characterized by a smooth line from the base of the vessel to the lip, with no inflections, corner points, or interior vertical tangents present (Figure 3.C.2).

Straight:

> Characterized by a straight line on the neck or the wall of the vessel to the lip (see Figure 3.C.2).

Flaring:

> Characterized by tangents at the end point that are less than 90°. We subdivided flaring rims into three categories that correspond to the kind of flare represented (see Figure 3.C.2): slight flare, moderate flare, and pronounced flare. We included an indeterminate flare for those rims that exhibited a flare, but one for which the degree of flaring could not be determined.

Everted:

> Characterized by sharp or abrupt angles in the contour near the end point that result in a tangent greater than 90° (see Figure 3.C.2). These could be slightly everted, moderately everted, or sharply everted.

Upturned:

> Characterized by tangents at the end point that are less than 90°. Like flaring rims, we subdivided upturned rims into three categories (see Figure 3.C.2). Rims were recorded as slight upturn, moderate upturn, pronounced upturn, or indeterminate.

Rim Orifice and Aperture Diameter

The orifice is defined as the opening or the mouth of the vessel rim. The rim aperture refers to the most restricted portion of the vessel, usually at the neck. These two diameters were measured in tenths of a centimeter, from the exterior through the center of the vessel to the exterior on the opposite side. If the vessel was not complete, or in the case of rim sherds, it was necessary to measure the diameter using the rim-diameter board, in which case the measurement was taken to the nearest centimeter rather than to the tenth of a centimeter.

Vessel Height

Two vessel-height measurements were recorded in centimeters. For rim sherds or partial vessels, the minimum vessel height was recorded (with the rim oriented to the horizontal axis); for whole vessels, the actual height was recorded.

Rim-Wall Angle

Rim angles, like wall angles, are assigned a value by projecting a tangent in line with the rim. We keyed the angle to the nearest number on the rim and wall angle chart (Figure 3.C.3). These results were used mainly in connection with the Braun analysis (see Chapter 3, this volume).

Vessel Number

Unique sequential number assigned to each whole or reconstructible vessel.

Use-Wear Attributes and Postfiring Modifications

A variety of different forms of vessel or sherd modification were recorded using LUT listings. Where necessary, additional information was recorded in the "comments" field.

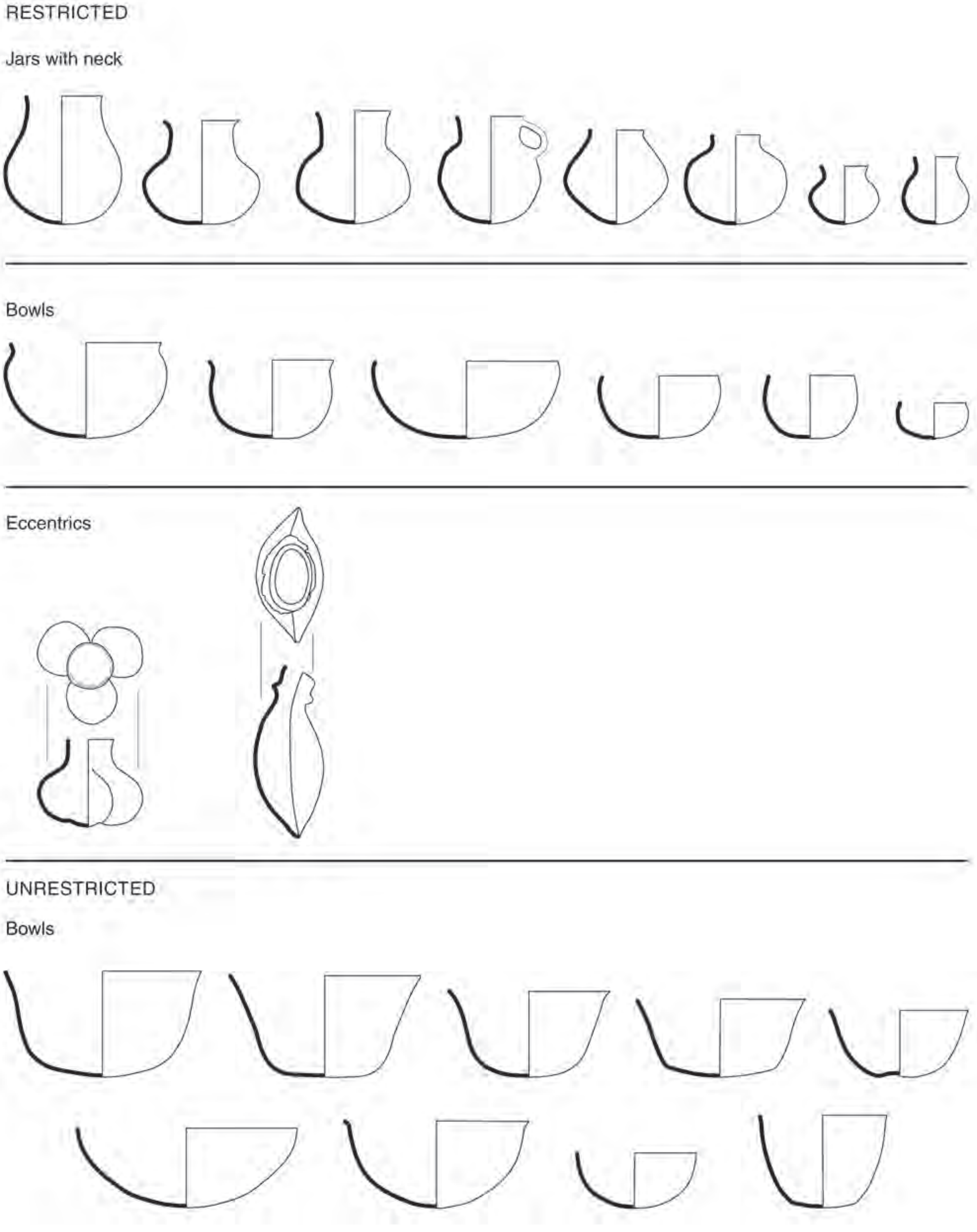


Figure 3.C.1. Gross formal categories used in this study (not to scale).

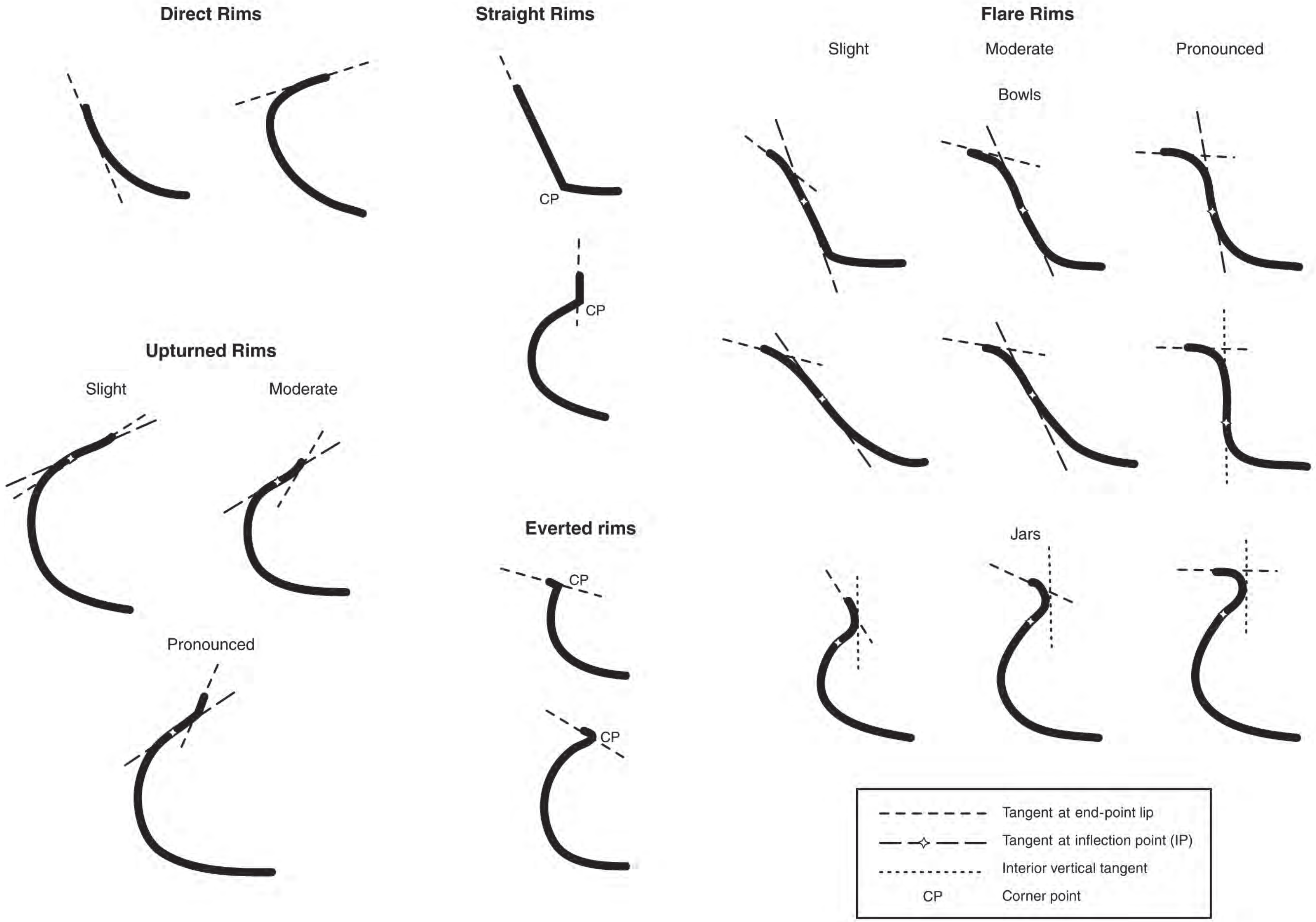


Figure 3.C.2. Examples of rim treatments and how to distinguish the treatment types.

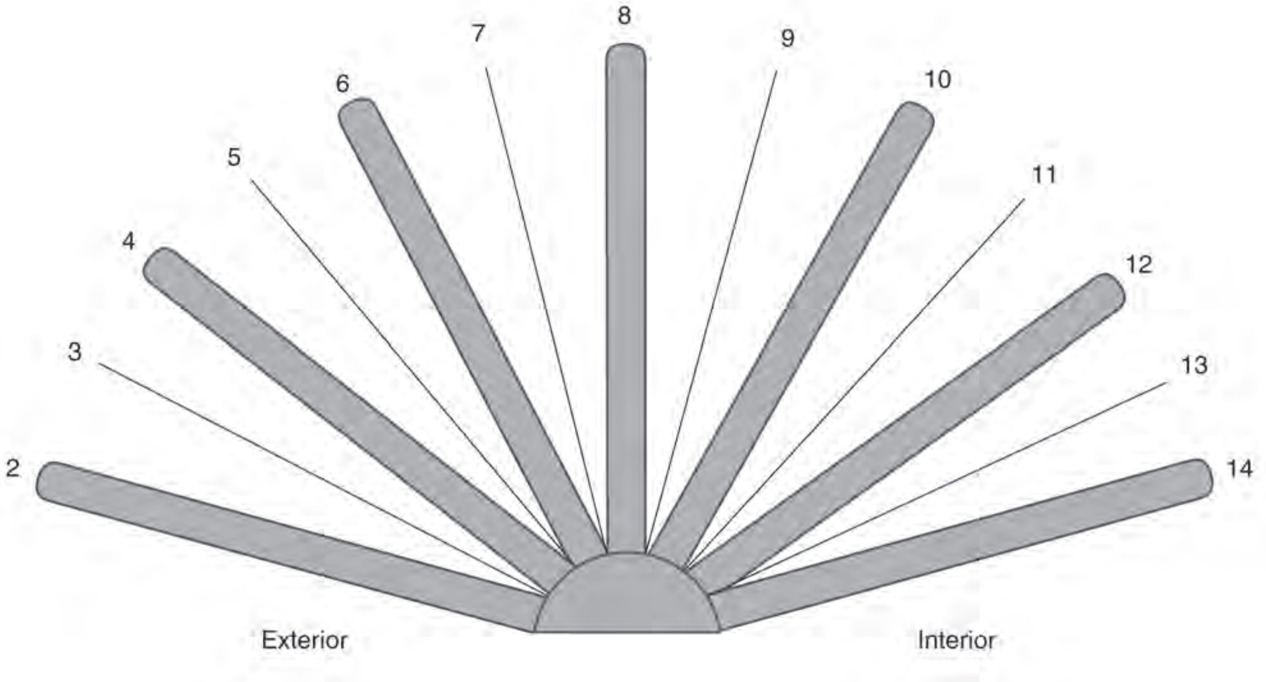


Figure 3.C.3. Rim- and wall-angle chart.

Surface Soot Deposition

The presence or absence of soot modification was recorded. Sooting is a carbon residue adhering to the vessel surface. It is attributed to the vessel's having been used in association with fire.

Surface Staining

The presence or absence of stains was recorded.

Surface Use Wear

This memo field was for recording the type and location of use-wear attributes. Abrasion, pitting, and sooting were the primary variables observed. Abrasion is defined as any marring of the vessel surface, apparently resulting from friction. Pitting is defined as any exfoliated surface.

Reuse

Reused vessels are vessels that had broken but continued to be used as containers, without any postbreakage modification. The lack of postbreakage modification distinguishes reuse from refurbished containers.

Refurbishment

Refurbished vessels are vessels that had broken and been subsequently shaped and modified to be used as other vessel forms. The most common example is a plate or griddle (see Beck 2001) made from the base of a broken jar.

Recycling

Recycled sherds (also known as "worked sherds") are those pieces of a vessel that were used for a completely different function after it had broken. An example is a sherd that was shaped into a perforated sherd disk. Recycled-sherd categories include perforated disk, nonperforated disk, perforated polygon, sherd with ground edge, and sherd with chipped edge. An "indeterminate" category also was employed.

Detailed Metric Attributes

In order to classify, record, measure, and, ultimately, synthesize information on vessel morphology, there needs to be a standardized method by which the data are collected. Presented here are detailed descriptions and definitions that facilitate standardized and replicable measurements and observations.

Contour Metrics

Contour metrics were measured on the vessels and rim sherds. Measurements were taken at various key points on the profile of a vessel (Figure 3.C.4). Supplementary points were taken every 1 or 2 cm. Using these measurements, the profile of the vessel was drawn and the volume calculated. These calculations provided the primary evidence for the Braun analysis.

Characteristic Contour Points of a Vessel Profile

Table 3.C.2 provides the numeric values used for each contour point. The numeric values were used to create a vessel index for each vessel. For example, the vessel in Figure 3.C.4a would have an index of 18, because only an end point at the lip and base are present. The vessel depicted in Figure 3.C.4d would have an index of 1345678. Shepard (1976:226) used Birkhoff's (1933) terminology to describe the characteristic points of vessel contour:

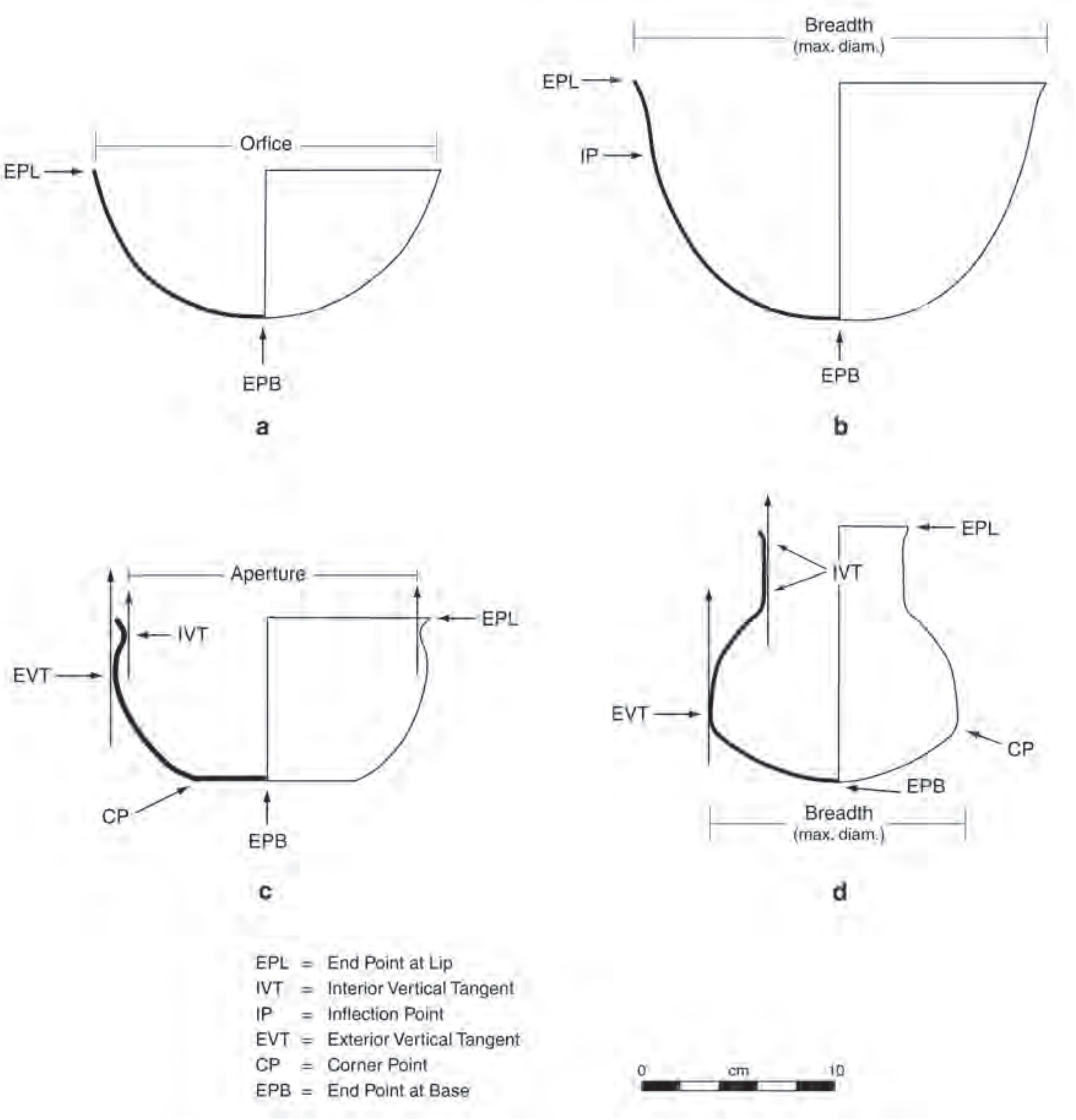


Figure 3.C.4. Characteristic points of vessel contour showing their relationships to standardized vessel measurements.

Table 3.C.2. Numeric Values for Characteristic Points of Vessel Contour

Numeric Value	Contour Point
1	end point at lip
2	interior vertical tangent
3	interior vertical tangent (highest point)
4	interior vertical tangent (lowest point)
5	inflection point
6	exterior vertical tangent
7	corner point
8	end point at base

End Points:

End points of the curve at the base and lip (see Figure 3.C.4).

Vertical Tangent:

Points where the tangent is vertical—for example, points of maximum diameter (see Figure 3.C.4c and d) and of minimum diameter (see Figure 3.C.4c and d). The vertical tangent can be interior and/or exterior.

Inflection Point:

This point is where the curvature gently changes from concave to convex, or vice versa (see Figure 3.C.4b–d).

Corner Point:

This marks the point where the direction of the tangent changes abruptly, rather than exhibiting a gentle change, such as the inflection point (see Figure 3.C.4b).

Supplementary:

An arbitrary point on the vessel profile, primarily used to facilitate taking a measurement every centimeter.

References Cited

Beck, Margaret E.

2001 Archaeological Signatures of Corn Preparation in the U.S. Southwest. *Kiva* 67:187–218.

Birkhoff, G. D.

1933 *Aesthetic Measure.* Harvard University Press, Cambridge, Massachusetts.

Shepard, Anna O.

1976 *Ceramics for the Archaeologist.* Publication 609. Carnegie Institution of Washington, Washington, D.C.

APPENDIX 5.A

Summary of Palettes and Palette Blanks Collected from the Mescal Wash Site

Provenience No.	Feature/Unit	Feature Type	Length (cm)	Width (cm)	Thickness (cm)	Depth of Grinding Surface (cm)	Material Type	Residues	Shape	Type	Design	Figure No.
Locus B												
521	Feature 245	possible structure (Phase 1), reassessed as a natural depression in Phase 2	12	7.7	1.1		sandstone	hematite pigment powder over most of surface	subrectangular and slightly concave	informal; ground all over with flattened sides and ends	no ornamentation	103a
Locus C												
8454	Feature 6098	structure	24	8.5	1.7	0.8	schist		Rectangular; the oval central grinding area is 10 cm long	formal; made by grinding and incising	incised border design includes zigzag in center of border with perpendicular lines on each side between the zigzag and border edges	101a
Locus D												
1720	Feature 1571	structure	12.5	6.8	2.9		sandstone	pink pigment possibly mixed with clay over most of one surface; tan to brown adherent on opposite surface	irregular	informal, made on a cobble	no ornamentation	105a
1751	PP 1751; in SU 1580		6.9	5.6	0.7		schist		rectangular	palette blank	no ornamentation	106b
1758	SU 1757		8.3	7	1.1		schist		square	palette blank	no ornamentation	106c
1941	Feature 3680	structure	14	11.2			sandstone	reddish adhesions	irregular	informal, made on a cobble	no ornamentation	105b
3010	PP 3010; in SU 3008		9.3	5.9	3.3	0.5	sandstone	yellow adhesions		informal; made by pecking and grinding; double sided	no ornamentation	104
5548	Feature 7880	structure	11.4	5.2	0.7	0.1–0.2	schist		Rectangular with subrectangular depressed area in center	formal; made by grinding and incising; ground all over	incised notches on the top surface of each end	102a
5574	Feature 7880	structure		5.3	0.5		indeterminate		unknown (fragment	possible palette; ground on remaining edges and one side	no ornamentation noted	
5725	Feature 7880, Subfeature 2	structure			0.9		schist		unknown (fragment)	formal; made by grinding and incising; shaped, slightly convex towards the interior	incised notches at edge, with a lightly incised line parallel to the edge	102c
7078	Feature 7880	structure			0.9		schist		unknown (fragment)	formal; ground over all remaining surface	border has single incised line parallel to intact edge on one side, and a double line bordering the other.	102b
7392	Feature 6095	unexcavated pit in SU 5190	15.5	8.2	1.1	0.2	igneous	black to reddish-black metallic looking solid gloss on surfaces and edges	rectangular; worn depression in center measures about 4 cm long by 2 cm wide	formal; made by grinding and incising; completely shaped	shallow incised line borders the edge,	101b
7512	Feature 5612	bell-shaped roasting pit	10.4	9	1.4		igneous		irregular form	informal; made by grinding	no ornamentation	103b
7546	Feature 5994	structure	8.5	4.4	0.9		igneous		rectangular	palette blank	no ornamentation	106a
9575	Feature 4733	structure	12.2	5.5	1		metamorphic		rectangular	palette blank	no ornamentation	
9635	Feature 8655	structure	5.5	5	0.6	0.1–0.2	schist		square with slight circular depression in center	formal; pendant made by grinding and incising; ground all over	biconically drilled hole in the center of one side; short lines incised perpendicular to the edge surround an incised line forming a square	107

APPENDIX 7.A

Summary of Bone Artifacts Collected from the Mescal Wash Site, by Type, Time, and Context

PD	Lot No.	Excavation Unit or Feature No.	Feature Type	Subfeature	Artifact Type
			Locus A		
8161	3407	2192	structure		ring
			Locus C		
7001	1243	SU 5188	N/A		tube
7077	2594	379	structure		tube or other
7369	2242	6139	structure		tube or handle/haft
7403	2137	6098	structure	2	tube
7403	2153	6098	structure	2	handle
9386	3179	995	structure		awl
			Locus D		
817	4204	723	nonthermal pit		wide blunt pointed awl or narrow spatulate tool
1726	144 and 145	1575	structure		awl
1913	82	437	multiple features		unknown, possible tool shaft
1921	4202	3544	multiple features		awl
1929	4059	3679	structure		awl midsection
2373	1143-1144	3879	structure		awl
2373	1145	3879	structure		shaft
2408	1216	3817	structure	40	awl tip
2429	3533	3545	structure		bead
2429	1610	3545	structure		possible tool
2480	528	3879	structure		awl tip and shaft
2484	1146	4105	nonthermal pit		bead
2675	1413	3710	structure		shaft
2901	4206	438	structure		awl
3039	1140	3681	structure		awl tip
3039	1141	3681	structure		unknown
3158	623	3679	structure	17	unknown
3304	4201	3681	structure		awl
5101	1727	4684	structure		flaker/awl
5105	1801	438	structure		bead
5135	1609	4729	structure		awl
5176	4207	4729	structure		awl tip
5210	4205	438	structure		tube
5210	2126	438	structure		awl
5210	2126	438	structure		shaft
5236	3534	4684	structure		awl tip and shaft
5326	4203	4684	structure		awl
5543	1990	4682	structure		awl
5756	3522	3595	multiple features		tube
5756	3523	3595	multiple features		ring
5782	2622	5781	structure		awl
5834	2624	7879	structure	1	awl
5878	2685	5612	bell-shaped roasting pit		flaker

continued on next page

PD	Lot No.	Excavation Unit or Feature No.	Feature Type	Subfeature	Artifact Type
5971	2625	4642	structure		awl
5971	3524	4642	structure		handle and/or shaft
6820	3742	4683	structure		awl
6868	2125	4683	structure		awl shaft, tip missing
7042	1967	4729	structure		awl
7506	2621	4768	structure		awl
7511	2623	5612	bell-shaped roasting pit		awl tip and shaft
7547	2283	834	structure		awl
7944	2519	5994	structure		tube
8536	2918	8644	structure		awl or spatulate tool
8536	2918	8644	structure		awl
8539	2919	8644	structure		awl tip
8628	3392	825	multiple features		tube
8789	3398	825	multiple features		awl
8802	3178	834	structure		awl
8853	3177	834	structure		tube or handle/haft
8853	3177	834	structure		handle
8900	3041	4733	structure	1	awl
8929	4060	4768	structure	1	bead
9589	3399	4733	structure		awl
9635	3396	8655	structure		tube or haft/handle
9643	3400	8655	structure		awl
9653	3401	8655	structure	2	awl
11339	3062	5505	nonthermal pit		handle/shaft
11339	3062	5505	nonthermal pit		awl tip

APPENDIX 9.A

Modern Plant Study for the Mescal Wash Site, Arizona

Katharine D. Rainey and Karen R. Adams

In conjunction with our study of the macrobotanical samples from the Mescal Wash site, we also set a goal of describing the present-day botany of the site's immediate area. This served three purposes. First, we wanted to know what plant resources may have been available to the people living at Mescal Wash, as well as the seasonal availability of these plants. Second, we wanted to collect representative plant tissues such as seeds and wood for comparative purposes in identifying the plant remains in the macrobotanical samples. Third, we wanted to record any unusual plant species in advance of the disruptions caused by the future construction.

In this appendix, we present the results of the modern landscape study. First, we describe our collection visits and the generated herbarium specimens. Next, we describe the biotic communities of the greater site area and the distribution of individual plants per landform. Finally, we highlight the richness of the local plant landscape and point out some of the differences between the site's archaeobotanical record and the modern plant inventory.

Materials and Methods

Over the course of our study, we visited eight collection-stop areas at or near the Mescal Wash site (Table 9.A.1; Figure 9.A.1), stopping at least once in each area. A total of four visits were made in March, April, and September of 2001, allowing us to observe plants during two parts of the spring season and early fall (Table 9.A.2). The winter preceding our collections was drier than usual, although there was still an abundance of annual plants in the spring of 2001 (Table 9.A.3). We made efforts to cover the plant diversity of the area immediately surrounding the Mescal Wash site. The authors are grateful for the assistance of Rex K. Adams and Rein Vanderpot on some of these visits.

At each collection stop, we recorded the plants present on the landscape. We recorded the coordinates for each location using either a recreational-grade global positioning system (GPS) or a topographic map, and ranged as much as 25 m from that central point to find as many types as possible. The collection-stop locations depicted in Figure 9.A.1 and listed in Table 9.A.1 should be considered to be general spots rather than specific pinpoints. We recorded each plant type on a checklist, where we noted its prevalence at that stop and whether the plant was flowering or fruiting. We recorded the frequency of the plant types with the terms "dominant," "codominant," "common," "sparse," and "rare" (Table 9.A.4). The list of abbreviations that we used in our seasonality observation database is presented in Table 9.A.5.

To preserve a record for future research, we collected herbarium voucher specimens and other plant materials such as seeds, fruit, and wood. Our strategy was to collect representative plants as well as plants that we could not identify in the field. Whenever we gathered comparative collection materials, we tried to collect voucher specimens for that plant type as well. The herbarium voucher specimens were identified using the *New Flora for Arizona* keys published by the Journal of the Arizona-Nevada Academy of Sciences (Vascular Plants of Arizona Editorial Committee 1992–2001). When families not yet included in the *New Flora* were encountered, Kearney and Peebles's (1960) *Arizona Flora* was used. Some herbarium specimens were identified through expert determination by Donald Pinkava, John and Charlotte Reeder, and Wendy Hodgson. The specimens were deposited at the Arizona State University (ASU) Vascular Plant Herbarium, with the Reeder's collection at the University of Arizona, or at

Table 9.A.1. Summary of Collection Stops At or Near the Mescal Wash Site

Study Area No.	Landform	Habitat	Coordinates (Approximate)	Additional Information
1	terrace	mixed shrub/grassland	31.984183°N 110.561033°W	Next to excavations in Locus C.
2	floodplain/ bottomlands	bosque	31.986251°N 110.558039°W	Mescal Wash, north of Locus B; may be currently grazed.
3	slight slope	shrubland	31.984374°N 110.558111°W	Shallow colluvial slope, north of Loci A and B; may be currently grazed.
4	steep slope	mixed shrub/grassland	31.983869°N 110.558050°W	North of Loci A and B; may be currently grazed.
5	terrace	grassland	31.985983°N 110.559783°W	In north half of Locus A; area is currently grazed.
6	floodplain	shrubland	31.983917°N 110.567317°W	Cienega Creek.
7	medium slope	bosque	31.98415°N 110.566383°W	Cienega Creek.
8	terrace	disturbed (bare) ground	31.981769°N 110.561236°W	Backfilled excavation site in Locus D.
1000	miscellaneous			This is a category for plants that were seen in the larger area surrounding the Mescal Wash site but were not located at an official collection stop (e.g., plants observed while driving on the highway).

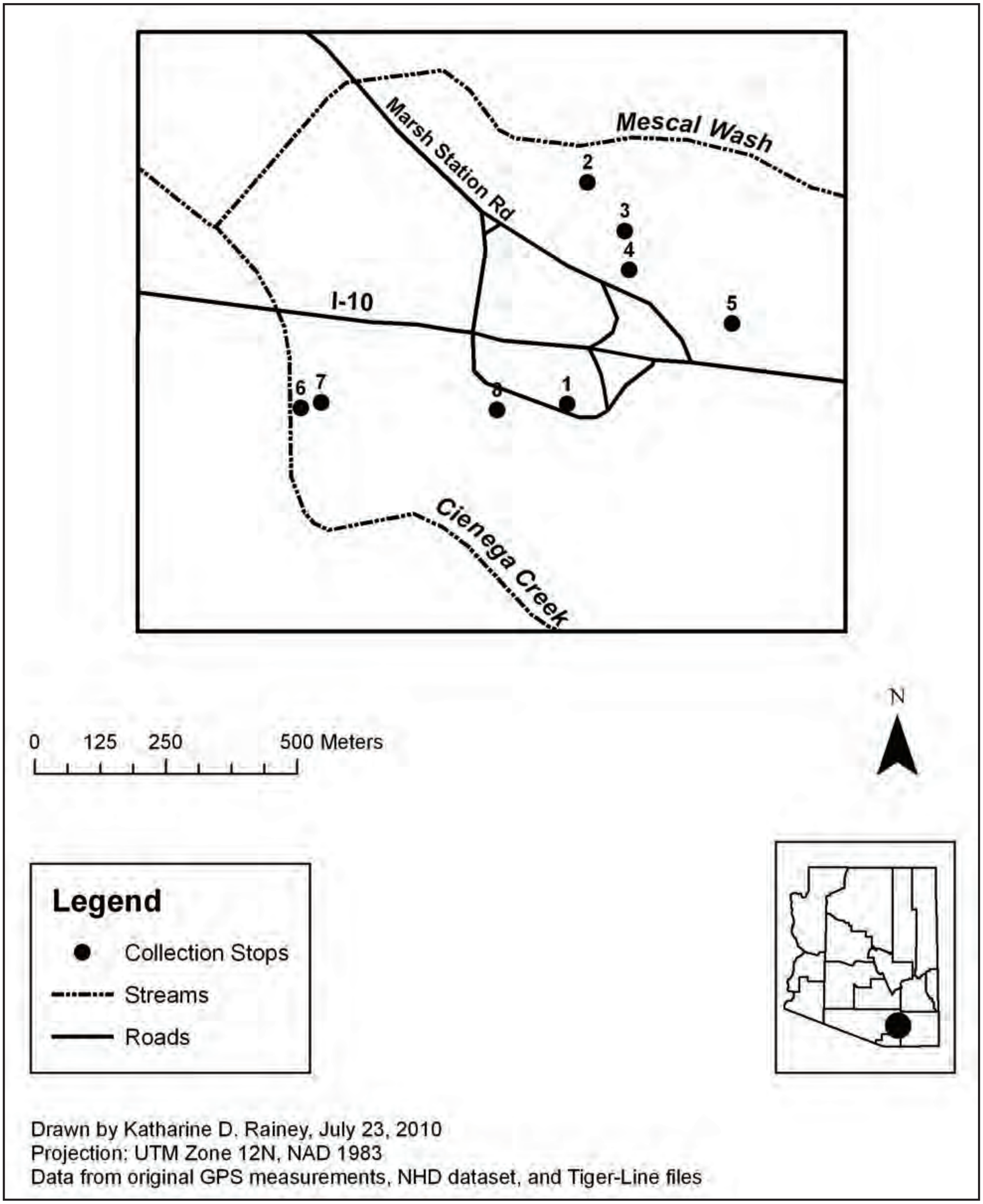


Figure 9.A.1. Collection-stop areas at or near the Mescal Wash site.

Table 9.A.2. Dates the Collection Stops Were Visited

Study Area No.	March 23-24, 2001	April 30, 2001	September 29, 2001
1	X	X	
2	X	X	
3	X	X	
4	X	X	X
5	X	X	
6	X	X	X
7	X	X	
8			X
1000	X	X	X

Table 9.A.3. Precipitation Amounts in the Fall and Winter Preceding Our Collection Visits

Weather Station	November 2000 (inches)	December 2000 (inches)	January 2001 (inches)	February 2001 (inches)	Actual Total (inches)	Normal Total (inches)
Douglas	1.22	0.00	0.75	0.25	2.22	3.19
Green Valley	1.66	0.00	1.71	0.57	3.94	3.57
Tombstone	0.12	0.00	0.07	0.00	0.19	3.54
Tucson	1.37	0.00	1.24	0.46	3.07	3.57

Note: Sources: Accuweather.com, Arizona State Climate Office, and the Western Regional Climate Center.

Table 9.A.4. Explanation of Frequency Terms

Descriptor	Abbreviation	Number
Dominant	D	most prevalent plant
Codominant	CD	shares prevalence with another plant
Common	C	>25 plants
Sparse	S	11–25 plants
Rare	R	1–10 plants

Table 9.A.5. List of Seasonality Abbreviations Used in the Database

Descriptor	Abbreviation
Flowers	
No flowers	NF
Flower buds	FB
Full flower	FF
Flowers wilted	FW
Fruit	
No fruit	NF
Immature fruit	IF
Mature fruit	MF

the Desert Botanical Gardens Herbarium. Information on the ASU specimens can be accessed through the SEINet Web site, http://swbiodiversity.org/seinet/.

The potential uses for the plants recorded at the collection stops surrounding the Mescal Wash site based on the ethnobotanical record is presented in Table 9.A.6. These data were assembled from a selection of published articles on native groups in southern Arizona and, to a lesser extent, the greater U.S. Southwest. The latter occurred most often when we found a citation for a plant that was arcane in the ethnobotanical literature for southern Arizona. Fortunately, we were able to present potential uses for most of the plants seen at the collection stops. In order to present a wider list of potential uses, we included ethnobotanical information related to the genus and not just the particular species found at the Mescal Wash site, even though we recognize that the utilization potential may not be identical within a genus. For detailed information about individual species, as well as their authorities, we refer the reader to the original ethnographic sources. Finally, the ethnobotanical information in Table 9.A.6 is listed as a historical record of past uses only; in no way does it identify kitchen-tested recipes or suggests courses of medical treatment.

Biotic Communities of the Area

In considering the botany of the Mescal Wash site, we can view the area on two levels: the immediate area surrounding the Mescal Wash site and the larger surrounding area. At the larger level, the Mescal Wash site is within the Cienega Creek basin, which is located at the transition between the Chihuahuan and Sonoran Deserts (Figure 9.A.2). As a consequence of being in a transitional area, the Cienega Creek basin vegetation is quite diverse. The topography of the Cienega Creek basin is also quite varied, ranging in elevation from 987 to 2,881 m. The vegetation of southeastern Arizona area has been described previously in Brown (1982), Minckley and Brown (1982), Eddy and Coolley (1983:4–5), Huckell (1995:17–23), Pima Association of Governments (2003), and Brown et al. (2007). The major biotic communities in the larger Cienega Creek basin area are

- Chihuahan desertscrub
- Madrean evergreen woodland
- Petran montane conifer forest
- Plains and Great Basin grassland
- Semidesert grassland

Additionally, there are areas of Interior chaparral and Arizona upland subdivision of Sonoran desertscrub within 10 km of the Cienega Creek basin boundary (Figure 9.A.3).

The predominant vegetation types immediately surrounding the Mescal Wash site are Chihuahuan desertscrub and semidesert grassland, with a landscape of scattered trees and frequent shrubs. The dominant trees on the landscape are *Prosopis velutina* (mesquite) trees. The dominant shrubs are *Baccharis salicifolia* (mule fat), *Larrea* sp. (creosote bush) and *Hymenoclea* sp. (burrobush). Herbaceous plants like *Amaranthus palmeri* (carelessweed), *Eragrostis lehmanniana* (Lehmann's lovegrass), and *Gutierrezia* sp. (snakeweed) are also dominant plants. A short walk upstream from the site along Cienega Creek brings one to a large riparian zone lined with cottonwood, willow, walnut, and mesquite trees (Sonoran riparian deciduous forest) (Rein Vanderpot, personal communication 2010).

Distribution of Individual Plant Resources

In this section, we present an inventory of the plant species encountered, including landform and seasonality information for four plant classes:

- native grasses, ruderals, and herbaceous perennials
- cacti and other succulents
- trees and shrubs
- adventive or introduced plants

Native Grasses, Ruderals, and Herbaceous Perennials

The first main category of plants from the Mescal Wash site collection stops is the category of native grasses, ruderals, and herbaceous perennials (Table 9.A.7). The growth cycles of these plants are most responsive to climatic conditions such as temperature and relative precipitation. There was less precipitation than usual in the winter preceding our March 2001 collection trip (see Table 9.A.3), but we still believe we recorded a representative sample of the plants in the area. In years of good productivity, the seeds and greens of these plants would provide abundant sources of food (Adams and Bowyer 2002:135; Adams and Welch 1998:34). The most-common plants in this category include *Descurainia obtusa* (tansy mustard),

Table 9.A.6. Seasonality and Ethnobotanical Information for Plants in the Mescal Wash Site Vicinity

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
	Native Grasses, Ruderals, and Herbaceous Perennials				
Allionia incarnata			full flower, young and mature fruit	Leaves used as a tobacco (Swank 1932:25). Root pounded and boiled, liquid drunk for gonorrhea (Gifford 1936:260). Boiled and then liquid applied to wounds (Hough 1897:41). Plant named, but no uses given (Robbins et al. 1916:53).	Acoma, Hopi, Laguna, Northeastern Yavapai
Amaranthus palmeri			full flower, young and mature fruit	Leaves cooked as greens or eaten fresh, seeds ground into meal (Castetter and Opler 1936:46; Castetter and Underhill 1935:14; Curtin 1984:47–48; Lange 1968:149; Rea 1991:5; Reagan 1929:155; Robbins et al. 1916:53; Standley 1912:458; Steggerda and Eckardt 1941:223; Stevenson 1915:65; Swank 1932:26; White 1962:107). Leaves cooked for greens, occasionally with dried agave (Gifford 1936:256). Possible ritual use but not specified (White 1945:558). Seeds ground and made into mush (Vestal 1940:162). Flowers used as a red dye or paint (Reagan 1929:155; Stevenson 1915:75, 83; Vestal 1940:162). Unspecified part boiled with meat (Vestal 1940:163). Leaves made into tea to treat stomach complaints (Swank 1932:26). Made into infusion or lotion for itchy skin (Wyman and Harris 1941:64). Seeds parched and then dried for later eating (Castetter and Underhill 1935:24).	Acoma, Chiricahua Apache, Cochiti, Hopi, Laguna, Mescalero Apache, Navajo, Northeastern Yavapai, Papago, Pima, Santa Ana, Sia, Tewa, White Mountain Apache, Zuni
Ambrosia psilostachya			full flower, young fruit	A tea made from the plant was given to women having a difficult labor (Swank 1932:26).	Acoma, Laguna
Amsinckia tessellata	full flower, young fruit	young fruit		Young leaves eaten raw (Hrdlička 1908:264).	Pima
Androsace occidentalis	young fruit			Plant made into tea for application to red ant and spider bites; leaves also applied as poultices to bites (Wyman and Harris 1941:65–66).	Navajo
Apodanthera undulata			full flower, young fruit	Seeds roasted and eaten (Lira and Caballero 2002:381). Fruit pulp mashed and used to treat urinary problems (Lira and Caballero 2002:381).	Guanajuato, Jalisco and Zacatecas states of Mexico
Aristida adscensionis			young and mature fruit	Ashes of *A. purpurea* rubbed on burns (Swank 1932:27).	Acoma, Laguna
Aristida purpurea var. *nealleyi*	no flowers, no fruit			Ashes rubbed on burns (Swank 1932:27). Used to make hair brushes (Vestal 1952:15).	Acoma, Laguna, Ramah Navajo
Astragalus nuttallianus	full flower, young fruit	mature fruit		Tubers eaten (Swank 1932:31). Fruit eaten raw or cooked (Reagan 1929:155). Pods eaten fresh or dried (Stevenson 1915:66). Juice of plant applied to wounds to stop bleeding (Wyman and Harris 1941:56). Soaked in water with other ingredients for ceremonial emetics (Wyman and Harris 1941:58). Decoction drunk as a diuretic (Wyman and Harris 1941:61). Plant named, but no use given (White 1945:562).	Acoma, Cochiti, Laguna, Navajo, White Mountain Apache, Zuni
Astragalus sp.	full flower, young fruit	no fruit		Tubers eaten (Swank 1932:31). Fruit eaten raw or cooked (Reagan 1929:155). Pods eaten fresh or dried (Stevenson 1915:66). Juice of plant applied to wounds to stop bleeding (Wyman and Harris 1941:56). Soaked in water with other ingredients for ceremonial emetics (Wyman and Harris 1941:58). Decoction drunk as a diuretic (Wyman and Harris 1941:61). Plant named, but no use given (White 1945:562).	Acoma, Cochiti, Laguna, Navajo, White Mountain Apache, Zuni

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Bahia absinthifolia			full flower, young and mature fruit	Tea used as an emetic and cathartic (Stevenson 1915:44; Swank 1932:32). Made into decoction or lotion to treat arthritis (Wyman and Harris 1941:59).	Acoma, Laguna, Navajo, Zuni
Baileya multiradiata		full flower, mature fruit		Used as an under-arm deodorant (Swank 1932:32).	Acoma, Laguna
Boerhavia coulteri			mature fruit	Plant hung as a fly-catching strip in houses (Hough 1897:39).	Hopi
Borage #3	full flower			No ethnobotanical uses for this plant were found in the literature.	
Bouteloua aristidoides			young and mature fruit	Ashes used in salve (Wyman and Harris 1941:74). Seeds gathered and ground for making bread or mush (Reagan 1929:149). Bunches made into brooms and hair brushes (Reagan 1929:155; Robbins et al. 1916:64; Stevenson 1915:83). Plant used in ceremonies (Castetter and Opler 1936:24).	Chiricahua Apache, Mescalero Apache, Navajo, Tewa, White Mountain Apache, Zuni
Bouteloua barbata			young and mature fruit	Ashes used in salve (Wyman and Harris 1941:74). Seeds gathered and ground for making bread or mush (Reagan 1929:149). Bunches made into brooms and hair brushes (Reagan 1929:155; Robbins et al. 1916:64; Stevenson 1915:83). Plant used in ceremonies (Castetter and Opler 1936:24).	Chiricahua Apache, Mescalero Apache, Navajo, Tewa, White Mountain Apache, Zuni
Bouteloua curtipendula	mature fruit			Grass used to line agave roasting pits (Castetter and Opler 1936:36). Ashes used in salve (Wyman and Harris 1941:74). Seeds gathered and ground for making bread or mush (Reagan 1929:149). Bunches made into brooms and hair brushes (Lange 1968:149; Reagan 1929:155; Robbins et al. 1916:64; Stevenson 1915:83). Plant used in ceremonies (Castetter and Opler 1936:24).	Chiricahua Apache, Cochiti, Mescalero Apache, Navajo, Tewa, White Mountain Apache, Zuni
Bromus carinatus	young fruit	mature fruit		Mature stalks gathered after seed-drop and tied into bundles for use as a broom and hair brush (Swank 1932:34).	Acoma, Laguna
Eschscholzio californica	full flower	full flower		No ethnobotanical uses for this plant were found in the literature.	
Chamaesaracha coronopus	full flower		flower buds, full flower, young fruit	Berries eaten (Hough 1897:37).	Hopi
Chamaesyce albomarginata	full flower, young fruit			Tea drunk to treat indigestion (Wyman and Harris 1941:56). Entire plant ground and powdered to treat sores, burns, and cuts (Lange 1968:149). Plant boiled, and liquid applied to sores and venereal disease (Gifford 1936:261).	Cochiti, Navajo, Northeastern Yavapai
Chamaesyce hirta			full flower, young fruit	Tea drunk to treat indigestion (Wyman and Harris 1941:56). Entire plant ground and powdered to treat sores, burns, and cuts (Lange 1968:149).	Cochiti, Navajo, Northeastern Yavapai
Chamaesyce pediculifera			full flower, young fruit	Tea drunk to treat indigestion (Wyman and Harris 1941:56). Entire plant ground and powdered to treat sores, burns, and cuts (Lange 1968:149). Plant boiled, and liquid applied to sores and venereal disease (Gifford 1936:261).	Cochiti, Navajo, Northeastern Yavapai
Chamaesyce serrula			full flower, young fruit	Tea drunk to treat indigestion (Wyman and Harris 1941:56). Entire plant ground and powdered to treat sores, burns, and cuts (Lange 1968:149). Plant boiled, and liquid applied to sores and venereal disease (Gifford 1936:261).	Cochiti, Navajo, Northeastern Yavapai

continued on next page

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Chenopodium salinum			mature utricles	Seeds parched and then ground into meal (Russell 1908:73). Seeds eaten (Standley 1912:458). Seeds ground and mixed with cornmeal to make steamed dumplings (Stevenson 1915:66). Seeds ground and made into mush (Reagan 1929:156; Vestal 1940:161). Leaves eaten as fresh greens as well as boiled (Castetter and Opler 1936:46; Castetter and Underhill 1935:14; Curtin 1984:70; Gifford 1936:254, 258; Lange 1968:149; Nequatewa 1943:19; Rea 1991:7; Reagan 1929:156; White 1945:560). Vapor from steeping plant inhaled to treat headaches (Stevenson 1915:45).	Chiricahua Apache, Cochiti, Hopi, Keres, Mescalero Apache, Navajo, Papago, Pima, Northeastern Yavapai, Western Yavapai, White Mountain Apache, Zuni
Chenopodium sp.	no flowers, no fruit	young fruit		Seeds parched and then ground into meal (Russell 1908:73). Seeds ground and made into mush (Reagan 1929:156; Vestal 1940:161). Seeds eaten (Standley 1912:458). Leaves eaten as fresh greens as well as boiled (Castetter and Opler 1936:46; Curtin 1984:70; Gifford 1936:254, 258; Lange 1968:149; Rea 1991:7; Reagan 1929:156; White 1945:560). Seeds ground and mixed with cornmeal to make steamed dumplings (Stevenson 1915:66). *C. cornutum* used as an emetic (Swank 1932:36). Vapor from steeping plant inhaled to treat headaches (Stevenson 1915:45).	Acoma, Chiricahua Apache, Cochiti, Hopi, Keres, Laguna, Mescalero Apache, Navajo, Northeastern Yavapai, Pima, Western Yavapai, White Mountain Apache, Zuni
Chloris virgata			young and mature fruit	No ethnobotanical uses for this plant were found in the literature.	
Corydalis aurea ssp. *occidentalis*	full flower, young fruit	mature fruit		Rub plant on self to aid climbing (Swank 1932:38).	Acoma, Laguna
Cucurbita digitata			young fruit	Roasted seeds eaten as a snack (Rea 1991:7). Root macerated then boiled; liquid poured into ear to treat earache (Russell 1908:79). Fruit macerated and clothes boiled in it like a detergent (Rea 1997:219). Occasionally made into canteens (Russell 1908:91).	Pima
Cymopterus multinervatus	full flower, young fruit			Roots eaten in the spring (Colton 1974:305).	Hopi
Datura meteloides			full flower, young fruit	Roots used to treat chest sores (Curtin 1984:85). Crushed leaves mixed with salt to place on sores (Curtin 1984:85). Roots and leaves crushed and applied to boils; ashes of leaves used in poultices (Swank 1932:41). Juice or powdered root used as one ingredient of an intoxicating beverage (Reagan 1929:151). Juice and ground flower and roots used as a disinfectant (Reagan 1929:156–157). Used as a medicine (Stevenson 1915:46). Powdered root used in ceremonies (Stevenson 1915:89). Root chewed or infusions drunk to treat “narcosis during minor operations, in divination, and in witchcraft” (Wyman and Harris 1941:59). Tea occasionally drunk for hunting success (Gifford 1936:261). Plant name given, but no uses specified (Robbins et al. 1916:55).	Acoma, Laguna, Navajo, Northeastern Yavapai, White Mountain Apache, Tewa, Yavapai, Zuni
Daucus pusillus	full flower	young and mature fruit		Roots eaten fresh or dried and then stored as a food for winter (Castetter 1935:26).	Navajo
Descurainia obtusa	full flower, young fruit	mature fruit		Seeds roasted and eaten as porridge (Curtin 1984:84). Possibly made into a beverage (Rea 1991:5).	Pima

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Descurainia pinnata ssp. *paysonii*	young and mature fruit	mature fruit		Seeds roasted and eaten as porridge (Curtin 1984:84). Made into a beverage (Rea 1991:5). Leaves pit-baked and eaten (Nequatewa 1943:19).	Hopi, Pima
Dichelostemma pulchellum	full flower			Bulbs eaten as a snack food (Rea 1991:5). Bulbs eaten raw or cooked in the spring (Hrdlička 1908:258).	Pima, San Carlos Apache
Digitaria californica			young and mature fruit	Seeds ground into meal (Vestal 1940:158).	Hopi
Elymus elymoides	full flower	young fruit		Young plants used for fodder (Vestal 1952:17). Plant named, but no use given (Swank 1932:42).	Acoma, Laguna, Ramah Navajo
Erigeron caespitosus	full flower	mature fruit		Members of the genus made into brooms (Swank 1932:42). Used as a snuff to treat head disorders (Wyman and Harris 1941:54). Juice of plant applied to wounds to stop bleeding (Wyman and Harris 1941:56). Plant used to treat indigestion (Wyman and Harris 1941:56). Leaves crushed and applied to pimples (Wyman and Harris 1941:64).	Acoma, Laguna, Navajo
Eriogonum abertianum			full flower	Stalks boiled and made into cakes; also boiled with mush as a flavoring (Vestal 1940:160). Used as teas to treat various ailments (Stevenson 1915:49; Swank 1932:43). Used as medicine (Reagan 1929:157). Root ground into powder, then mixed with water for medicine (Stevenson 1915:49). Flowers used in ceremonies (Stevenson 1915:91). Plant made into a poultice or tea to treat sore throats (Wyman and Harris 1941:55). Decoction made to treat diarrhea and dystentery (Wyman and Harris 1941:57). Plant made into powder, lotion, or poultice to treat venereal disease (Wyman and Harris 1941:61). Made into poultices, lotions, powders, and teas to treat infected wounds (Wyman and Harris 1941:63). Plant named, but no uses given (Robbins et al. 1916:55). Bunches of stems used to brush spines off cactus fruits (Gifford 1936:257). Stalk used to hold tobacco, if a clay pipe not available (Gifford 1936:263).	Acoma, Hopi, Laguna, Navajo, Northeastern Yavapai, Tewa, White Mountain Apache, Zuni
Erioneuron pulchellum	mature fruit			No ethnobotanical uses for this plant were found in the literature.	
Gilia tenuiflora	full flower, young fruit	full flower, young fruit		Used as paste to treat muscle cramps and for emetic tea (Swank 1932:45). Dried flowers soaked in water to make lather to treat sores and headache (Robbins et al. 1916:55). Plant taken as snuff and used for fumigation during childbirth (Robbins et al. 1916:56). Plant boiled in water and drunk to treat stomach troubles (Robbins et al. 1916:56). The freshly picked plant was rubbed on the ear to treat earaches (Robbins et al. 1916:56). Plant used in prayer sticks (Robbins et al. 1916:56). Powdered plant applied to headache and wounds (Stevenson 1915:52). Dried flowers powdered and applied to painful areas (Nickerson 1966:49). Tea made from whole plant used to treat blood disease (Nickerson 1966:49). Plant used to treat indigestion (Robbins et al. 1916:56).	Acoma, Arapaho, Hopi, Laguna, Navajo, Nevada Paiute, Tewa, Zuni

continued on next page

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Gutierrezia sp.	no flowers, no fruit			Plant soaked in water, then liquid drunk as a ritual emetic (White 1945:563). Tea used to treat many ailments either through ingestion or external application (Swank 1932:46). Tea drunk for "retention of urine" (Stevenson 1915:53). Plant used in ceremonies (Castetter and Opler 1936:24; Stevenson 1915:92). Soaked in water with other ingredients for ceremonial emetics (Wyman and Harris 1941:58).	Acoma, Chiricahua Apache, Laguna, Mescalero Apache, Navajo, Sia, Zuni
Gutierrezia microcephala	full flower	no flowers, no fruit		Plant soaked in water, then liquid drunk as a ritual emetic (White 1945:563). Prayer-stick component (Vestal 1940:168). Tea used to treat many ailments either through ingestion or external application (Swank 1932:46). Tea drunk for "retention of urine" (Stevenson 1915:53). Plant used in ceremonies (Castetter and Opler 1936:24; Stevenson 1915:92). Soaked in water with other ingredients for ceremonial emetics (Wyman and Harris 1941:58). Decoction drunk to speed labor (Wyman and Harris 1941:62).	Acoma, Chiricahua Apache, Hopi, Laguna, Mescalero Apache, Navajo, Sia, Zuni
Helianthus annuus			full flower, young and mature fruit	Seeds eaten raw, roasted, and as meal (Castetter and Opler 1936:48; Curtin 1984:103; Lange 1968:150; Reagan 1929:158; Watahomigie et al. 1982:2). Decoction of leaves taken to treat high fevers (Curtin 1984:104). Seeds used for a black/purple dye (Watahomigie et al. 1982:2). Plant ground with others to make poultice for snake bites (Reagan 1929:158; Stevenson 1915:53). Dried stalk used to light cigarettes (Robbins et al. 1916:56). Flowers used in ceremonies (Stevenson 1915:93). Plant named, but no use given (White 1945:563). Seeds eaten as a starvation food (Steggerda and Eckardt 1941:223). Pith powdered and burnt, then applied to warts (Wyman and Harris 1941:65). Stems used in prayer sticks (Wyman and Harris 1941:72).	Chiricahua Apache, Cochiti, Hualapai, Keres, Mescalero Apache, Navajo, Pima, Tewa, White Mountain Apache, Zuni
Heliomeris longifolia var. *annua*			full flower, young fruit	Plant used in life medicine (Vestal 1952:54).	Ramah Navajo
Heterotheca subaxillaris			full flower, young and mature fruit	Leaves made into poultice for ant bites or sore nose (Vestal 1952:49). Root mashed and applied to toothache (Vestal 1952:49).	Ramah Navajo
Ipomoea cristulata			full flower, young fruit	Plant named, but no uses given (Swank 1932:48).	Acoma, Laguna
Ipomopsis longiflora ssp. *longiflora*			full flower, young and mature fruit	Leaves made into a decoction to treat stomachache (Whiting 1939:87). Plant ground and mixed with water to make emetic (Elmore 1944:70).	Hopi, Navajo
Isocoma pluriflora	no flowers, no fruit	no flowers, no fruit		Leaves chewed to treat coughs (Curtin 1984:101). Warmed leaves applied as poultice to muscle aches (Curtin 1984:101). Dried plant used as kindling (Curtin 1984:101).	Pima
Kallstroemia grandiflora			full flower, young and mature fruit	Leaves chewed to make a poultice to treat sores and swellings (Robbins et al. 1916:57). Roots used as medicine to treat diarrhea (Robbins et al. 1916:57).	San Ildefonso, Santa Clara
Lappula redowskii	full flower, young fruit	young and mature fruit		Cold infusion of the plant used as a lotion on sores and swellings (Vestal 1952:37). Unnamed part used as a poultice on insect bites (Wyman and Harris 1951:40). Plant named, but no uses given (Robbins et al. 1916:57; Swank 1932:51).	Acoma, Kayenta Navajo, Laguna, Ramah Navajo, Tewa

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Lepidium lasiocarpum var. wrightii	full flower, young fruit	mature fruit		Plant used as a disinfectant (Hocking 1956:153). Plant named, but no uses given (Swank 1932:51). Seeds ground into meal to make cakes (Weber and Seaman 1985:66).	Acoma, Havasupai, Laguna, Navajo
Lesquerella gordonii	full flower, young fruit	young and mature fruit		Root made into a tea and drunk as an emetic for ceremonies (Whiting 1939:77). Root chewed and placed on snake bite as poultice (Whiting 1939:32, 77). Plant bruised and rubbed on swellings (Swank 1932:52).	Acoma, Hopi, Laguna
Lesquerella purpurea	full flower, young and mature fruit			No ethnobotanical uses for this plant were found in the literature.	
Linum lewisii	full flower	full flower, young fruit		Tea drunk by runners to improve speed (Swank 1932:52). Juice of fruit used occasionally for eye medicine (Reagan 1929:158; Stevenson 1915:56). Root made into medicinal tea (Nickerson 1966:48). Fibers in the root and stem used for string (Nickerson 1966:48). Used as a snuff to treat head disorders (Wyman and Harris 1941:54). Juice of plant applied to wounds to stop bleeding (Wyman and Harris 1941:56).	Acoma, Laguna, Navajo, Paiute, White Mountain Apache, Zuni
Lotus humistratus	full flower			Decoction drunk as a diuretic (Wyman and Harris 1941:61). Plant named, but no uses given (Swank 1932:52).	Acoma, Laguna, Navajo
Lupinus #2	full flower			Pod eaten to cure female infertility (Matthews 1886:771). Leaves boiled and eaten (Gifford 1936:254).	Navajo, Northeastern Yavapai
Lupinus concinnus	full flower, young fruit			Pod eaten to cure female infertility (Matthews 1886:771). Leaves boiled and eaten (Gifford 1936:254).	Navajo, Northeastern Yavapai
Machaeranthera pinnatifida		full flower, mature fruit		Plant mixed with warm water and drunk as an emetic (Stevenson 1915:56). Plant used in ceremonies (Stevenson 1915:94).	Zuni
Machaeranthera tagetina			full flower, young and mature fruit	Plant mixed with warm water and drunk as an emetic (Stevenson 1915:56). Plant used in ceremonies (Stevenson 1915:94).	Zuni
Mentzelia multiflora cf. var. *multiflora*			full flower, young fruit	Young seeds pounded and made into gruel; mature seeds parched for storage (Watahomigie et al. 1982:52). Seeds mashed and formed into sticks for eating (Vestal 1940:164). Tea used as a diuretic (Swank 1932:54). Roots and leaves used as a strong medicine to treat tuberculosis (Swank 1932:54). Root powdered and taken to treat constipation (Reagan 1929:158; Stevenson 1915:57). Children whipped with the fresh plant “that they may be strong to hold on to [an]… object” (Stevenson 1915:85). Soaked in water with other ingredients for ceremonial emetics (Wyman and Harris 1941:58).	Acoma, Hopi, Hualapai, Laguna, Navajo, White Mountain Apache, Zuni
Muhlenbergia porteri			young and mature fruit	Bunches of grass used to make brooms and hair brushes (Lange 1968:150; Robbins et al. 1916:64; Vestal 1940:158). Seeds ground into meal and made into bread (Castetter and Opler 1936:48; Vestal 1940:158). Grass used to line agave roasting pits (Castetter and Opler 1936:36). Grass used as layer in roof construction (Hough 1897:38).	Chiricahua Apache, Cochiti, Hopi, Mescalero Apache, Tewa

continued on next page

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Nicotiana trigonophylla			full flower, young and mature fruit	Smoked in ceremonies (Reagan 1929:158; Stevenson 1915:95; Watahomigie et al. 1982:54). Smoke blown in a patient's face (Wyman and Harris 1941:59). Wild and planted forms of tobacco smoked (Castetter and Underhill 1935:27; Gifford 1936:264). Plant recorded as frequently used, but uses not specified (Spier 1928:105; Vestal 1940:166).	Hopi, Havasupai, Hualapai, Navajo, Papago, Western Yavapai, White Mountain Apache, Zuni
Oenothera L. sp.	full flower			Mashed into a paste and used as a poultice to treat swellings (Swank 1932:27). Flowers used in preparation for ceremonies (Stevenson 1915:87). Used as an eye wash (Wyman and Harris 1941:54). Plant made into a poultice or tea to treat sore throats (Wyman and Harris 1941:55). Plant boiled and eaten (Castetter and Bell 1942:62).	Acoma, Laguna, Navajo, Papago, Zuni
Panicum hirticaule			young and mature fruit	Seeds ground into meal and made into bread (Vestal 1940:159). Seeds ground into meal and made into porridge (Castetter and Opler 1936:48). Bundles used as brooms for "cleaning metates and metate boxes" (Robbins et al. 1916:64). Plant named, but no uses given (Swank 1932:57).	Acoma, Chiricahua Apache, Hopi, Laguna, Mescalero Apache, Tewa
Penstemon sp.		full flower		Tea made from plant used as an emetic (Swank 1932:58). Flowers used in ceremonies (Swank 1932:58). Used as "magic medicine" (Reagan 1929:159). Applied to sores as a dressing (Robbins et al. 1916:58; Wyman and Harris 1941:63). Leaves or root crushed and placed on toothache (Wyman and Harris 1941:55). Plant taken as a cathartic for constipation and gas (Wyman and Harris 1941:57). Decoction drunk to aid placenta delivery (Wyman and Harris 1941:62). Used in many forms on burns and scalds (Wyman and Harris 1941:63).	Acoma, Laguna, Navajo, Santa Clara, White Mountain Apache
Perezia nana			no flowers, no fruit	Used as a styptic (Russell 1908:80). Roots added to fermented corn beverage to strengthen it (Hrdlička 1908:27). Fluff from root base applied to newborn umbilicus (Gifford 1936:261).	Northeastern Yavapai, Pima, San Carlos Apache
Phacelia arizonica	full flower, young fruit	young and mature fruit		Tea drunk to treat sore throat (Swank 1932:59). Root steeped in water and rubbed on swellings (Swank 1932:59). Plant name listed, but no uses specified (Robbins et al. 1916:59).	Acoma, Laguna, Tewa
Phacelia crenulata	full flower	young fruit		Tea drunk to treat sore throat (Swank 1932:59). Root steeped in water and rubbed on swellings (Swank 1932:59). Eaten as greens, possibly a starvation food (Rea 1991:5).	Acoma, Laguna, Pima
Physalis latiphysa			young fruit	Fruit eaten raw and cooked (Castetter and Opler 1936:45; Lynch 1986:17; Rea 1991:5; Reagan 1929:159; Robbins et al. 1916:59; Steggerda and Eckardt 1941:222; Stevenson 1915:70; Swank 1932:59).	Acoma, Chiricahua Apache, Laguna, Mescalero Apache, Navajo, Pima, Tewa, White Mountain Apache, Zuni
Plantago insularis	full flower	full flower, young and mature fruit		Seeds soaked in water, then liquid drunk to cure diarrhea (Curtin 1984:97). Roots used in blood medicine (Swank 1932:61). Young shoots eaten (Swank 1932:61). Tea drunk to treat diarrhea and headache (Swank 1932:61). Seeds used to make a "mucilaginous drink" (Rea 1991:5). Plant used to treat indigestion (Wyman and Harris 1941:56). Decoction drunk as a diuretic (Wyman and Harris 1941:60).	Acoma, Navajo, Pima, Laguna

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Plantago patagonica	full flower, young fruit	young fruit		Seeds soaked in water, then liquid drunk to cure diarrhea (Curtin 1984:97). Plant used to treat indigestion (Wyman and Harris 1941:56). Decoction drunk as a diuretic (Wyman and Harris 1941:60).	Navajo, Pima
Poa bigelovii	full flower, young fruit	mature fruit		Plant named, but no uses given (Matthews 1886:777).	Navajo
Polanisia trachysperma			young fruit	Young shoots and leaves eaten as greens (Swank 1932:37, 62). Seeds eaten as mush (Swank 1932:37, 62). Plant used for paint (Robbins et al. 1916:59, 61). Plant boiled for greens (Robbins et al. 1916:59, 61). Plant used in ceremonies (Stevenson 1915:96).	Acoma, Laguna, Tewa, Zuni
Proboscidea parviflora			young fruit	Seeds eaten (Curtin 1984:108; Rea 1991:5). Cultivated for use in basketry (Curtin 1984:107). Young pods eaten for food (Curtin 1984:107). "For rheumatic paind a small piece of claw was broken off and pressed into the flesh, then lighted and allowed to burn" (Curtin 1984:108).	Pima
Psilostrophe cooperi		full flower		Crushed flowers boiled to create a yellow dye (Reagan 1929:160; Swank 1932:64).	Acoma, Laguna, White Mountain Apache
Rafinesquia neomexicana	full flower	full flower, mature fruit		No ethnobotanical uses for this plant were found in the literature.	
Rumex cf. *hymenosepalus*	full flower, young fruit	no fruit		Tuber used for tanning and dyeing (Curtin 1984:51–52; Lange 1968:150; Watahomigie et al. 1982:53). Seeds ground for meal and made into cakes (Curtin 1984:51; Lynch 1986:30). Root chewed as medicine for colds (Curtin 1984:51–52; Rea 1991:5). Leaves boiled for greens (Castetter and Opler 1936:46; Castetter and Underhill 1935:14; Curtin 1984:51–52; Lange 1968:150; Rea 1991:5). Stem roasted or stewed, then eaten (Russell 1908:77). Roots eaten raw (Russell 1908:77). Powdered root applied to sores (Hrdlička 1908:242; Russell 1908:80). Young stems (prebudding) boiled for a drink (Watahomigie et al. 1982:53). Dried roots used for tinder (Swank 1932:67). Root ashes mixed with water to make a paste for burns (Swank 1932:67). Leaves made into tea for sore throats (Reagan 1929:160; Stevenson 1915:59). A tea made from the root was drunk by women to promote fertility (Stevenson 1915:85). Roots used in ceremonies (Stevenson 1915:98). Upper stalk roasted and eaten as starvation food (Gifford 1936:258). Roots boiled, then liquid gargled to treat sore throat, but drunk to treat cough or stomachache (Gifford 1936:261).	Acoma, Chiricahua Apache, Cochiti, Hualapai, Laguna, Mescalero Apache, Navajo, Northeastern Yavapai, Papago, Pima, White Mountain Apache, Zuni
Sanvitalia abertii			full flower, young and mature fruit	Plant chewed to treat canker sores (Elmore 1944:88; Vestal 1952:53). Leaves used in a cold infusion for headaches (Vestal 1952:53).	Ramah Navajo
Setaria leucopila			young and mature fruit	No ethnobotanical uses for this plant were found in the literature.	

continued on next page

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Solanum elaeagnifolium			full flower, young and mature fruit	Crushed or whole dried berries used as snuff to induce sneezing for colds (Curtin 1984:89; Swank 1932:69). Nursing mothers drink tea of the plant to sustain milk supply (White 1945:562). Heated root held to aching tooth (Swank 1932:70). Berries used in ceremonial garb (Lange 1968:151; Swank 1932:70). Used as a medicine; ailment not specified (Reagan 1929:160). Piece of chewed root placed on a toothache (Stevenson 1915:60). Powdered root mixed with water to treat stomachache (Stevenson 1915:60).	Acoma, Cochiti, Keres, Laguna, Pima, White Mountain Apache, Zuni
Sphaeralcea sp.		full flower, young fruit		Roots and leaves boiled in water, then drunk to treat diarrhea (Curtin 1984:80; Russell 1908:79). Sap from crushed roots used as glue (Swank 1932:71). Roots used as a medicine by pregnant women (Swank 1932:71). Roots powdered and applied to snake bites and infected sores (Robbins et al. 1916:61). Root skin peeled and made into paint (Robbins et al. 1916:61). Root used in ceremonies (Stevenson 1915:98). Leaves powdered and applied as a paste to treat rheumatism (Lange 1968:151).	Acoma, Cochiti, Laguna, Pima, Tewa, Zuni
Sphaeralcea rusbyi	full flower, young fruit	full flower, mature fruit	full flower, young fruit	Roots and leaves boiled in water, then drunk to treat diarrhea (Curtin 1984:80; Russell 1908:79). Sap from crushed roots used as glue (Swank 1932:71). Roots used as a medicine by pregnant women (Swank 1932:71). Root used in ceremonies (Stevenson 1915:98). Tea drunk to treat respiratory issues (Wyman and Harris 1941:55). Leaves powdered and applied as a paste to treat rheumatism (Lange 1968:151).	Acoma, Cochiti, Laguna, Navajo, Pima, Zuni
Sporobolus wrightii	no flowers, no fruit	no flowers, no fruit		Seeds gathered and ground for making bread or mush (Castetter and Opler 1936:48; Reagan 1929:149; Steggerda and Eckardt 1941:223). Bunches made into mats for covering openings (Stevenson 1915:81). Seeds ground and made into mush (Nequatewa 1943:20). Grass used to line agave roasting pits (Castetter and Opler 1936:36). Stems made into bunches for brooms to brush off cactus spines (Castetter and Opler 1936:40). Seeds parched, dried, and then stored for later eating (Castetter and Underhill 1935:24).	Chiricahua Apache, Hopi, Mescalero Apache, Navajo, Papago, White Mountain Apache, Zuni
Stephanomeria pauciflora			full flower, young and mature fruit	Sap applied to sore eyes (Swank 1932:72).	Acoma, Laguna
Streptanthus carinatus ssp. *arizonicus*	full flower			Juice made from roots put in sore eyes (Wyman and Harris 1951:25). Leaves eaten as greens (Wyman and Harris 1951:25).	Kayenta Navajo
Thelesperma megapotamicum			full flower, young fruit	Leaves and roots boiled for tea (Castetter and Opler 1936:53; Lange 1968:151; Matthews 1886:773; Robbins et al. 1916:61; Swank 1932:72; Vestal 1940:168; White 1945:563). Decoction drunk as a diuretic (Wyman and Harris 1941:61). Plant made into tea for application to red ant bites; leaves also applied as poultices to bites (Wyman and Harris 1941:65). Red-brown dye made from whole plant (Hough 1897:39).	Acoma, Chiricahua Apache, Cochiti, Hopi, Keres, Laguna, Mescalero Apache, Navajo, Tewa
Tidestromia lanuginosa			full flower	No ethnobotanical uses for this plant were found in the literature.	
Trianthema portulacastrum			full flower, possibly young fruit	Plant cooked and eaten as greens (Curtin 1984:64).	Pima

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Xanthium saccharatum	mature fruit	mature fruit	young fruit	Burs boiled in water, which was drunk to treat constipation and diarrhea (Curtin 1984:97). Pulp mixed with soot, applied to sore eyes (Russell 1908:80). Seeds powdered for application to sores (Swank 1932:74). Ground seeds used for a blue paint for ceremonial uses (Swank 1932:74). Seeds ground for meal (Reagan 1929:161; Stevenson 1915:72). Roots and leaves used for blood medicine (Reagan 1929:161). Plant “used as a remedy for diarrhea and vomiting” (Robbins et al. 1916:49). Used to fumigate children with urinary disorders (Robbins et al. 1916:49). Seeds ground with squash seeds and corn to make a paste, which was applied to cactus splinters in the skin (Stevenson 1915:62). Seeds eaten (Gifford 1936:255). Seeds parched and then ground into meal (Gifford 1936:258).	Acoma, Laguna, Northeastern Yavapai, Pima, Santa Clara, White Mountain Apache, Zuni
Zinnia pumila			full flower, young fruit	Decoction drunk as a diuretic (Wyman and Harris 1941:61). Used as a fumigant after improper sexual intercourse (Wyman and Harris 1941:61). Plant made into tea for application to red ant bites; leaves also applied as poultices to bites (Wyman and Harris 1941:65).	Navajo
Ziziphus obtusifolia	no flowers, no fruit	no flowers, no fruit		Root macerated and boiled; liquid used as an eye wash (Russell 1908:79). Planted as a fence (Rea 1991:5). Fruit eaten (Standley 1912:457). Berries mashed and mixed with water to make a beverage (Gifford 1936:258). Fruit boiled down into syrup (Castetter and Underhill 1935:19).	Navajo, Northeastern Yavapai, Papago, Pima
				Cacti and Other Succulents	
Agave palmeri	mature fruit	no flowers, no fruit	young fruit	Heart baked in pits, then sliced and dried for storage (Castetter and Opler 1936:36; Curtin 1984:48–49; Gifford 1936:255, 259; Hrdlička 1908:257; Rea 1991:4; Reagan 1929:146; Russell 1908:70). Flower stalks used as poles for carrying litters (Gifford 1936:259).	Chiricahua Apache, Mescalero Apache, Northeastern Yavapai, Papago, Pima, San Carlos Apache, Western Yavapai, White Mountain Apache
Carnegiea gigantea	unknown			Fruit used to make syrup, jam, and fermented beverages; seeds used to make meal (Castetter and Bell 1937:13–15; Castetter and Opler 1936:40; Dawson 1944:134; Gifford 1936:260; Rea 1991:4; Russell 1908:72). Ribs used as drying racks for construction and in basketry (Castetter and Bell 1937:25). Ribs used as splints for broken bones (Hrdlička 1908:247). Fruit “made into a kind of butter” (Reagan 1929:147). Ribs used for constructing shelters (Gifford 1936:271). Ribs used as tongs for collecting cholla buds (Castetter and Underhill 1935:15).	Chiricahua Apache, Northeastern Yavapai, Pima, Papago, Seri, Western Yavapai, White Mountain Apache

continued onnext page

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Cylindropuntia spp.	no flowers, no fruit			Fruit pit-baked or sun-dried, then eaten (Curtin 1984:58; Rea 1991:4; Watahomigie et al. 1982:10). Dried buds cooked with *Atriplex* greens as flavoring or ground for use in gruel (Curtin 1984:59). Joints roasted and eaten as a famine food (Swank 1932:55). Dried woody stems used for torches and candles (Swank 1932:55). Thorns used for sewing and tattoo needles (Swank 1932:55). Pith placed in the ear to treat ear complaints (Swank 1932:56). Fruit eaten raw, dried, or stewed (Reagan 1929:159; Stevenson 1915:69). Plant used in ceremonies (Stevenson 1915:95). Buds boiled with corn cobs and then eaten (Nequatewa 1943:19). Spines used to lance boils (Wyman and Harris 1941:64). Young shoots and buds eaten (Castetter and Underhill 1935:14).	Acoma, Hopi, Hualapai, Laguna, Papago, Pima, White Mountain Apache, Zuni
Ferocactus	mature fruit	mature fruit		Cactus flesh eaten with mesquite pods (Rea 1991:5). Stems used as supplies of emergency water (Castetter and Underhill 1935:17; Dawson 1944:136). Pulp eaten (Castetter and Underhill 1935:14).	Papago, Pima, Seri
Echinocereus spp.	no flowers, no fruit	full flower		Fruits eaten (Castetter and Opler 1936:41; Rea 1991:5; Reagan 1929:158; Swank 1932:42). Seeds “parched, ground, and boiled into mush” (Hrdlička 1908:257). Stem used as an emergency source of water (Hrdlička 1908:257).	Acoma, Chiricahua Apache, Laguna, Mescalero Apache, Pima, San Carlos Apache, White Mountain Apache
Opuntia leptocaulis	mature fruit	no flowers, no fruit		Fruit gathered and eaten raw; plants often cultivated in gardens (Curtin 1984:60). Fruits roasted and eaten (Rea 1991:7). Ground root boiled for tea to treat children with diarrhea (Hrdlička 1908:244). Fruits crushed and mixed with alcoholic beverages (Castetter and Opler 1936:55).	Chiricahua Apache, Mescalero Apache, Pima
Opuntia spp.	no flowers, no fruit	no flowers, no fruit		Young pads cooked and sliced “like string beans” (Castetter and Underhill 1935:14; Curtin 1984:61). Ripe fruit boiled to make a pink dye (Curtin 1984:61). “Roasted in damp sand and eaten with chili” (White 1945:560, 1962:107). Fruit eaten fresh, dried, or made into a drink or mush (Lynch 1986:14; Robbins et al. 1916:62; Steggerda and Eckardt 1941:222; Swank 1932:56; Watahomigie et al. 1982:4). Spines burned off pad, then split and inner juice applied as a poultice to treat cuts and burns (Watahomigie et al. 1982:4). Buds baked and ground for a gruel to treat stomach disorders (Watahomigie et al. 1982:4). Fruit used for red paint (Swank 1932:56). Spines used as sewing needles (Swank 1932:56). Whole plants boiled with corn cobs, then spines removed and pads eaten (Nequatewa 1943:19). Spines used to lance boils (Wyman and Harris 1941:64). Powdered stems placed on boils and pimples to bring them to a head (Lange 1968:150). Flowers fried in grease and eaten (Castetter and Underhill 1935:16).	Acoma, Cochiti, Hopi, Hualapai, Laguna, Navajo, Papago, Pima, Sia, Tewa

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Yucca elata	no flowers, no fruit	flower buds, no fruit	no flowers, no fruit	Fruits eaten raw, boiled, and dried (Bell and Castetter 1941:15; Gifford 1936:258; Hrdlička 1908:258; Nequatewa 1943:18; Reagan 1929:147; Robbins et al. 1916:50; Russell 1908:72; Steggerda and Eckardt 1941:221; Stevenson 1915:72; Swank 1932:75; Watahomigie et al. 1982:39–40; White 1962:107). Fibers used for twine and basketry (Bell and Castetter 1941:30; Gifford 1936:259; Reagan 1929:147; Robbins et al. 1916:50; Stevenson 1915:78, 81; Swank 1932:75; Watahomigie et al. 1982:39–40). Roots used for soap (Bell and Castetter 1941:64; Robbins et al. 1916:50; Stevenson 1915:83; Swank 1932:76; Watahomigie et al. 1982:39; Wyman and Harris 1941:53). Leaves used for ceremonial purposes (Swank 1932:75). Yucca hearts made into tea to treat weakness (Swank 1932:75). Leaves used as matting to cover shelters and hatches (Reagan 1929:144; Stevenson 1915:79). Fruit of one variety eaten to encourage easy childbirth (Robbins et al. 1916:50). Leaves baked and eaten as an emergency food (Robbins et al. 1916:51). Leaves used for paintbrushes (Stevenson 1915:82). Leaves and stalks used in ceremonies (Stevenson 1915:99). Tender center leaves cooked and eaten (Castetter and Opler 1936:39).	Acoma, Chiricahua Apache, Hopi, Hualapai, Laguna, Mescalero Apache, Navajo, Northeastern Yavapai, Papago, Pima, San Carlos Apache, Sia, Tewa, White Mountain Apache, Zuni
Dasylirion wheeleri		unknown		Tender young crowns baked, macerated, dried, and then stored as a food for winter (Castetter and Opler 1936:38). Crowns baked in roasting pits, then ground into meal and made into cakes (Bell and Castetter 1941:58–59). Flower stalks cooked for greens (Bell and Castetter 1941:58–59). Leaves used for twine fibers, sandals, and mats (Bell and Castetter 1941:65). Young stalk roasted or boiled and then pith eaten (Castetter and Opler 1936:38).	Chiricahua Apache, Mescalero Apache, Papago, Pima
				Trees and Shrubs	
Acacia	no flowers, no fruit			Bushes used for firewood or brush fences (Curtin 1984:90). Branches used to make bows (Curtin 1984:90). Green twigs used to make baskets (Castetter and Bell 1942:185; Spier 1928:128). Seeds may have been eaten as a starvation food (Rea 1991:6; Russell 1908:76). Beans eaten (Dawson 1944:136). Branches used for basketry frames (Dawson 1944:138). Sticks used to knock down saguaro fruit (Castetter and Underhill 1935:20). "Buds and blossoms . . . dried and kept . . . as a perfume sachet" (Castetter and Underhill 1935:52). Pliable branches used in construction (Castetter and Underhill 1935:53).	Havasupai, Papago, Pima, Seri

continued on next page

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Atriplex sp.	no flowers, no fruit			Seeds parched and then ground into meal (Russell 1908:73). Leaves combined in water to make a detergent (Curtin 1984:66–67). Seeds eaten as a famine food (Curtin 1984:67; Rea 1991:6). Burning galls applied to rheumatic areas (Curtin 1984:68). Leaves steeped in water and liquid applied to sore places (Watahomigie et al. 1982:11). Leaves boiled with meat; ashes used as a leavening agent (Vestal 1940:160). Seeds eaten and young leaves eaten as greens (Lange 1968:149; Swank 1932:31). Boiled with food to give a salty flavor (Lange 1968:149; Russell 1908:69). Red-colored *Atriplex* species were used as a tea for "blood medicine" (Swank 1932:32). Ashes stirred into dough to give blue coloring (Robbins et al. 1916:54). Paste made from dried root and blossoms and applied to ant bites (Stevenson 1915:44). Seeds ground for mush (Stevenson 1915:66). Used in rituals (Stevenson 1915:88). Made into decoction or lotion to treat itchy skin (Wyman and Harris 1941:64). Plant named, but no use given (White 1945:563).	Acoma, Cochiti, Hano, Hopi, Hualapai, Laguna, Maricopa, Navajo, Pima, Sia, Zuni
Baccharis salicifolia	no flowers, no fruit			Tea made from leaves rubbed on swellings and headaches (Swank 1932:32). Used as a snuff to treat head disorders (Wyman and Harris 1941:54). Leaves and roots boiled; liquid applied to rheumatism and gonorrhea (Gifford 1936:261). Branches used as shades and roofing (Gifford 1936:271).	Acoma, Laguna, Navajo, Northeastern Yavapai, Western Yavapai
Baccharis sarothroides	no flowers, no fruit	no flowers, no fruit		Stalks combined to make brooms (Curtin 1984:65). Tea made from leaves rubbed on swellings and headaches (Swank 1932:32). Used as a snuff to treat head disorders (Wyman and Harris 1941:54). Tea made from seeds (Castetter and Underhill 1935:27).	Acoma, Laguna, Navajo, Papago, Pima
Dalea formosa	no flowers, no fruit			Root eaten (Vestal 1940:163). Plant sometimes used as firewood (Swank 1932:57). Leaves made into an infusion for an emetic (Swank 1932:57).	Acoma, Hopi, Laguna
Ephedra trifurca	full flower, young fruit	mature fruit		Green branches used for tea (Castetter and Underhill 1935:25; Curtin 1984:76; Stevenson 1915:67; Watahomigie et al. 1982:34). Stems used to strain boiling pine pitch (Watahomigie et al. 1982:34). Tea drunk to treat coughs or urinary tract problems (Hrdlička 1908:233; Swank 1932:42). Used in sweat baths (Swank 1932:42.). Dried, powdered roots applied to sores (Curtin 1984:76). Bark made into tea to treat "ague, fevers, and gonorrhea" (Reagan 1929:154). Leaves and stems boiled in water, then liquid drunk to treat diarrhea (Robbins et al. 1916:46). Tea drunk to treat syphilis (Stevenson 1915:49; Wyman and Harris 1941:60).	Acoma, Hualapai, Laguna, Navajo, Papago, Pima, San Carlos Apache, Tewa, White Mountain Apache, Zuni
Fouquieria splendens	no flowers, no fruit			Planted as a fence (Curtin 1984:89); Sticks used for house construction (Castetter and Underhill 1935:53; Curtin 1984:89; Dawson 1944:136). Planted in gardens for beautification (Curtin 1984:90). Root made into a decoction to treat symptoms of gonorrhea (Hrdlička 1908:233). Children suck on flowers for nectar (Gifford 1936:256). Nectar expressed from blossoms to make a sort of hard candy (Castetter and Underhill 1935:28). Thorns used to pierce children's ears (Castetter and Underhill 1935:51).	Northeastern Yavapai, Papago, Pima, San Carlos Apache, Seri

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Hymenoclea salsola	no flowers, no fruit	no flowers, no fruit		Seeds eaten (Dawson 1944:136). Used to make brushes and brooms (Watahomigie et al. 1982:47). Used for kindling (Watahomigie et al. 1982:47). Used to make arrow shafts (Watahomigie et al. 1982:47).	Hualapai, Seri
Juglans major		unknown		Nut meats ground to extract nut oils; both meat and oils eaten (Gifford 1932:209). Nut meats ground and mixed with agave syrup to make a beverage (Gifford 1936:256). Nut meats eaten plain or mixed with other ingredients (Castetter and Opler 1936:42; Gifford 1936:256).	Chiricahua Apache, Mescalero Apache, Northeastern Yavapai, Southeastern Yavapai
Juniperus sp.	unknown			Berries eaten raw or cooked (Castetter and Opler 1936:37; Gifford 1932:212, 1936:257; Lynch 1986:22; Nequatewa 1943:18; Robbins et al. 1916:40; Swank 1932:50; Watahomigie et al. 1982:32; White 1945:561). Ashes of leaves applied to sores (Watahomigie et al. 1982:32). Leaves boiled for tea (Reagan 1929:158; Watahomigie et al. 1982:32). Tea made from branches used by women in confinement (Reagan 1929:158; Vestal 1940:158). Tea made from twigs and drunk as an emetic (Swank 1932:48). Branches used in ceremonies (Robbins et al. 1916:39; Swank 1932:48). “Leaves ground with salt and put in the ear to get bugs to come out” (Swank 1932:48). Different species used to make green or yellow dyes (Nickerson 1966:46; Swank 1932:49). Larger twigs used as frames in basketry (Swank 1932:49). Important source of firewood and posts (Lange 1968:145; Swank 1932:49). Bark chewed as a laxative and cure for spider bites (Swank 1932:49). Used for firewood (Robbins et al. 1916:39; Stevenson 1915:93). Bark used for tinder and kindling (Robbins et al. 1916:39; Stevenson 1915:93). Bark used for chinking in construction (Robbins et al. 1916:39). Infusion of leaves used to purify women after childbirth (Robbins et al. 1916:40). Hot twigs applied to a bruise or sprain (Robbins et al. 1916:40). Used in ceremonies (Stevenson 1915:93). Ashes used as a mordant for dyes (Nickerson 1966:46). Soaked in water with other ingredients for ceremonial emetics (Wyman and Harris 1941:58). Bark stripped from trees and used as thatch for shelter (Gifford 1936:271).	Acoma, Chiricahua Apache, Cochiti, Great Basin groups, Hano, Hopi, Hualapai, Keres, Laguna, Mescalero Apache, Navajo, New Mexico Tewa, Northeastern Yavapai, Southeastern Yavapai, White Mountain Apache, Zuni
Larrea tridentata	mature fruit			Branches used as kindling (Curtin 1984:62). Leaves boiled in water to make emetic for fever (Curtin 1984:62; Russell 1908:79). Infusion applied to skin diseases or as mouth rinse for toothache (Curtin 1984:62). Plants ground and applied as under-arm deodorant (Curtin 1984:62). Boiled leaves used in poultices (Russell 1908:79). Leaves and stems boiled, then liquid drunk to treat sore throats (Gifford 1936:261). Leaves and stems boiled, then liquid used to bathe cuts, sores, rheumatism, and venereal disease (Gifford 1936:261). Branches used to make bedding, especially for sick people (Gifford 1936:272).	Northeastern Yavapai, Pima, Western Yavapai

continued on next page

Taxon	Observed Stage of Inflorescence or Fruit Development			Ethnobotanical Use	Used By
	March	April	September		
Lycium berlandieri	no flowers, no fruit	no flowers, no fruit		Berries cooked and made into syrup (Curtin 1984:87; Swank 1932:52). Berries eaten, method not specified (Robbins et al. 1916:47). Berries boiled or eaten raw (Russell 1908:75; Steggerda and Eckardt 1941:222; Stevenson 1915:68). Berries crushed and boiled to make a cold beverage (Rea 1991:4). Roots ground and boiled; liquid drunk to treat headaches (Hrdlička 1908:232). Berries stewed, then ground into a jelly and mixed with clay to be eaten (Nequatewa 1943:19). Plant had ritual importance (Matthews 1886:775; Stevenson 1915:94). Berries dried and eaten like raisins (Castetter and Underhill 1935:19).	Acoma, Hopi, Laguna, Navajo, Papago, Pima, San Carlos Apache, Zuni
Populus fremontii	no flowers, no fruit	no flowers, no fruit		New shoots used for basketry (Curtin 1984:109; Watahomigie et al. 1982:3). Used for fuel and fence posts but not preferred (Curtin 1984:109). Leaves boiled in water and then used to bathe sores (Curtin 1984:109). Leaves used as an ingredient in hair dye, along with *Prosopis* bark (Curtin 1984:109). Catkins eaten raw (Russell 1908:69). Trunk hollowed for drums (Robbins et al. 1916:42; Watahomigie et al. 1982:3). Wood used for fuel and construction (Swank 1932:62). Buds, cotton, and pitch chewed as gum (Castetter and Opler 1936:45; Reagan 1929:159; Swank 1932:62). Wood used as cross pieces in house construction (Curtin 1984:111). Pitch used to treat coughs (Reagan 1929:159). Buds eaten (Rea 1991:5; Reagan 1929:159). Twigs used in ceremonies (Stevenson 1915:97). Used for firewood (Lange 1968:147). Name given, but no uses listed (White 1945:561).	Acoma, Cochiti, Hualapai, Keres, Laguna, Pima, Tewa, White Mountain Apache, Zuni
Prosopis velutina	no flowers, no fruit	no flowers, no fruit		Used for house construction poles (Curtin 1984:111). Sap eaten as a snack (Rea 1991:5; Russell 1908:75). Catkins eaten (Russell 1908:75). Black gum boiled in water, then diluted liquid used to dress sore eyes and wounds (Russell 1908:79). Inner bark boiled to make emetic and cathartic (Russell 1908:79). Leaves made into eye wash (Swank 1932:63). Beans eaten raw, cooked, or ground into flour (Castetter and Opler 1936:41; Castetter and Underhill 1935:25; Dawson 1944:136; Gifford 1936:257, 258; Rea 1991:4; Russell 1908:74; Swank 1932:62). Root bark used to make fiber for cords (Dawson 1944:134).	Acoma, Chiricahua Apache, Laguna, Mescalero Apache, Northeastern Yavapai, Western Yavapai, Papago, Pima, Seri
Salix taxifolia	full flower	no flowers, no fruit		Used as a frame for basketry and mats; also used for shelter and firewood (Castetter and Underhill 1935:53; Curtin 1984:108; Gifford 1936:282; Reagan 1929:150; Stevenson 1915:81; Swank 1932:67; Watahomigie et al. 1982:29). Leaves and bark steeped in water to make drink to treat fevers (Curtin 1984:108; Swank 1932:67). Catkins eaten raw (Curtin 1984:108). Planted for fences (Curtin 1984:108). Used for prayer sticks (Robbins et al. 1916:49; Swank 1932:68; White 1945:564; Wyman and Harris 1941:72). Branches tied together to make a whisk for cooking (Reagan 1929:160; Stevenson 1915:70). Branches used for the hoop-and-pole game (Reagan 1929:160). Twigs used in ceremonies (Robbins et al. 1916:48). Charcoal used for body paint (Robbins et al. 1916:49). Used for filling in rafters (Stevenson 1915:81). Soaked in water with other ingredients for ceremonial emetics (Wyman and Harris 1941:58).	Acoma, Hualapai, Keres, Laguna, Navajo, Northeastern Yavapai, Papago; Pima, Tewa, White Mountain Apache, Zuni

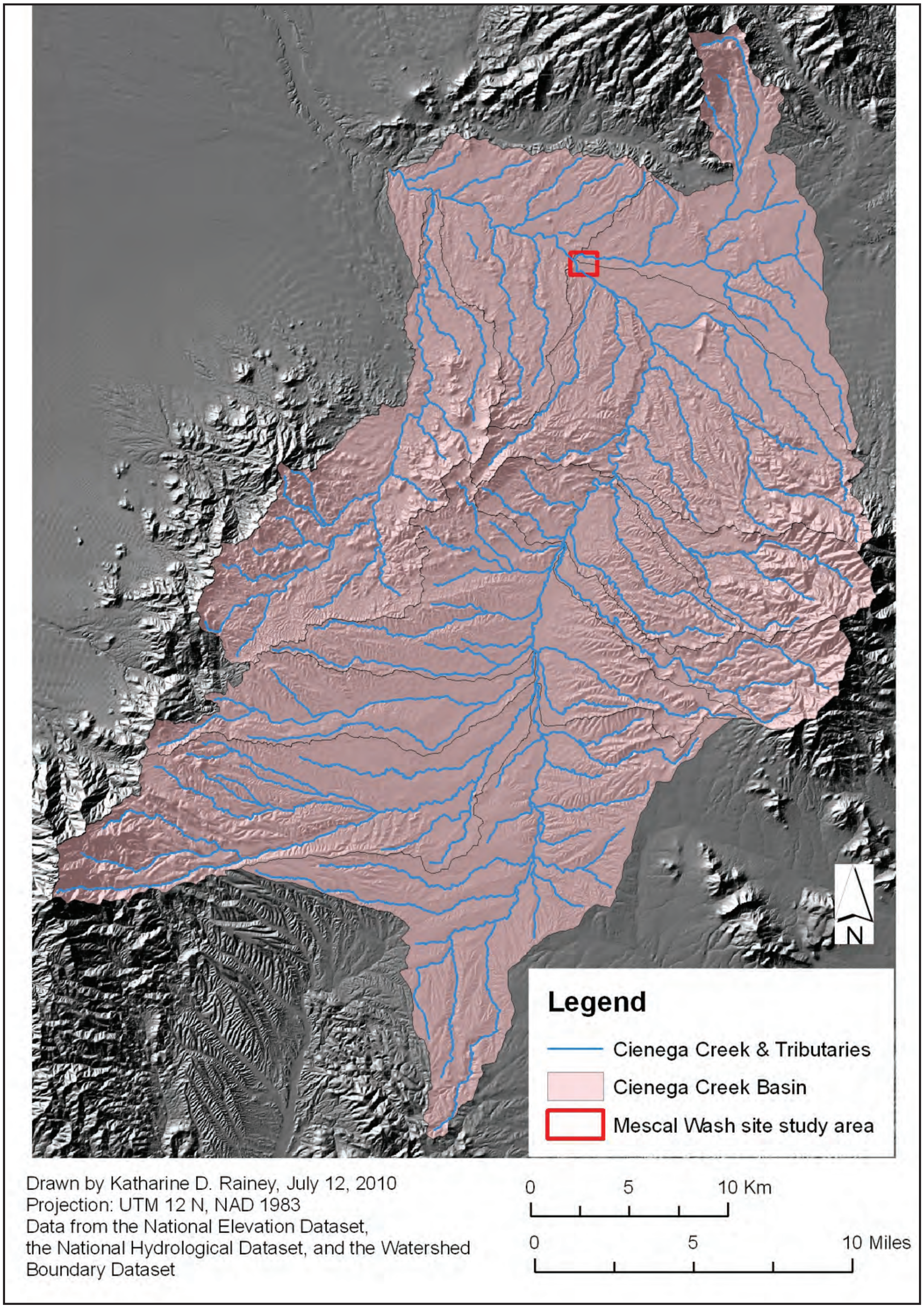
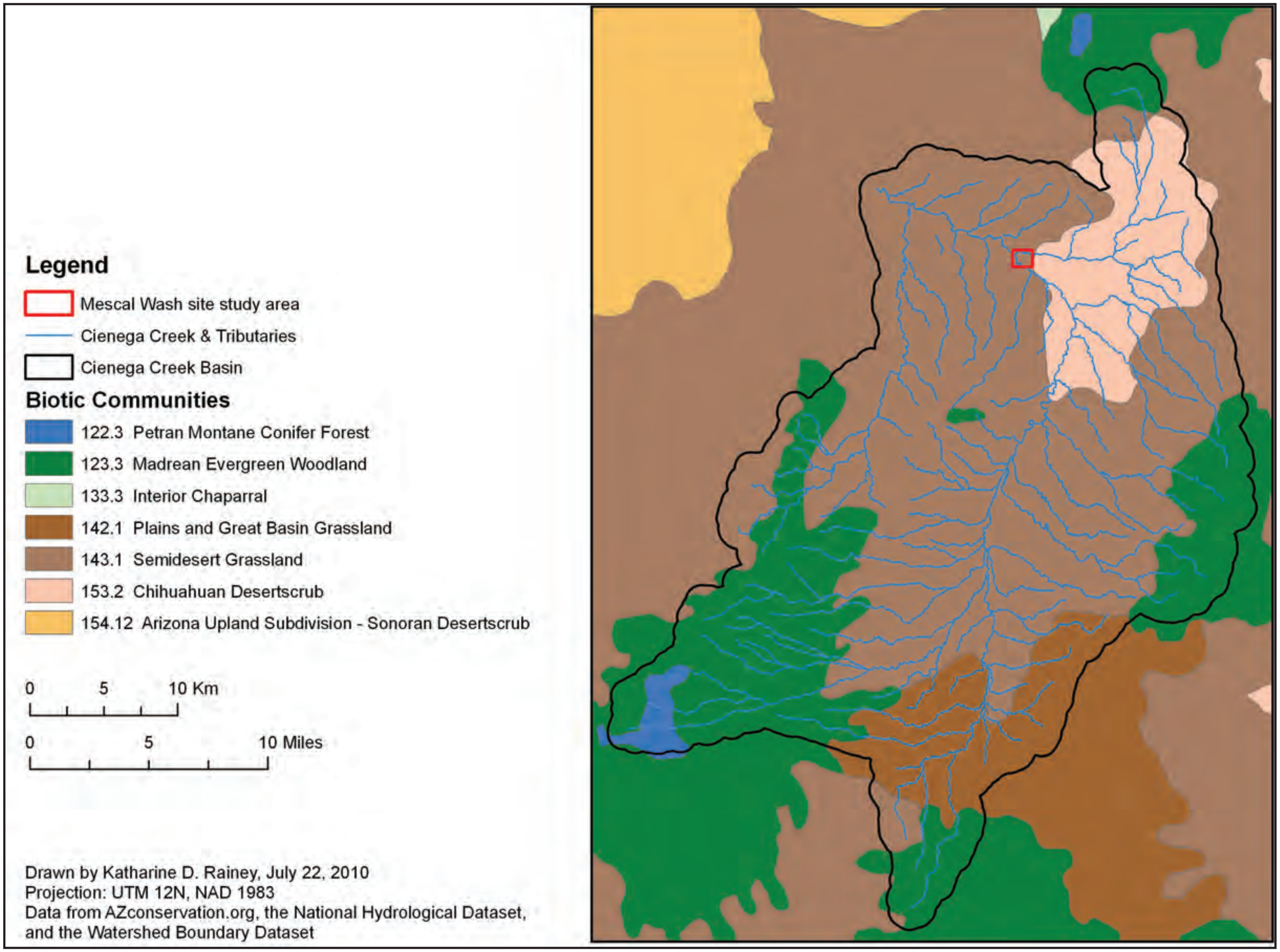


Figure 9.A.2. Overview of the Cienega Creek basin, showing the location of Mescal Wash site area.



Drawn by Katharine D. Rainey, July 22, 2010
Projection: UTM 12N, NAD 1983
Data from AZconservation.org, the National Hydrological Dataset, and the Watershed Boundary Dataset

Figure 9.A.3. Biotic communities of the Cienega Creek basin, showing location of Mescal Wash site area.

Table 9.A.7. Presence of Native Grasses, Ruderals, and Herbaceous Perennials at the Collection Stops

Taxon	Stop No. 1	Stop No. 2	Stop No. 3	Stop No. 4	Stop No. 5	Stop No. 6	Stop No. 7	Stop No. 8	Stop No. 1000
Allionia incarnata								C	
Amaranthus palmeri								CD	
Ambrosia psilostachya								C	
Amsinckia tessellata	C (March), S (April)	S							
Androsace occidentalis		S							
Apodanthera undulata								C	
Aristida adscensionis								C	
Aristida purpurea var. *nealleyi*				C					
Astragalus nuttallianus	C (March), R (April)								
Astragalus sp.			C	R	C	R			
Bahia absinthifolia								S	
Baileya multiradiata	S								
Boerhavia coulteri								R	
Borage #3						C			
Bouteloua aristidoides								C	
Bouteloua barbata								C	
Bouteloua curtipendula				C					
Bromus carinatus							C		
California poppy						R			
Chamaesaracha coronopus	S							C	
Chamaesyce albomarginata					C				
Chamaesyce hirta						R			
Chamaesyce pediculifera						R			
Chamaesyce serrula								C	
Chenopodium salinum						R			
Chenopodium sp.	R					R (March), S (April)	R		
Chloris virgata								C	
Corydalis aurea ssp. *occidentalis*		S				S (March), R (April)	R		
Cucurbita digitata								R	
Cymopterus multinervatus			R	S	R				
Datura meteloides						R			
Daucus pusillus	C				C	R	R		
Descurainia obtusa	C	C	C	C	S	C (March), S (April)	C (March), S (April)		
Descurainia pinnata ssp. *paysonii*	S (March), C (April)			C		R			

continued on next page

Taxon	Stop No. 1	Stop No. 2	Stop No. 3	Stop No. 4	Stop No. 5	Stop No. 6	Stop No. 7	Stop No. 8	Stop No. 1000
Dichelostemma pulchellum	C		R		R				
Digitaria californica								C	
Elymus elymoides						C	C		
Erigeron caespitosus	C (March), R (April)		S	S	R	R	R		
Eriogonum abertianum						R			
Erioneuron pulchellum					C				
Gilia tenuiflora	C	C	S	S	C	C	C		
Gutierrezia sp.				C	CD				
Gutierrezia microcephala	C			R					
Helianthus annuus						R			
Heliomeris longifolia var. *annua*						R			
Heterotheca subaxillaris						C			
Ipomoea cristulata						R			
Ipomopsis longiflora ssp. *longiflora*						R		R	
Isocoma pluriflora	C	S	C	R	S (March), C (April) S (March), C (April)		C		
Kallstroemia grandiflora								R	
Lappula redowskii	C	C (March), R (April)	C	S	C	S	C		
Lepidium lasiocarpum var. *wrightii*	C		C		S	S			
Lesquerella gordonii		C	C		C	C	C		
Lesquerella purpurea				C		S			
Linum lewisii						S			
Lotus humistratus	C				C				
Lupinus #2							R		
Lupinus concinnus		S			S				
Machaeranthera pinnatifida	S								
Machaeranthera tagetina								S	
Mentzelia multiflora cf. var. *multiflora*								S	
Muhlenbergia porteri								C	
Nicotiana trigonophylla						R			
Oenothera sp.	S					C	R		
Panicum hirticaule								C	
Penstemon sp.						R			
Perezia nana								C	
Phacelia arizonica	C			C					
Phacelia crenulata	C	R				C	R		
Physalis latiphysa								S	

Taxon	Stop No. 1	Stop No. 2	Stop No. 3	Stop No. 4	Stop No. 5	Stop No. 6	Stop No. 7	Stop No. 8	Stop No. 1000
Plantago insularis	C	S	S	C	S				
Plantago patagonica	C		C		C		R		
Poa bigelovii	C								
Polanisia trachysperma						R			
Proboscidea parviflora						R			
Psilostrophe cooperi					C				
Rafinesquia neomexicana	C	R	C		C		R		
Rumex cf. *hymenosepalus*	S	S				C (March), R (April)	R		
Sanvitalia abertii								R	
Setaria leucopila								C	
Solanum elaeagnifolium								C	
Sphaeralcea sp.						R			
Sphaeralcea rusbyi	S	R	R	R		R			
Sporobolus wrightii						C	R		
Stephanomeria pauciflora								R	
Streptanthus carinatus ssp. *arizonicus*						R			
Thelesperma megapotamicum						R			
Tidestromia lanuginosa								C	
Trianthema portulacastrum								R	
Xanthium saccharatum						C			
Zinnia pumila								S	
Ziziphus obtusifolia		C					C		

Key: C = common; CD = codominant; D = dominant; R = rare; S = sparse.

Gilia tenuiflora (greater yellowthroat gilia), and *Lappula redowskii* (stickseed). These plants were found at every collection stop except Stop 8 (the locale of the Locus D excavations conducted by Statistical Research, Inc.). The collection stop with the greatest variety of native grasses, ruderals, and herbaceous perennials is Stop 6, the riparian floodplain of Cienega Creek, with 39 different taxa. The collection stop with the smallest variety of plants in this category is Stop 3 with 14 taxa. This stop is on a slope where steep, loose ground might make it hard for plants to take root and develop.

Cacti and Other Succulents

The second principal category of plants recorded at the collection stops includes the cacti and other succulents. We recorded nine different types of cacti and other succulents at the collection stops (Table 9.A.8). The members of this category would have provided sources of food and fibers for the people of the Mescal Wash site. The cacti that we recorded all produce edible fruit (see Table 9.A.6), which would have been an important resource, especially when other food crops such as weedy seeds failed (see Adams and Bowyer 2002). The Mescal Wash site inhabitants could have made use of succulents such as *Agave palmeri* (century plant), *Yucca elata* (soaptree yucca), and *Dasylirion wheeleri* (sotol) for fibers for twine, basketry, and construction, as well as the edible yucca fruits and agave and sotol crowns (see Table 9.A.6). Among the collection stops, these plants are predominantly found at the Mescal Wash stops rather than at the Cienega Creek stops. One possible explanation is that the area of the Mescal Wash collection stops may currently be grazed, which would favor the growth of cacti and succulents, because they are not preferred as fodder by livestock. One surprising characteristic of the cacti and succulent complement at the collection stops is that agave is present in large quantities in the valley of Mescal Wash but was uncommon in the archaeobotanical samples.

Table 9.A.8. Presence of Cacti and Other Succulents at the Collection Stops

Taxon	Stop No. 1	Stop No. 2	Stop No. 3	Stop No. 4	Stop No. 5	Stop No. 6	Stop No. 7	Stop No. 8	Stop No. 1000
Agave palmeri			C (March), R (April)	C					
Carnegiea gigantea									seen[a]
Cylindropuntia spp.					R				
Ferocactus sp.		R			R				
Echinocereus spp.	R	R	R		C (March), S (April)				
Opuntia leptocaulis		R	R		R (March), S (April)				
Opuntia spp.	R	C	C (March), S (April)		C	R			
Yucca elata	C (March), S (April)	C	S (March), R (April)	S	S			S	
Dasylirion wheeleri									seen[a]

Key: C = common; R = rare; S = sparse.

[a] Plants that were seen in the larger area surrounding the Mescal Wash site but were not located at an official collection stop (e.g., plants observed while driving on the highway).

Trees and Shrubs

The third principal category of plants recorded at the Mescal Wash site collection stops includes trees and shrubs. We recorded 15 different native tree and shrub taxa at the Mescal Wash site collection stops (Table 9.A.9). Species such as *Prosopis velutina*, *Ephedra trifurca* (Mormon tea), *Larrea*, and *Lycium berlandieri* (wolfberry) are widely distributed across landforms. *Atriplex* sp. (saltbush), *Baccharis salicifolia*, *Hymenoclea* sp., *Populus* sp., and *Salix taxifolia* (yewleaf willow) were found only in riparian floodplain environments. Finally, there are plants that grow on the upper terraces and slopes such as *Acacia* sp., *Dalea formosa* (indigo bush), and *Fouquieria splendens* (ocotillo). Among the collection stops, none stands out as having a noticeably greater variety of tree and shrub taxa. The collection stops closest to watercourses (Stops 2 and 6) each have 5 different tree and shrub taxa, but at the same time, Stop 5 (on an upland terrace) also has 5 unique taxa.

Adventive or Introduced Plants

Because landscapes are dynamic, new plant taxa often move in when opportunities open. The final category of plants from the Mescal Wash site collection stops includes the adventive and introduced plants. We encountered 11 plant species that are not native to southern Arizona and have been introduced subsequent to the abandonment of the Mescal Wash site (Table 9.A.10). Many of the species are annuals, which excel at colonizing disturbed areas. New plant species can enter an area inadvertently by travelling as weeds in crop seeds or carried by animals and vehicles. They can also be planted as ornamentals and deliberately seeded by agencies for erosion control or to fill a perceived need in an ecological niche such as animal forage (Chauhan and Johnson 2009:235; Cohn 2005:650; Fowler et al. 2008:291).

In their study of exotic species in northern Arizona, Fowler et al. (2008:291) found that exotic species were more commonly found along roadsides than in adjacent native habitants. We did not find any patterning of exotic species near vs. away from roadsides. For example, Stop 1, within the circle of a highway off-ramp, we found two exotic species, whereas at Stop 2, the collection stop furthest from a road, we found five exotic species, one of the highest richness counts. We also found no patterning between distance to roads and taxon richness at the other collection stops. One possible explanation is that our collection stops are not far enough from roads to avoid their effects. A second explanation is that because Stops 2–5 may possibly be in grazed areas, livestock may have been a means of seed dispersal instead of people and vehicles (Fowler et al. 2008:291). Finally, some of the exotic species that we recorded, such as *Bromus rubens* (cheatgrass), are found even in comparatively undisturbed areas (Salo et al. 2005:95), and Fowler et al.'s model may not apply in

Table 9.A.9. Presence of Trees and Shrubs at the Collection Stops

Taxon	**Stop No. 1**	**Stop No. 2**	**Stop No. 3**	**Stop No. 4**	**Stop No. 5**	**Stop No. 6**	**Stop No. 7**	**Stop No. 8**	**Stop No. 1000**
Acacia? sp.				R					
Atriplex sp.		S							
Baccharis salicifolia						CD			
Baccharis sarothroides	S					C			
Dalea formosa				C					
Ephedra trifurca		R		R	R				
Fouquieria splendens					R				
Hymenoclea salsola						CD			
Juglans major									seen[a]
Juniperus sp.									seen[a]
Larrea tridentata		S	D		C				
Lycium berlandieri	R	S	R		R		R		
Populus fremontii						R			
Prosopis velutina	CD	D	CD	C (March), D (April)	C (March), D (April)		D		
Salix taxifolia						S			

Key: C = common; CD = codominant; D = dominant; R = rare; S = sparse.

[a] Plants that were seen in the larger area surrounding the Mescal Wash site but were not located at an official collection stop (e.g., plants observed while driving on the highway).

Table 9.A.10. Presence of Adventive or Introduced Plants at the Collection Stops

Plant Name	**Stop No. 1**	**Stop No. 2**	**Stop No. 3**	**Stop No. 4**	**Stop No. 5**	**Stop No. 6**	**Stop No. 7**	**Stop No. 8**	**Stop No. 1000**
Bromus rubens		R				C	C		
Echinochloa colona								C	
Eragrostis cilianensis								C	
Eragrostis lehmanniana	CD (March), C (April)	S	C	C	CD (March), C (April)	C		C	
Erodium cicutarium	C	C	C		C		C		
Hordeum leporinum		C							
Ipomoea purpurea								C	
Salsola iberica								C	
Sida abutifolia						R			
Sisymbrium irio		C	C	C		C	C		
Tamarix pentandra						R			

Key: C = common; CD = codominant; R = rare; S = sparse.

these cases. Of the exotic species at the collection stops, *Eragrostis lehmanniana* is the most common, having been recorded at seven stops (see Table 9.A.10).

Seasonality and Ethnobotanical Information

The seasonality and ethnobotanical references for the plants recorded at the collection stops are presented in Table 9.A.6. The seasonality information is taken from our direct observations. The ethnobotanical literature regarding native groups from southern Arizona and the greater U.S. Southwest suggests that seasonal availability of plants would have been a key factor in movement between harvesting locations. Knowing what plants would be available where and when also facilitated a backup strategy in the event of the failure of an expected crop or wild resource. Some principal wild-plant foods found around the Mescal Wash site and in the larger Cienega Creek basin may have been the fruits and seeds of *Carnegiea gigantea* (saguaro), *Prosopis velutina*, *Olneya tesota* (ironwood), *Cercidium floridum* (palo verde), and *Opuntia* spp. (prickly pear cactus), which ripen in that order (Curtin 1984:90–93; Gifford 1936:258). In this way, as one plant went out of season, some other plant would usually be coming into season.

First, although our survey of the plants around the Mescal Wash site suggests that there would have been a wide variety of wild plants available, it is possible that the inhabitants could have made temporary or longer-term logistical moves within the larger Cienega Creek basin or outside the basin to gather important plant resources (see also Huckell 1995:25). Gifford (1936:254–255) has described a series of moves by the Northeastern Yavapai throughout the year to areas where particular plants were plentiful. Gifford wrote: “The cycle was definitely based on wild plant foods rather than cultivated plant or animal foods” (1936:254). Depending on their various emphases on wild-plant foods or cultivated foods, the Mescal Wash site inhabitants could have targeted plants in a similar fashion.

Second, there may have been a tiered approach to wild-plant selection, as suggested by the ethnobotanical literature (see Table 9.A.6). As Rea (1991:6–8) has suggested, some plant products that have unpleasant tastes or textures may have been less-preferred or even eaten only in case of food scarcity. Rea (1991:6) related that the spring months of April, May, and June would have been the periods of game scarcity and depleted food stores and that during this time period wild greens, *Lycium* spp., and *Cylindropuntia* spp. (cholla) buds would have been important resources.

Observed Plants by Landform

In this section, we discuss the recorded plants by general landform. (We omit discussion of the nonnative plants, which would not have been available to the site inhabitants.) The landforms in the vicinity of the Mescal Wash site can be grouped into several broad categories: terraces, slopes, and lowlands near waterways (see Table 9.A.1). Overall, the collection stop that yielded the highest number of plant taxa is Stop 6, the floodplain of Cienega Creek (Table 9.A.11). The collection stops along Mescal Wash have the lowest number of different plant taxa.

Table 9.A.11. Number of Unique Plant Taxa Recorded at Each Collection Stop

Stop No.	Observed Unique Plant Taxa[a]
1	31
2	25
3	21
4	22
5	31
6	46
7	22
8	30
1000	4

[a] Counts exclude adventives or invasive plants.

Disturbed Upland Terrace Settings

Two of the collection stops (Stop 5 and Stop 8) are disturbed upland terrace locations. Although both areas can be classified as “disturbed,” their similarities end there. The causes of their disturbance (grazing vs. dirt and vegetation disruption) have led to different inventories of plants at each area. We inferred that Stop 5 (on the northern side of the interstate highway) is a grazed area, based on the absence of plants on which cattle like to graze and the presence of plants that cattle find unpleasant to eat. Additionally, Stop 5 has the subjective typical look of a pasture where some plants have been bitten off to the ground, whereas others have been left untouched. Stop 8 is the backfilled excavation area at Locus D. It is intriguing that the inventories of plants at each area are almost entirely mutually exclusive. For example, plants that excel at colonizing bare earth, like *Amaranthus palmeri* and *Apodanthera undulata* (melon-loco), were found at Stop 8 but not at Stop 5 (see Table 9.A.7). Stop 5, although grazed, did not have the pervasive disturbance of the top soil similar to Stop 8. It did show the effects of grazing, as the cattle had presumably eaten the popular forage plants. For example, we did not find *Bouteloua aristidoides* (needle grama) (Kearney and Peebles 1960:127) at Stop 5, but we did observe it at Stop 8. We also recorded six types of cacti and other succulents at Stop 5 (see Table 9.A.8) but only one succulent taxon at Stop 8.

Although the comparisons between the two collection stops are interesting from a modern-day range-management perspective, the disturbance type at Stop 8 is most relevant to archaeological interpretations. The ground disturbance conditions are most analogous to the conditions that might have existed during the settlement of the Mescal Wash site, including the field edges and trash middens. Some of the unique plants at Stop 8 could have had economic importance for the Mescal Wash inhabitants, such as *Amaranthus palmeri*, *Cucurbita digitata* (fingerleaf gourd), and *Mentzelia multiflora* (stickleaf), which can be used for food and medicinal purposes (see Table 9.A.6). We found immature fruit for all three of these taxa in September.

Also of interest was the strong presence of *Apodanthera undulata* plants at Stop 8. The fruit of this plant is reported to have a very bitter taste, yet fragments of what we believe to be *Apodanthera undulata* seed coats are present in many of the archaeobotanical samples from the Mescal Wash site and other sites in southeastern Arizona and northern Sonora, Mexico. For example, Huckell (1995:94) described these items, referring to them by their common working name of “columnar-celled seed coat fragments.” The U.S. Southwestern ethnographic record is silent regarding this plant, but Lira and Caballero (2002:381) have reported that in Mexico the pulp of the fruits is used to treat urinary tract problems, and the seeds are roasted and eaten. The seeds of the plant are very nutritious, being high in fat and protein (Bemis et al. 1967:2, 637). In light of the high nutrition content, we hypothesize that the plant may have been tolerated or even encouraged for its nutritional contribution despite its other objectionable qualities. When we recorded these plants at Stop 8 in September, the pepos (squash fruits) were still immature.

Plants on Undisturbed Upper Terraces

The second landform category consists of undisturbed upper terraces. The only member of this group is Stop 1, located in the crook of one of the highway off-ramps in Locus C, directly across Marsh Station Road from Stop 8. This area has not been disturbed by excavation or grazing. *Prosopis velutina* dominates the area, along with *Eragrostis lehmanniana*. The plant complement at this collection stop is very similar to plants at other places that we visited. We recorded only a few plants that were unique to Stop 1, including *Astragalus nuttallianus* (milkvetch), *Baileya multiradiata* (desert marigold), and *Machaeranthera pinnatifida* (lacy tansy-aster). *Astragalus nuttallianus* and the *Machaeranthera pinnatifida* both had mature fruit in April. *Astragalus* pods were eaten in the past (see Table 9.A.6), although we are not immediately aware of any food uses for *Machaeranthera pinnatifida*. There are many available resources that could have been used by the Mescal Wash site inhabitants for food and other purposes, such as mesquite, cacti, yucca, *Chenopodium* (goosefoot), and *Descurainia obtusa*. The hedgehog cacti were in bloom when we made our visit in April, so that the fruit would have been available after that.

Plants in Lowlands near Waterways

The next category of landforms is lowlands near waterways. We visited the bottomlands of both Mescal Wash and Cienega Creek. Although the floodplain of Mescal Wash at Stop 2 is broad, the floodplain of Cienega Creek (Stop 6) is narrower. The area at Stop 2 is a *Prosopis velutina* bosque habitat, whereas the dominant plants at Stop 6 are shrubs such as *Baccharis salicifolia* and *Hymenoclea*. We recorded the greatest variety of plants in the Cienega Creek floodplain, as well as more plants unique to that particular collection stop (see Table 9.A.11). Nonwoody plants unique to the floodplains include plants such as California poppy, *Androsace occidentalis* (rock jasmine), and two species of *Chamaesyce* (sandmat), along with *Datura* (jimsonweed), *Helianthus annuus* (sunflower), *Nicotiana trigonophylla* (desert tobacco), and *Proboscidea parviflora* (unicorn plant). The trees and shrubs found only in the floodplains are *Atriplex*, *Baccharis salicifolia*, *Hymenoclea*, and *Salix taxifolia*.

The Mescal Wash site plant gatherers could have made good use of the floodplains. There was a higher concentration of *Chenopodium* plants in the Cienega Creek floodplain than in other areas. The seeds (utricles) and young leaves of this plant would have been valuable food sources. The *Chenopodium salinum* plants had immature fruits in April. The inhabitants could have gathered *Helianthus annuus* achenes and *Atriplex* seeds as well. The mesquite bosques would have provided firewood and building timber, as well as seed pods for food.

Plants on Slopes

The fourth landform category that we recorded was slopes. The terrain surrounding the Mescal Wash site encompasses several slopes adjoining the terraces. The angles of the slopes range from slight shallow colluvial slopes (Stop 3) to medium slopes (Stop 7) to tall steep slopes (Stop 4). Stops 3 and 4 are on the south side of Mescal Wash, whereas Stop 7 is on the northeastern side of Cienega Creek. *Prosopis velutina* trees provide the dominant vegetation cover on both the Mescal Wash and Cienega Creek slopes. Stop 7 is a mesquite bosque environment, which differs from Mescal Wash, where the bosque is along the flat floodplain terrace. The richness of plant taxa at these sites is lower compared to other observation areas. Despite this lower richness, some plants grow here that do not grow at other places. There are many *Agave palmeri* plants along the slopes leading to Mescal Wash, but not at other stops. Other trees and shrubs unique to the slopes of Mescal Wash include *Acacia* and *Dalea formosa*. *Aristida purpurea* (three-awn) and *Bouteloua curtipendula* (sideoats grama) grow only on the Mescal Wash slopes. We recorded nonwoody plants like *Bromus carinatus* (mountain brome), *Lupinus* #2 (lupine), and *Ziziphus obtusifolia* (lotebush) only on the Cienega Creek slope.

The sloped areas would have provided important resources to the local population. The agaves would have been an important source for fibers and food. We saw *Agave palmeri* (Palmer agave) with mature fruit in March and immature fruit in September. Although the prehistoric inhabitants would have harvested agaves for baking just before blooming (efflorescence), we did not see any plants beginning to send up a blooming stalk on our collection visits. Although not as common as in the floodplain of Cienega Creek, *Chenopodium* also grows on the slope of Cienega Creek at Stop 7. *Elymus elymoides* (a species of wild rye) grows at Stop 7, as well as in the Cienega Creek floodplain; it had mature and immature fruit in both March and April.

Widely Distributed Plants

Finally, among all the landforms that we visited and the plants that we recorded, some plants stand out as being widely available over the area surrounding the Mescal Wash site. These plants can be considered to represent the “typical” vegetation of the Cienega Creek basin. For the purposes of this report, we categorized plant taxa found at five or more collection stops as “widely distributed.” Trees, shrubs, and succulents such as *Lycium berlandieri*, *Opuntia* spp., *Prosopis velutina*, and *Yucca elata* grew in at least five locations on the landscape. Nonwoody plants such as *Descurainia obtusa*, *Erigeron caespitosus* (fleabane), *Gilia tenuiflora*, *Isocoma pluriflora*, *Lappula redowskii*, *Lesquerella gordonii* (Gordon’s bladderpod), *Plantago insularis* (plantain), *Rafinesquia neomexicana* (New Mexico plumseed), *Rumex* cf. *hymenosepalus* (canaigre), and *Sphaeralcea rusbyi* (Rusby’s globemallow) all grow in a wide variety of places.

The large number of widely distributed plants shows the richness of the Cienega Creek basin as a whole. People living at the Mescal Wash site could have easily utilized many different plant resources without having to travel long distances. The seeds of *Descurainia obtusa* and *Plantago insularis* would have been useful food resources (Whiting 1985:70, 86). *Descurainia obtusa* plants had immature fruit in March and mature fruit in April. *Plantago insularis* had young and mature fruit in April.

Some plants would have had value for their nonfood products, such as *Lappula redowskii* and *Sphaeralcea rusbyi*. *Lappula redowskii* was flowering in March and April and had immature fruit in March and mature fruit in April. Unspecified parts of the plant were used for medicinal purposes by the Navajo for insect bite poultices and lotions for sores and swellings (Vestal 1952:37; Wyman and Harris 1951:40). *Sphaeralcea rusbyi*, which was in flower and fruiting on all three visits, had been used for medicinal purposes by the Pima, who boiled the roots and leaves to make a tea for diarrhea (Curtin 1984:80; Russell 1908:79), as well as the Acoma and Laguna, who crushed the roots to make a glue (Swank 1932:71) (see also Table 9.A.6).

Modern Plant Landscape vs. Prehistoric Plants

Although the modern landscape observations shed light on many aspects of prior plant used at the Mescal Wash site, they did raise several questions about divergences between plants on the modern landscape and plants in the archaeobotanical samples. The first question raised by the study concerned the prevalence of *Agave palmeri* plants near the site. In contrast to the modern prevalence of *Agave palmeri*, we found few remains of *Agave* in the macrobotanical and flotation samples from the excavations. We are confident in our identification of monocot fibers, because *Agave* fibrovascular bundles have distinctive U-shaped bundles. Possible explanations could include overharvesting of *Agave* plants, leading to decreased availability through time and thus a decreased presence in the flotation samples. Alternatively, some form of climatic variability or grazing might favor *Agave* growth today but not during the occupation of the Mescal Wash site. The simplest explanation may be that our approach in identifying potential *Agavaceae* tissues in the charred samples was highly conservative, only attributing them to specific taxa if they met certain morphological criteria.

A second question raised by the modern landscape study is the absence of *Olneya tesota* and *Cercidium floridum* trees at the collection stops. We found wood charcoal from these trees in the flotation and macrobotanical samples from the Mescal Wash site, which shows that they were available in the past. Huckell (1995:20–21) has suggested that the hydrology of Cienega Creek has greatly changed since the introduction of cattle grazing in the second part of the 1800s, causing arroyo cutting and the demise of many wetlands along the creek. It has also been documented that there are more *Prosopis velutina* trees on the landscape today than in previous times (Eddy and Coolley 1983; Huckell 1995:21). Another theory could be that a shift in wildland fire frequency and intensity has made it more difficult for the *Olneya tesota* and *Cercidium floridum* trees to grow and reproduce (Cohn 2005:650–651). In the case of *Olneya tesota*, which generally grows at much lower elevations, the wood may have been collected from far outside the immediate site area.

Summary

Fieldwork for the modern landscape study included three visits in March, April, and September of 2001. We recorded the plant complements at eight different collection stops, reflecting a range of environments from stream bottomlands to upland terraces near the Mescal Wash site. We believe that our research has created a baseline for knowledge of the plant landscape that might have been available to the Mescal Wash site inhabitants. The plant taxa recorded at our eight collection stops are mostly representative of the Cienega Creek basin as a whole. However, some areas were absent from our study, such as the higher elevations at the far southern headwaters of the Cienega Creek, as well as the wetter, more riparian areas where water flow is closer to the surface. A strategy to round out the picture of the Cienega Creek basin plant landscape would include these areas, as well as additional visits at other times of the year.

From these trips, we made inferences about the plant resources that might have been available to the Mescal Wash site inhabitants. They had a wide variety of plants available to support their construction, firewood, food, and other needs. Our landscape and seasonality information shows that they would have had several major wild-plant food sources available to them, such as saguaro (*Carnegiea gigantea*), *Prosopis velutina*, *Agave* spp., and *Yucca elata* (soaptree yucca), along with grasses and other plants that produce edible seeds.

From a plant taxonomic standpoint, our research has been beneficial in several areas. We believe we have positively identified the "columnar-celled seed coat fragments" common in archaeological sites throughout southern Arizona and northern Sonora, Mexico, as pieces of *Apodanthera undulata* seeds. Additionally, we were able to find specimens of *Chenopodium salinum* in flowering and fruiting status, which allowed us to positively identify them to the species level. This was a useful contribution to the flora record of the Cienega Creek and surrounding areas, because fellow researchers at the ASU Herbarium had previously only been able to identify the specimens to the genus level. In summary, the modern landscape study in the Mescal Wash site area has provided useful information regarding the potential prehistoric landscape, as well as contributing to the overall plant knowledge of the Cienega Creek basin.

References Cited

Adams, Karen R., and Vandy E. Bowyer

2002 Sustainable Landscape: Thirteenth-Century Food and Fuel Use in the Sand Canyon Locality. In *Seeking the Center Place: Archaeology and Ancient Communities in the Mesa Verde Region*, edited by Mark D. Varien and Richard H. Wilshusen, pp. 123–142. University of Utah Press, Salt Lake City.

Adams, Karen R., and John R. Welch

1998 Landform Associations, Seasonal Availability, and Ethnobotany of Plants in the Lower Verde. In *Agricultural, Subsistence and Environmental Studies,* edited by Jeffrey A. Homburg and Richard. Ciolek-Torrello, pp. 33–54. Vanishing River: Landscapes and Lives of the Lower Verde Valley: The Lower Verde Archaeological Project, vol. 2. CD-ROM. SRI Press, Tucson.

Bell, Willis H., and Edward F. Castetter

1941 *The Utilization of Yucca, Sotol, and Beargrass by the Aborigines in the American Southwest*. University of New Mexico Bulletin No. 372. Ethnobiological Studies in the American Southwest 7. Biological Series Vol. 5, No. 5. University of New Mexico Press, Albuquerque.

Bemis, W., J. Berry, M. Kennedy, D. Woods, M. Moran, and A. Deutchman, Jr.

1967 Oil Composition of Cucurbita. *Journal of the American Oil Chemists' Society* 44:429–430.

Brown, David E. (editor)

1982 Biotic Communities of the American Southwest—United States and Mexico. Special issue, *Desert Plants* 4(1–4).

Brown, David E., Peter J. Unmack, and Thomas C. Brennan

2007 Digitized Map of Biotic Communities Comparing Distribution of North American Animals. *The Southwestern Naturalist* 52:610–616.

Castetter, Edward F.

1935 *Uncultivated Native Plants Used as Sources of Food*. University of New Mexico Bulletin No. 266. Ethnobiological Studies in the American Southwest 1. Biological Series Vol. 4, No. 1. University of New Mexico Press, Albuquerque.

Castetter, Edward F., and Willis H. Bell

1937 *The Aboriginal Utilization of the Tall Cacti in the American Southwest*. University of New Mexico Bulletin No. 307. Ethnobiological Studies in the American Southwest 4. Biological Series Vol. 5, No. 1. University of New Mexico Press, Albuquerque.

1942 *Pima and Papago Indian Agriculture.* Inter-Americana Studies 1. University of New Mexico School of Inter-American Affairs. University of New Mexico Press, Albuquerque.

Castetter, Edward F., and M. E. Opler

1936 *The Ethnobiology of the Chiricahua and Mescalero Apache: The Use of Plants for Foods, Beverages, and Narcotics*. University of New Mexico Bulletin No. 297. Ethnobiological Studies in the American Southwest 3. Biological Series Vol. 4, No. 5. University of New Mexico Press, Albuquerque.

Castetter, Edward F., and Ruth Underhill

1935 *The Ethnobiology of the Papago Indians*. University of New Mexico Bulletin No. 275. Ethnobiological Studies in the Southwest 2. Biological Series, Volume 4, No. 3. University of New Mexico Press, Albuquerque.

Chauhan, Bhagirath S., and David E. Johnson

2009 Seed Germination Ecology of Junglerice (*Echinochloa colona*): A Major Weed of Rice. *Weed Science* 57:235–240.

Cohn, Jeffrey P.

2005 Tiff over Tamarisk: Can a Nuisance by Nice, Too? *BioScience* 55:648–654.

Colton, Harold S.

1974 Hopi History and Ethnobotany. In *Hopi Indians*, compiled and edited by David Agee Horr, pp. 279–373. Garland Publishing, New York.

Curtin, L. S. M.

1984 *By the Prophet of the Earth: Ethnobotany of the Pima*. University of Arizona Press, Tucson. Originally published 1949, San Vicente Foundation, Santa Fe, New Mexico.

Dawson, E. Yale
1944 Some Ethnobotanical Notes on the Seri Indians. *Desert Plant Life* 9:132–138.

Eddy, Frank W., and Maurice E. Coolley
1983 *Cultural and Environmental History of Cienega Valley, Southeastern Arizona*. Anthropological Paper No. 43. University of Arizona Press, Tucson.

Elmore, Francis H.
1944 *Ethnobotany of the Navajo*. Monograph No. 8. School of American Research, Santa Fe, New Mexico.

Fowler, James F., Carolyn H. Sieg, Brett G. Dickson, and Victoria Saab
2008 Exotic Plant Species Diversity: Influence of Roads and Prescribed Fire in Arizona Ponderosa Pine Forests. *Rangeland Ecology & Management* 61:284–293.

Gifford, E. W.
1932 *The Southeastern Yavapai*. University of California Publications in American Archaeology and Ethnology, Vol. 29, No. 3. University of California Press, Berkeley.

1936 *Northeastern and Western Yavapai*. University of California Publications in American Archaeology and Ethnology, Vol. 34, No. 4. University of California Press, Berkeley.

Hocking, George M.
1956 Some Plant Materials Used Medicinally and Otherwise by the Navaho Indians in the Chaco Canyon, New Mexico. *El Palacio* 63(5–6):146–165.

Hough, Walter.
1897 The Hopi in Relation to Their Plant Environment. *American Anthropologist* (o.s.) 10(2):33–44.

Hrdlička, Aleš
1908 *Physiological and Medical Observations among the Indians of Southwestern United States and Northern Mexico*. Bureau of American Ethnology Bulletin 34. Smithsonian Institution, Washington, D.C.

Huckell, Bruce.
1995 *Of Marshes and Maize: Preceramic Agricultural Settlements in the Cienega Valley, Southeastern Arizona*. Anthropological Paper No. 59. University of Arizona Press, Tucson.

Kearney, Thomas H., and Robert H. Peebles.
1960 *Arizona Flora*. 2nd ed. University of California Press, Berkeley.

Lange, Charles H.
1968 *Cochiti: A New Mexico Pueblo, Past and Present*. Southern Illinois University Press, Carbondale.

Lira, Rafael, and Javier Caballero
2002 Ethnobotany of the Wild Mexican Cucurbitaceae. *Economic Botany* 56:380–398.

Lynch, Regina H.
1986 *Cookbook*. Navajo Curriculum Center, Rough Rock Demonstration School, Rough Rock, Arizona.

Matthews, W.
1886 Navajo Names for Plants. *American Naturalist* 20(9):767–777.

Minckley, W. L., and David E. Brown
1982 Wetlands. In “Biotic Communities of the American Southwest—United States and Mexico,” edited by David E. Brown, special issue, *Desert Plants* 4(1–4):223–287.

Nequatewa, Edmund
1943 Some Hopi Recipes for the Preparation of Wild Plant Foods. *Plateau* 16:18–20.

Nickerson, Gifford S.
1966 Some Data on Plains and Great Basin Indian Uses of Certain Native Plants. *Tebiwa, The Journal of the Idaho State University Museum* 9(1):45–51.

Pima Association of Governments
2003 Geologic Influences on the Hydrology of Lower Cienega Creek. Electronic document, http://www.pagnet.org/documents/Water/LIB/cienega_geology.pdf, accessed March 29, 2010.

Rea, Amadeo M.
1991 Gila River Pima Dietary Reconstruction. *Arid Lands Newsletter* 31:3–10.

1997 *At the Desert’s Green Edge: An Ethnobotany of the Gila River Pima*. University of Arizona Press, Tucson.

Reagan, Albert B.
1929 Plants Used by the White Mountain Apache Indians of Arizona. *Wisconsin Archeologist* 8:143–161.

Robbins, Wilfred W., John P. Harrington, and Barbara Freire-Marreco

1916 *Ethnobotany of the Tewa Indians*. Bulletin No. 55. Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Russell, Frank

1908 The Pima Indians. In *Twenty-Sixth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1904–1905*, edited by William Henry Holmes, pp. 3–390. U.S. Government Printing Office, Washington, D.C.

Salo, L. F., G. R. McPherson, and D. G. Williams

2005 Sonoran Desert Winter Annuals Affected by Density of Red Brome and Soil Nitrogen. *American Midland Naturalist* 153:95–109.

Spier, Leslie

1928 *Havasupai Ethnography*. Anthropological Papers, vol. 29, no. 3. American Museum of Natural History, New York.

Standley, Paul C.

1912 Some Useful Native Plants of New Mexico. In *Annual Report for 1911*, pp. 447–462. Smithsonian Institution, Washington, D.C.

Steggerda, Morris, and Ruth B. Eckardt

1941 Navajo Foods and Their Preparation. *Journal of the American Dietetic Association* 17:217–225.

Stevenson, Matilda Coxe

1915 *Ethnobotany of the Zuñi Indians*. Annual Report No. 30. Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

Swank, George R.

1932 *The Ethnobotany of the Acoma and Laguna Indians*. Unpublished Masters Thesis, Department of Biology, University of New Mexico, Albuquerque.

Vascular Plants of Arizona Editorial Committee

1992–2001 *A New Flora for Arizona in Preparation*. Arizona-Nevada Academy of Science, Tempe Arizona. Published as *Journal of the Arizona-Nevada Academy of Science* 26(1) [1992], 27(2) [1994], 29(1) [1995], 30(2) [1998], 32(1) [1999], 33(1) [2001].

Vestal, Paul A.

1940 Notes on a Collection of Plants from the Hopi Indian Region of Arizona Made by J. G. Owens in 1891. *Harvard University Botanical Museum Leaflets* 8:153–168.

1952 *Ethnobotany of the Ramah Navaho*. Reports of the Ramah Project No. 4. Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 40, No. 4. Harvard University, Cambridge.

Watahomigie, Lucille J., Malinda Powskey, and Jorigine Bender

1982 *Hualapai Ethnobotany*. Peach Springs School District No. 8, Peach Springs, Arizona.

Weber, Steven A., and P. David Seaman.

1985 *Havasupai Habitat: A. F. Whiting's Ethnography of a Traditional Indian Culture.* University of Arizona Press, Tucson.

White, Leslia A.

1945 Notes on the Ethnobotany of the Keres. *Michigan Academy of Science Arts and Letters Papers* 30:557–568.

1962 *The Pueblo of Sia, New Mexico*. Bulletin No. 184. Bureau of American Ethnology, Washington, D.C.

Whiting, Alfred F.

1939 *Ethnobotany of the Hopi*. Bulletin No. 15. Museum of Northern Arizona, Flagstaff.

1985 *Havasupai Habitat: A. F. Whiting's Ethnography of a Traditional Indian Culture*, edited by Steven A. Weber and P. David Seaman. University of Arizona Press, Tucson.

Wyman, Leland C., and Stuart K. Harris

1941 *Navajo Indian Medical Ethnobotany*. University of New Mexico Bulletin Anthropological Series, Vol. 3, No. 5. University of New Mexico Press, Albuquerque.

1951 *The Ethnobotany of the Kayenta Navaho: An Analysis of the John and Louisa Wetherill Ethnobotanical Collection*. University of New Mexico Press, Albuquerque.

APPENDIX 9.B

Macrobotanical Specimens, by Locus and Feature

Table 9.B.1. Macrobotanical Specimens, by Locus and Feature

Feature No.	Feature Type	Subfeature No.	Subfeature Type	Unit No.	Unit Type	Level	PD No.	Common Name	Taxon	ID Level	Part	Condition	Count[a]	Comments
								Locus A						
200	recessed-hearth style structure	NA	NA	2024	PP	3	2024	juniper	*Juniperus*	T	charcoal	C	20	post, <30 rings
		NA	NA	2037	PP	3	2037	juniper	*Juniperus*	T	charcoal	C	20	post, 3 pieces with >30 rings
		NA	NA	2031	PP	3	2031	juniper	*Juniperus*	T	charcoal	C	1	post, <30 rings
		NA	NA	2036	PP	3	2036	juniper	*Juniperus*	T	charcoal	C	3	post?, <30 rings
		NA	NA	2035	PP	3	2035	reed	*Phragmites*	T	stem fragment	C	5	from PD 2037
		NA	NA	2	H	2	1259	reed	*Phragmites*	T	stem fragment	C	1	
		NA	NA	2051	PP	3	2051	reed	*Phragmites*	T	stem fragment	C	1	
		NA	NA	2	H	2	1259	reed	*Phragmites*	T	charcoal	C	20	
		NA	NA	2036	PP	3	2036	pine	*Pinus*	T	charcoal	C	3	post?, <30 rings
		NA	NA	2030	PP	3	2030	pine	*Pinus*	T	charcoal	C	1	post, <30 rings
		NA	NA	2051	PP	3	2051	pine	*Pinus*	T	charcoal	C	19	<30 rings
		NA	NA	2032	PP	3	2032	pine	*Pinus*	T	charcoal	C	20	post, <30 rings
		NA	NA	2025	PP	3	2025	pine	*Pinus*	T	charcoal	C	1	post, >30 rings
		NA	NA	2026	PP	3	2026	pine	*Pinus*	T	charcoal	C	20+	post, <30 rings
		NA	NA	2035	PP	3	2035	pine	*Pinus*	T	charcoal	C	20	post, <30 rings
		NA	NA	2050	PP	3	2050	pine	*Pinus*	T	charcoal	C	20	3 pieces with >30 rings
		NA	NA	2	H	2	1259	pine	*Pinus*	T	charcoal	C	2	
		NA	NA	2049	PP	3	2049	mesquite	*Prosopis*	T	charcoal	C	20+	some in adobe; likely a post
		NA	NA	2048	PP	3	2048	mesquite	*Prosopis*	T	charcoal	C	20	post
		NA	NA	2027	PP	3	2027	mesquite	*Prosopis*	T	charcoal	C	20+	post
		NA	NA	2034	PP	3	2034	mesquite	*Prosopis*	T	charcoal	C	20	
		SF 11	posthole	NA	NA	1	2007	mesquite	*Prosopis*	T	charcoal	C	20	
		NA	NA	1201	PP	4	1201	pine	*Pinus*	T	charcoal	C	20+	<30 rings
		NA	NA	1350	PP	3	1350	pine	*Pinus*	T	charcoal	C	2	posts, >30 rings

continued on next page

Feature No.	Feature Type	Subfeature No.	Subfeature Type	Unit No.	Unit Type	Level	PD No.	Common Name	Taxon	ID Level	Part	Condition	Count[a]	Comments
		NA	NA	1351	PP	3	1351	pine	*Pinus*	T	charcoal	C	1	post, <30 rings
2192	recessed-hearth style structure	SF 7	ash-filled pit	NA	NA	1	8239	ironwood	*Olneya*	T	charcoal	C	3	
		NA	NA	8167	TP	1	8165	hackberry	*Celtis*	T	seed fragment	U	2	
								Locus C						
379	recessed-hearth style structure	SF 79	entry sill	NA	NA	1	7389	juniper	*Juniperus*	T	charcoal	C	18	
		SF 79	entry sill	NA	NA	1	7389	juniper	*Juniperus*	T	wood	PC	2	
		SF 79	entry sill	NA	NA	1	7389	juniper	*Juniperus*	T	wood	U	6	wood intentionally thinned
		SF 79	entry sill	NA	NA	1	7389	juniper	*Juniperus*	T	charcoal	C	20	some with >30 rings
		SF 1	entry	NA	NA	1	7134	juniper	*Juniperus*	T	charcoal	C	8	
		SF 1	entry	NA	NA	1	7134	juniper	*Juniperus*	T	wood	PC	12	
		SF 1	entry	NA	NA	1	7134	mesquite	*Prosopis*	T	charcoal	C	1	likely post?
7461	house-in-pit	SF 26	posthole	NA	NA	1	10045	juniper	*Juniperus*	T	charcoal	C	2	
		SF 26	posthole	NA	NA	1	10045	mesquite	*Prosopis*	T	charcoal	C	7	
		SF 48	posthole	NA	NA	1	10095	mesquite	*Prosopis*	T	charcoal	C	18	
								Locus D						
438	house-in-pit	NA	NA	1	H	2	5210	ironwood	*Olneya*	T	charcoal	C	3	
		SF 3	posthole	NA	NA	1	6506	juniper	*Juniperus*	T	wood	U	10	likely ancient
		SF 3	posthole	NA	NA	1	6506	juniper	*Juniperus*	T	charcoal	C	10	
		SF 56	posthole	NA	NA	1	7925	mesquite	*Prosopis*	T	charcoal	C	7	post remnants
833	multiple features	NA	NA	8507	TP	4	8539	NA					2	soil clump
3067	basic roasting pit	NA	NA	1	H	2	3030	ironwood	*Olneya*	T	charcoal	C	1	
		NA	NA	1	H	1	3068	ironwood	*Olneya*	T	charcoal	C	2	
3544	multiple features	NA	NA	2482	PP	2	2482	mesquite	*Prosopis*	T	charcoal	C	10	
3545	house-in-pit	NA	NA	2392	PP	floor	2392	juniper	*Juniperus*	T	wood	PC	6	
		NA	NA	2392	PP	floor	2392	pine	*Pinus*	T	charcoal	C	5	

Feature No.	Feature Type	Subfeature No.	Subfeature Type	Unit No.	Unit Type	Level	PD No.	Common Name	Taxon	ID Level	Part	Condition	Count[a]	Comments
		NA	NA	2394	PP	floor	2394	pine	*Pinus*	T	charcoal	C	20	1 piece with >30 rings
		NA	NA	2395	PP	floor	2395	mesquite	*Prosopis*	T	charcoal	C	20	
		NA	NA	2393	PP	floor	2393	mesquite	*Prosopis*	T	charcoal	C	10	
		SF 52	posthole	NA	NA	1	5041	juniper	*Juniperus*	T	wood	PC	1	post, >30 rings
		SF 52	posthole	NA	NA	1	5041	juniper	*Juniperus*	T	wood	PC	1	in situ post; partially charred; <30 rings
3667	disturbance	NA	NA	1	H	1	2619	mesquite	*Prosopis*	T	charcoal	C	6	
3668	rock-lined roasting pit	NA	NA	7841	PP	7	7841	mesquite	*Prosopis*	T	charcoal	C	12	
3669	basic roasting pit	NA	NA	2	H	1	3323	ironwood	*Olneya*	T	charcoal	C	4	
3679	house-in-pit	SF 53	posthole	NA	NA	1	3377	mesquite	*Prosopis*	T	charcoal	C	1	post
3681	house-in-pit	SF 1	hearth	NA	NA	1	3363	ironwood	*Olneya*	T	charcoal	C	1	
3756	bell-shaped roasting pit	NA	NA	NA	F	1	3322	mesquite	*Prosopis*	T	nutshell fragment	C	1	
3790	bell-shaped nonthermal pit	NA	NA	1	H	1	3338	ironwood	*Olneya*	T	charcoal	C	4	
3976	bell-shaped nonthermal pit	NA	NA	NA	H	1	5778	ironwood	*Olneya*	T	charcoal	C	2	
3983	bell-shaped nonthermal pit	NA	NA	NA	F	1	2589	walnut	*Juglans*	T	nutshell fragment	C	14	
		NA	NA	NA	F	1	2589	walnut	*Juglans*	T	nutshell fragment	C	1	
		NA	NA	NA	F	1	2589	walnut	*Juglans*	T	nutshell fragment	C	20	
4120	rock-lined roasting pit	NA	NA	1	H	1	2499	ironwood	*Olneya*	T	charcoal	C	20	
		NA	NA	1	H	1	2499	ironwood	*Olneya*	T	charcoal	C	20+	
		NA	NA	1	H	1	2499	ironwood	*Olneya*	T	charcoal	C	2	
4683	adobe-walled structure	NA	NA	2	Q	2	2999	reed	*Phragmites*	T	stem fragment	C	3	
		NA	NA	2	Q	2	2999	NA					1	soil clump

continued on next page

Feature No.	Feature Type	Subfeature No.	Subfeature Type	Unit No.	Unit Type	Level	PD No.	Common Name	Taxon	ID Level	Part	Condition	Count[a]	Comments
		NA	NA	2	Q	2	2999	indeterminate		T	stem fragment	C	1	
4725	multiple features	NA	NA	6745	TP	1	6746	juniper	*Juniperus*	T	charcoal	C	1	upright post
4729	adobe-walled structure	NA	NA	5329	PP	3	5329	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	20	
		NA	NA	5330	PP	3	5330	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	3	
		SF 14	posthole	NA	NA	1	6976	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	12	post
4768	house-in-pit	NA	NA	8911	PP	2	8911	grass family	Poaceae	T	stem fragment	C	100+	1 mm diameter
		NA	NA	8917	PP	2	8917	creosote bush	*Larrea*	T	charcoal	C	13	
		NA	NA	8911	PP	2	8911	reed	*Phragmites*	T	stem fragment	C	1	
		NA	NA	8917	PP	2	8917	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	7	
		SF 3	entry	8972	PP	2	8972	juniper	*Juniperus*	T	wood	U	1	long log; damaged by insects
		SF 11	posthole	NA	NA	1	8948	corn/ maize	*Zea mays*		kernel fragment	C	1	tentative identification
		SF 12	posthole	NA	NA	1	8950	creosote bush	*Larrea*	T	stem fragment	C	7	single ring
		SF 12	posthole	NA	NA	1	8950	cottonwood/ willow	*Populus/Salix*	T	stem fragment	C	4	single ring
5994	house-in-pit	NA	NA	7932	TP	4	7944	indeterminate		T	seed fragment	C	1	possible Cucurbitaceae; *Apodanthera*?
		NA	NA	7997	PP	5	7997	juniper	*Juniperus*	T	charcoal	C	1	intact post; >30 rings
		NA	NA	7932	TP	4	7944	reed	*Phragmites*	T	stem fragment	C	2	
7697	multiple features	SF 30	pit	NA	NA	2	7921	banana yucca	*Yucca baccata*	T	seed	C	1	
7879	house-in-pit	SF 23	posthole	NA	NA	1	5970	corn/ maize	*Zea mays*		cob fragment	C	1	
7943	house-in-pit	NA	NA	8544	PP	3	8544	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	20	

Feature No.	Feature Type	Subfeature No.	Subfeature Type	Unit No.	Unit Type	Level	PD No.	Common Name	Taxon	ID Level	Part	Condition	Count[a]	Comments
		NA	NA	8543	PP	2	8543	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	1	embedded in adobe
		SF 70	posthole	10661	PP	1	10661	juniper	*Juniperus*	T	wood	U	20	likely ancient
		SF 70	posthole	10661	PP	1	10661	juniper	*Juniperus*	T	wood	U	1	post, 17 inches long, 3 inches in diameter; likely ancient
		NA	NA	8546	PP	3	8546	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	10	
		NA	NA	8545	PP	3	8545	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	7	
8644	house-in-pit	NA	NA	8507	TP	3	8536	NA					5	soil clump
8655	house-in-pit	NA	NA	1	H	2	9643	juniper	*Juniperus*	T	charcoal	C	2	
		NA	NA	1	H	2	9643	monocotyledon		T	tissue fragment	C	1	*Agave* or *Dasylirion*
		NA	NA	2	H	2	9874	ironwood	*Olneya*	T	charcoal	C	1	
		NA	NA	1	H	2	9643	cottonwood/ willow	*Populus/Salix*	T	charcoal	C	6	
		NA	NA	1	H	2	9643	mesquite	*Prosopis*	T	charcoal	C	11	
		NA	NA	9875	PP	3	9875	mesquite	*Prosopis*	T	charcoal	C	4	
		NA	NA	8974	TP	2	8977	creosote bush	*Larrea*	T	twig fragment	C	2	single ring
		NA	NA	8974	TP	2	8977	monocotyledon		T	stem fragment	C	2	likely Poaceae
		NA	NA	8974	TP	2	8977	mesquite	*Prosopis*	T	charcoal	C	20	
		NA	NA	8974	TP	2	8977	indeterminate		T	bone fragment	C	3	

Key: C = charred; F = feature; H = half; ID = identification; PC = partially charred; PD = provenience designation; PP = point provenienced; Q = quarter; SF = subfeature; T = type; TP = test pit; U = uncharred.

[a] Count represents an absolute count of specimens.

APPENDIX 10.A

Pollen Results as Raw Counts

PD No.	Feature or Profile No.	Feature Type	Comments	Period	Date Range	Tracers	Pollen Sum	Pollen Concentration (gr/cc)	Taxa Richness	Aggregate Taxa Richness	Degraded	Unknown	Paloverde (*Cercidium*)	Mesquite (*Prosopis*)	Hackberry (*Celtis*)	Ocotillo (*Fouquieria*)	Rose Family (Rosaceae)	Pine (*Pinus*)	Juniper (*Juniperus*)	Oak (*Quercus*)	Mormon Tea (*Ephedra*)	Sagebrush (*Artemisia*)	Maize (*Zea*)	Squash (*Cucurbita*)	Cotton (*Gossypium*)	Cholla (*Cylindropuntia*)	Prickly Pear (*Platyopuntia*)	Cacti (Cactaceae)	Cheno-Am
Locus A																													
1158	F 200	pit structure	house fill/trash	Middle Formative	A.D. 935–1040	12	293	30,581.6	19	1	12	—	4	—	—	—	—	0.1	—	—	—	—	0.1	—	—	0.1	—	0.1	203
1200	F 200	pit structure	point-located on floor under ceramic bowl	Middle Formative	A.D. 935–1040	20	220	13,796.2	8	1	7	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	159
1164	F 290	pit structure	point-located on floor under rock/manuport	Middle Formative B	A.D. 1010–1150	13	259	25,016.5	12	2	32	—	4	—	—	—	—	3	—	—	—	—	0.1	—	—	0.1	0.1	—	173
6380	F 2160	pit structure	composite sample from floor outside recessed hearth area	Middle Formative	A.D. 935–1040	58	264	5,708.8	14	2	12	3	—	—	—	—	1	2	—	—	—	—	20	—	1	—	4	2	142
7064	F 2160	pit structure	composite sample from floor in recessed hearth area	Middle Formative	A.D. 935–1040	62	244	4,944.0	11	1	14	1	—	—	—	—	—	1	—	—	—	—	2	—	—	0.1	0.1	1	172
Locus C																													
7400	F 379	pit structure	composite sample from floor in recessed hearth area	Middle Formative B	A.D. 1010–1140	22	172	9,805.6	5	1	12	—	—	—	—	—	—	—	—	—	—	—	10	—	—	6	—	—	125
7420	F 379	pit structure	from base of hearth	Middle Formative B	A.D. 1010–1140	6	25	5,225.8	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	25
9336	F 995	pit structure	house fill/trash	Middle Formative	A.D. 935–1100	38	225	7,429.5	7	2	30	1	2	—	—	—	—	—	1	—	—	—	4	—	—	—	0.1	—	146
8463	F 995	pit structure	from base of hearth	Middle Formative	A.D. 935–1100	22	216	12,314.0	6	—	18	3	1	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	140
9374	F 995	pit structure	from under RV in recessed hearth area	Middle Formative	A.D. 935–1100	27	213	9,903.5	13	2	21	2	3	—	—	—	—	1	2	—	—	—	10	—	—	—	1	—	121
9406	F 995	pit structure	from base of storage pit (SF 7)	Middle Formative	A.D. 935–1100	82	231	3,536.2	10	1	12	—	—	—	—	—	—	—	—	1	—	—	0.1	—	—	0.1	1	—	150
7449	F 6098	pit structure	house fill/trash	Middle Formative	A.D. 935–1015	26	248	11,972.8	6	1	8	—	—	—	—	—	—	—	—	—	—	—	10	—	—	0.1	0.1	—	184
9301	F 6098	pit structure	from floor in recessed hearth area; under slab (PD 9258)	Middle Formative	A.D. 935–1015	25	230	11,558.7	17	2	10	1	—	0.1	—	—	—	—	—	—	—	—	2	—	0.1	0.1	—	0.1	128
9363	F 6098	pit structure	from base of hearth	Middle Formative	A.D. 935–1015	56	253	5,673.0	11	1	8	—	—	—	—	—	—	2	—	—	—	—	4	0.1	—	0.1	0.1	—	180
9356	F 6098	pit structure	from base of storage pit	Middle Formative	A.D. 935–1015	192	213	1,391.4	3	1	14	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	156
8448	F 6129	pit structure	from base of hearth	Middle Formative	A.D. 935–1015	100	240	3,013.8	9	1	24	1	—	—	—	—	—	1	—	—	—	—	2	—	1	—	—	—	152
10128	F 6129	pit structure	from base of storage pit	Middle Formative	A.D. 935–1015	9	15	2,090.3	4	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	4
9128	F 6154	pit structure	from base of hearth	Middle Formative	A.D. 935–1015	6	282	59,031.0	11	2	10	—	—	—	—	—	—	1	—	—	—	—	—	—	—	0.1	0.1	—	213
10061	F 7461	pit structure	form base of hearth	Middle Formative	A.D. 935–1040	52	252	6,080.5	13	—	32	4	2	—	—	3	—	1	—	—	—	—	2	—	—	—	0.1	—	136
10125	F 7461	pit structure	from under large rock on floor	Middle Formative	A.D. 935–1040	35	203	7,285.1	12	1	11	—	—	—	—	—	—	1	—	—	—	—	0.1	—	—	—	0.1	—	133
9249	F 6143	indeterminate extramural pit	from pit fill (trash); pit is near structure F 6154	not determined	not dated	14	362	32,465.9	11	1	16	—	—	—	—	—	—	0.1	2	—	—	—	0.1	—	—	0.1	0.1	—	252
9250	F 6143	indeterminate extramural pit	from pit base; pit is near structure F 6154	not determined	not dated	5	206	51,673.0	6	1	9	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	146
11176	F 7195	extramural hearth	from base of hearth	not determined	not dated	24	226	11,826.1	11	0	14	—	—	0.1	—	—	—	—	—	—	—	—	—	—	1	—	0.1	—	126

continued on next page

PD No.	Feature or Profile No.	Feature Type	Comments	Period	Date Range	Tracers	Pollen Sum	Pollen Concentration (gr/cc)	Taxa Richness	Aggregate Taxa Richness	Degraded	Unknown	Paloverde (Cercidium)	Mesquite (Prosopis)	Hackberry (Celtis)	Ocotillo (Fouquieria)	Rose Family (Rosaceae)	Pine (Pinus)	Juniper (Juniperus)	Oak (Quercus)	Mormon Tea (Ephedra)	Sagebrush (Artemisia)	Maize (Zea)	Squash (Cucurbita)	Cotton (Gossypium)	Cholla (Cylindropuntia)	Prickly Pear (Platyopuntia)	Cacti (Cactaceae)	Cheno-Am
Locus D																													
7821	F 1815	pole-and-brush structure	composite sample from floor	Late Archaic/Early Formative	1500 B.C.– A.D. 700	134	221	2,071.3	10	2	6	4	—	—	—	—	—	2	6	—	—	—	—	—	—	0.1	0.1	0.1	132
7868	F 1815	pole-and-brush structure	from under mano in floor groove	Late Archaic/Early Formative	1500 B.C.– A.D. 700	19	231	15,261.6	11	1	4	1	—	—	—	—	—	—	—	—	—	—	1	—	—	0.1	1	—	182
7874	F 1816	pole-and-brush structure	composite sample from floor	Late Archaic/Early Formative	1500 B.C.– A.D. 700	14	413	37,034.7	14	2	16	—	—	—	—	—	1	6	4	—	—	—	0.1	—	—	0	0.1	0.1	282
11257	F 11251	pole-and-brush structure	from pit base (SF 22)	Early Formative	A.D. 1–700	8	224	35,117.6	12	2	12	7	—	1	—	—	—	—	—	—	—	—	0.1	—	—	1	—	0.1	132
2901	F 438	pit structure	house fill/trash	Early Formative–Middle Formative A	A.D. 735–865	5	224	56,213.2	5	2	6	—	—	—	—	—	—	—	—	—	—	—	0.1	—	—	1	1	—	201
5731	F 784	pit structure	from under mano (PD 5730) near hearth	Early Formative–Middle Formative	A.D. 700–1150	12	231	34,804.1	4	1	4	—	—	—	—	—	—	—	—	—	—	—	2	—	—	—	—	—	192
2504	F 3817	pit structure	from under sherd on base of pit	Early Formative–Middle Formative	A.D. 700–1015	20	207	12,949.6	13	1	11	—	—	—	—	—	—	0.1	—	—	—	1	2	0.1	—	—	0.1	—	168
2363	F 3869	pit structure	on floor around hearth	Early Formative–Middle Formative	A.D. 700–1050	10	272	34,164.4	13	2	6	5	—	—	—	—	—	3	—	—	—	—	3	0.1	—	0.1	0.1	—	213
8932	F 4768	pit structure	from hearth base	Middle Formative B	A.D. 1010–1090	32	97	3,809.6	7	2	8	—	2	—	—	—	—	—	—	—	—	—	0.1	—	0.1	—	—	—	64
8982	F 4768	pit structure	from under mano (PD 8981)	Middle Formative B	A.D. 1010–1090	7	219	39,256.5	14	2	5	1	4	—	1	—	—	1	—	—	1	—	2	—	—	1	1	—	137
3190	F 7558	pit structure	from base of storage pit	Early Formative–Middle Formative A	A.D. 710–740	7	256	45,921.6	12	1	7	1	1	—	—	—	—	3	1	—	—	—	0.1	—	—	2	0.1	—	186
6856	F 7880	pit structure	house fill/trash	Early Formative–Middle Formative A	A.D. 735–865	8	240	37,688.7	11	1	11	—	—	—	—	—	—	—	—	—	—	—	0.1	—	—	0.1	0.1	—	173
8851	F 7942	pit structure	from pit base	Early Formative–Middle Formative A	A.D. 700–925	20	346	21,710.2	11	1	29	1	—	—	—	—	—	2	—	—	—	—	0.1	—	—	0.1	—	—	251
10606	F 10781	pit structure	from base of hearth	Middle Formative	A.D. 935–1015	2	6	3,825.3	2	—	—	—	—	—	—	—	—	—	—	—	—	—	0.1	—	—	—	—	—	6
1858	F 1575	adobe structure	from under mano (PD 1857)	Late Formative B	A.D. 1385–1450	31	223	9,022.1	9	3	22	1	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	140
7731	F 1575	adobe structure	from floor under rock near center of house	Late Formative B	A.D. 1385–1450	20	285	17,884.9	10	2	8	—	—	—	—	—	—	2	—	—	1	—	2	—	—	0.1	—	—	198
5034	F 4683	adobe structure	from beneath trough metate (PD 5029) on floor	Late Formative B	A.D. 1385–1450	3	21	8,779.4	1	1	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	20
6651	F 4683	adobe structure	from sediments clinging to plaster of hearth	Late Formative B	A.D. 1385–1450	8	197	30,916.0	8	—	10	—	—	—	—	—	—	2	—	—	—	—	0.1	—	—	2	—	—	152
5299	F 4729	adobe structure	from beneath Gila Poly RV	Late Formative B	A.D. 1340–1390	8	294	46,091.9	7	—	12	—	—	—	—	—	—	2	—	—	—	—	—	—	—	2	—	—	174
5455	F 4729	adobe structure	from beneath RV (PD 5452)	Late Formative B	A.D. 1340–1390	5	294	73,772.0	12	1	21	2	—	—	—	—	1	—	1	—	—	—	0.1	—	—	—	1	—	202

PD No.	Feature or Profile No.	Feature Type	Comments	Period	Date Range	Tracers	Pollen Sum	Pollen Concentration (gr/cc)	Taxa Richness	Aggregate Taxa Richness	Degraded	Unknown	Paloverde (Cercidium)	Mesquite (Prosopis)	Hackberry (Celtis)	Ocotillo (Fouquieria)	Rose Family (Rosaceae)	Pine (Pinus)	Juniper (Juniperus)	Oak (Quercus)	Mormon Tea (Ephedra)	Sagebrush (Artemisia)	Maize (Zea)	Squash (Cucurbita)	Cotton (Gossypium)	Cholla (Cylindropuntia)	Prickly Pear (Platyopuntia)	Cacti (Cactaceae)	Cheno-Am
6731	F 4729	adobe structure	house fill/trash	Late Formative B	A.D. 1340–1390	9	207	28,902.3	11	3	11	—	—	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	144
8006	F 3876	indeterminate pit	from pit base; possible storage pit	not determined	not dated	38	235	7,756.2	11	2	12	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	145
11297	F 1812	bell-shaped pit	from pit base	not determined	not dated	7	226	40,403.2	13	2	10	—	—	—	—	—	—	1	—	—	—	—	0.1	—	—	0.1	0.1	—	132
7695	F 3557	bell-shaped pit	from pit base	Late Archaic	1060–880 B.C.	12	221	23,108.6	6	1	17	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	0.1	166
5885	F 3976	bell-shaped pit	from pit base	Late Archaic	1280–1010 B.C.	24	226	11,810.4	7	1	18	—	—	—	—	—	—	—	4	—	—	—	—	—	—	—	—	—	154
2627	F 3983	bell-shaped pit	from pit base	Late Archaic	1070–900 B.C.	22	223	12,718.7	6	3	18	—	1	—	—	—	—	2	—	—	—	—	0.1	—	—	—	—	—	172
5112	F 4295	bell-shaped pit	from pit base	not determined	not dated	4	109	34,271.0	10	1	14	—	—	—	—	—	—	1	—	—	—	—	0.1	—	—	—	0.1	—	48
5862	F 4312	bell-shaped pit	from pit base	Late Archaic/Early Formative	1500 B.C.– A.D. 300	7	220	39,471.5	8	1	11	—	—	—	—	—	—	1	—	—	—	—	—	—	—	—	—	—	175
11340	F 5505	bell-shaped pit	from pit base	Late Archaic	1110–900 B.C.	4	520	163,046.0	6	1	7	2	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	457
Off Site/No Associated Locus																													
10859	Profile 6	*cienega*	42–52 cm, 2Ab soil horizon		A.D. 1476–1947	7	215	38,521.9	9	3	16	—	—	—	—	—	—	2	—	—	—	—	—	—	—	—	—	—	124
10862	Profile 6	*cienega*	72–79 cm, 2Ab soil horizon		not dated	8	234	36,716.7	13	1	12	1	1	—	—	1	—	5	—	—	1	—	—	—	—	0.1	—	—	134
10866	Profile 6	*cienega*	125–135 cm, 4A soil horizon		A.D. 1412–1638	4	250	78,418.9	9	1	9	2	—	—	—	—	—	7	—	—	—	—	—	—	—	—	—	—	155
10871	Profile 6	*cienega*	235–245 cm, 6Ab soil horizon		A.D. 1269–1420	8	300	47,079.5	13	1	41	1	2	—	—	—	—	1	—	—	—	—	0.1	—	0.1	—	—	0.1	159
10934	Profile 7	*cienega*	25–35 cm, 2Ab1 soil horizon		not dated	19	241	15,915.1	12	1	7	1	—	—	—	—	—	13	1	—	3	2	1	—	—	—	—	—	93
10938	Profile 7	*cienega*	76–87 cm, 2Ab4 soil horizon		A.D. 1304–1474	18	233	16,241.9	10	1	26	1	—	—	—	—	—	—	2	—	—	—	—	—	—	—	0.1	—	127
10940	Profile 7	*cienega*	194–203 cm, 5Acb soil horizon		A.D. 1062–1378	67	209	3,914.2	10	1	30	7	3	0.1	—	3	—	5	—	—	—	—	—	—	—	—	—	—	64
10942	Profile 7	*cienega*	310 cm, 6Acb2 soil horizon		not dated	42	216	6,450.2	10	2	18	2	4	—	—	—	—	1	—	—	—	—	—	—	—	—	—	1	93

REFERENCES CITED

Abbott, David R.
2000 *Ceramics and Community Organization among the Hohokam.* University of Arizona Press, Tucson.

2006 Hohokam Ritual and Economic Transformation: Ceramic Evidence from the Phoenix Basin, Arizona. *North American Archaeologist* 27: 285–310.

2010 The Rise and Demise of Marketplace Exchange among the Prehistoric Hohokam of Arizona. In *Archaeological Approaches to Market Exchange in Ancient Societies*, edited by Christopher P. Garraty and Barbara L. Stark, pp. 63–86. University Press of Colorado, Boulder.

Abbott, David R., Alexa M. Smith, and Emiliano Gallaga
2007 Ballcourts and Ceramics: The Case for Hohokam Marketplaces in the Arizona Desert. *American Antiquity* 72:461–484.

Abbott, David R., Joshua Watts, and Andrew D. Lack
2007 The Provenance and Concentrated Production of Hohokam Red-on-Buff Pottery from the Arizona Desert. *Journal of Anthropological Research* 63:331–358.

Abbott, R. Tucker
1974 *American Seashells: The Marine Mollusca of the Atlantic and Pacific Coasts of North America*. 2nd ed. Van Nostrand Reinhold, New York.

Adams, Jenny L.
1988 Use-Wear Analysis of Handstones Used to Grind and Process Hides. *Journal of Field Archaeology* 15:307–315.

1989 Experimental Replication of the Use of Ground Stone Tools. *Kiva* 54:261–271.

1993 Toward Understanding the Technological Development of Manos and Metates. *Kiva* 53:331–344.

1999 Focusing the Role of Food-Grinding Tools as Correlates for Subsistence Strategies in the U.S. Southwest. *American Antiquity* 64:475–498.

2002 *Ground Stone Analysis: A Technological Approach.* University of Utah Press, Salt Lake City. Published in conjunction with the Center for Desert Archaeology, Tucson, Arizona.

2003 Tortolita Phase Grinding Technology. In *Roots of Sedentism: Archaeological Excavations at Valencia Vieja, a Founding Village in the Tucson Basin of Southern Arizona*, edited by H. D. Wallace, pp. 193–225. Anthropological Papers No. 29. Center for Desert Archaeology, Tucson, Arizona.

2005 Early Agricultural Period Grinding Technology. In *Material Cultures and Lifeways of Early Agricultural Communities in Southern Arizona*, edited by R. Jane Sliva, pp. 99–120. Anthropological Papers No. 35. Center for Desert Archaeology, Tucson, Arizona.

Adams, Karen R.
2001 Looking Back Through Time: Southwestern U.S. Archaeobotany at the New Millennium. In *Ethnobiology at the Millennium*: *Past Promise and Future Prospects*, edited by Richard I. Ford, pp. 49–100. Anthropological Papers No. 91. University of Michigan Museum of Anthropology, Ann Arbor.

2004 Plant Remains. In *Analyses of Prehistoric Remains*, edited by Eric Eugene Klucas, Richard Ciolek-Torrello, and Rein Vanderpot, pp. 223–246. From the Desert to the Mountains: Archaeology of the Transition Zone; The State Route 87–Sycamore Creek Project, vol. 2. Technical Series 73. Statistical Research, Tucson, Arizona.

Adams, Karen R., and Vandy E. Bowyer
2002 Sustainable Landscape: Thirteenth-Century Food and Fuel Use in the Sand Canyon Locality. In *Seeking the Center Place: Archaeology and Ancient Communities in the Mesa Verde Region*, edited by Mark D. Varien and Richard H. Wilshusen, pp. 123–142. University of Utah Press, Salt Lake City.

Adams, Karen R., and J. Kevin Hanselka
2004 Plant Use in the Late Archaic Period. Manuscript on file, Department of Anthropology, University of Texas, San Antonio.

Adams, Karen R., Susan J. Smith, and Manuel Palacios-Fest
2002 *Pollen and Micro-Invertebrates from Modern Earthen Canals and Other Fluvial Environments along the Middle Gila River, Central Arizona: Implications for Archaeological Interpretation*. Gila River Indian Community Anthropological Research Papers No. 1. Gila River Indian Community, Sacaton, Arizona.

Adler, Michael A. (editor)
1996 *The Prehistoric Pueblo World, A.D. 1150–1350*. University of Arizona Press, Tucson.

Altschul, Jeffrey H.
1994 From North to South: Shifting Sociopolitical Alliances during the Formative Period in the San Pedro Valley. Paper presented at "Prehistory of the Borderlands," Arizona Archaeological Council Spring Meeting, Tucson, Arizona.

Altschul, Jeffrey H., and Bruce A. Jones
1990 *Settlement Trends in the Middle San Pedro Valley: A Cultural Resources Sample Survey on the Fort Huachuca Military Reservation*. Technical Series 19. Statistical Research, Tucson, Arizona.

Altschul, Jeffrey H., César A. Quijada, and Robert A. Heckman
1999 Villa Verde and the Late Prehistoric Period along the San Pedro River. In *Sixty Years of Mogollon Archaeology: Papers from the Ninth Mogollon Conference, Silver City, New Mexico, 1996*, edited by Stephanie M. Whitlesey, pp. 81–92. SRI Press, Tucson, Arizona.

Altschul, Jeffrey H., Rein Vanderpot, César A. Quijada, and Robert A. Heckman
forthcoming People of the Grassland: Archaic and Formative Cultures of the Upper and Middle San Pedro Valley. In *The Archaeology of a Land Between: Regional Dynamics in the Prehistory and History of Southeastern Arizona*, edited by Henry Wallace. University of Arizona Press, Tucson.

Altschul, Jeffrey H., Stephanie M. Whittlesey, Richard Ciolek-Torrello, and Rein Vanderpot
2000 *Data Recovery Plan for the Mescal Wash Site (AZ EE:2:51 [ASM]), Marsh Station Traffic Interchange, Pima County, Arizona*. Technical Report 00-14. Statistical Research, Tucson, Arizona.

Andrefsky, William, Jr.
1994 Raw-Material Availability and the Organization of Technology. *American Antiquity* 59:21–34.

1998 *Lithics: Macroscopic Approaches to Analysis*. Cambridge Manuals in Archaeology. Cambridge University Press, Cambridge, England.

Andrews, Peter
1990 *Owls, Caves and Fossils: Predation, Preservation, and Accumulation of Small Mammal Bones in Caves, with an Analysis of the Pleistocene Cave Faunas from Westbury-sub-Mendip, Somerset, UK*. University of Chicago Press, Chicago, Illinois.

Arizona Game and Fish Department
2009 Quail. electronic resource http://www.azgfd.gov/h_f/game_quail.shtml accessed June 29, 2011

Bailey, Geoff
2007 Time Perspectives, Palimpsests and the Archaeology of Time. *Journal of Anthropological Archaeology* 26:198–223.

Baker, Kathleen A.
2004 *Ancillary Survey Report for Link Two Arizona: Addendum 9 to an Archaeological Survey of the Arizona Portion of Link Two of the AT&T Nexgen/Core Project for AT&T Corporation*. Western Cultural Resource Management, Farmington, New Mexico.

Baker, Kathleen A., and Joshua Jones
2004 *An Archaeological Survey of Link Two Arizona Ingress/Egress Routes: Addendum 4 to an Archaeological Survey of the Arizona Portion of Link Two of the AT&T Nexgen/Core Project for*

AT&T Corporation. Western Cultural Resource Management, Farmington, New Mexico.

Bamforth, Douglas B.
1990 Settlement, Raw Material, and Lithic Procurement in the Central Mohave Desert. *Journal of Anthropological Archaeology* 9:70–104.

Bamforth, Douglas B., and M. S. Becker
2000 Core/Biface Ratios, Mobility, Refitting, and Artifact Use-Lives: A Paleoindian Example. *Plains Anthropologist* 45(173):273–290.

Bamforth, Douglas B., and Peter Bleed
1997 Technology, Flaked Stone Technology, and Risk. In "Rediscovering Darwin: Evolutionary Theory in Archeological Explanation," edited by C. Michael Barton and Geoffrey A. Clark, special issue, *Archeological Papers of the American Anthropological Association* 7(1):109–139.

Barth, Fredrik
1969 Introduction. In *Ethnic Groups and Boundaries: The Social Organization of Culture Difference*, edited by Fredrik Barth, pp. 9–38. Universitetsforlaget, Bergen, Germany.

Bartlett, Katharine
1933 *Pueblo Milling Stones of the Flagstaff Region and Their Relation to Others in the Southwest*. Museum of Northern Arizona Bulletin No. 3. Northern Arizona Society of Science and Art, Flagstaff.

1949 Hopi Yucca Baskets. *Plateau* 21:33–41.

Basso, Keith H.
1983 Western Apache. In *Southwest*, edited by Alfonzo Ortiz, pp. 482–488. Handbook of North American Indians, vol. 10, William C. Sturtevant, general editor. Smithsonian Institution, Washington, D.C.

Bayham, Frank E.
1982 A Diachronic Analysis of Prehistoric Animal Exploitation at Ventana Cave. Unpublished Ph.D. dissertation, Arizona State University, Tempe.

Bayham, Frank E., and P. C. Hatch
1985 Archaeofaunal Remains from the New River Area. In *Hohokam Settlement and Economic Systems in the Central New River Drainage, Arizona*, edited by David E. Doyel and Mark D. Elson, pp. 405–433. Publications in Archaeology No. 4. Soil Systems, Phoenix, Arizona.

Bayliss, Alex, and Christopher Bronk Ramsey
2004 Pragmatic Bayesians: A Decade of Integrating Radiocarbon Dates into Chronological Models. In *Tools for Constructing Chronologies*, edited by Caitlin E. Buck and Andrew R. Millard, pp. 25–41. Springer, New York.

Bayman, James M.
2001 The Hohokam of Western North America. *Journal of World Prehistory* 15:257–311.

2002 Hohokam Craft Economies and the Materialization of Power. *Journal of Archaeological Method and Theory* 9:69–95.

2007 Papaguerian Perspectives on Economy and Society in the Sonoran Desert. In *Hinterlands and Regional Dynamics in the Ancient Southwest*, edited by Alan Sullivan III and James M. Bayman, pp. 109–124. University of Arizona Press, Tucson.

Beck, Margaret E.
2001 Archaeological Signatures of Corn Preparation in the U.S. Southwest. *Kiva* 67:187–218.

2006 Midden Ceramic Assemblage Formation: A Case Study from Kalinga, Philippines. *American Antiquity* 71:27–51.

Beckwith, Ronald J.
1986 Analysis of the Ground Stone and Small Artifacts. In *The 1985 Excavations at the Hodges Site, Pima County, Arizona*, edited by Robert W. Layhe, pp. 167–205. Archaeological Series No. 170. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

Behrensmeyer, A. K.
1978 Taphonomic and Ecologic Information from Bone Weathering. *Paleobiology* 4:150–162.

Bell, Willis H., and Edward F. Castetter
1937 *The Utilization of Mesquite and Screwbean by the Aborigines in the American Southwest.* University of New Mexico Bulletin No. 314. Ethnobiological Studies in the American Southwest 5. Biological Series Vol. 5, No. 2. University of New Mexico Press, Albuquerque.

Bemis, W. P., M. Moran, J. W. Berry, and A. J. Deutschmann
1967 Composition of *Apodanthera undulata* Oil. *Canadian Journal of Chemistry* 45(21):2,637.

Bennett, J. L.
1999 Thermal Alteration of Burned Bone. *Journal of Archaeological Science* 26:1–8.

Bennyhoff, James A., and Richard E. Hughes
1987 *Shell Bead and Ornament Exchange Networks between California and the Western Great Basin.* Anthropological Papers Vol. 64, Pt. 2. American Museum of Natural History, New York.

Bequaert, Joseph C., and Walter B. Miller
1973 *The Mollusks of the Arid Southwest, with an Arizona Check List.* University of Arizona Press, Tucson.

Berelov, Ilya
2006 Signs of Sedentism and Mobility in an Agro-Pastoral Community during the Levantine Middle Bronze Age: Interpreting Site Function and Occupation Strategy at Zahrat adh-Dhra’ 1 in Jordan. *Journal of Anthropological Archaeology* 25:117–143.

Berglund, Björn E. (editor), with the assistance of Magdalena Ralska-Jasiewiczowa
1986 *Handbook of Palaeoecology and Palaeohydrology*. J. Wiley, Chichester, West Sussex, England.

Bernard-Shaw, Mary
1983 The Stone Tool Assemblage of the Salt-Gila Aqueduct Project Sites. In *Material Culture*, edited by Lynn S. Teague and Patricia L. Crown, pp. 373–443. Hohokam Archaeology along the Salt-Gila Aqueduct, Central Arizona Project, vol. 8. Archaeological Series No. 150. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1984 A Systematic and Comparative Study of Hohokam Tabular Tool Use. Paper presented at the 49th Annual Meeting of the Society for American Archaeology, Portland, Oregon.

1985 MNA Tabular Knives Abstract. Manuscript on file, SWCA Environmental Consultants, Flagstaff, Arizona.

Bettinger, Robert L., and Martin A. Baumhoff
1982 The Numic Spread: Great Basin Cultures in Competition. *American Antiquity* 47:485−503.

Binford, Lewis R.
1978 *Nunamiut Ethnoarchaeology.* Academic Press, New York.

1979 Organization and Formation Processes: Looking at Curated Technologies. *Journal of Anthropological Research* 35:255–273.

1980 Willow Smoke and Dogs’ Tails: Hunter-Gatherer Settlement Systems and Archaeological Site Formation. *American Antiquity* 45:4–20.

1981 *Bones: Ancient Men and Modern Myths.* Academic Press, New York.

1982 *In Pursuit of the Past: Decoding the Archaeological Record*. Thames and Hudson, New York.

Binford, Lewis R., and J. B. Bertram
1977 Bone Frequencies and Attritional Processes. In *For Theory Building in Archaeology: Essays on Faunal Remains, Aquatic Resources, Spatial Analysis, and Systemic Modeling*, edited by Lewis R. Binford, pp. 77–156. Academic Press, New York.

Blake, Karry L., and William M. Graves
2008 *Results of Archaeological Monitoring at AZ EE:2:51 for the Replacement of a Sprint Fiber-Optic Line at the Marsh Station/I-10 Traffic Interchange, Pima County, Arizona*. Technical Report 08-52. Statistical Research, Tucson, Arizona.

Bodner, Gita, Jeff Simms, and Dave Gori
2007 *State of the Las Cienegas National Conservation Area: Gila Topminnow Population Status and Trends 1989–2005*. The Nature Conservancy, Tucson, Arizona. Report submitted to the USDI Bureau of Land Management, Tucson Office, Arizona.

Boekelman, Henry J.
1936 Shell Trumpet from Arizona. *American Antiquity* 2:27–31.

Bohrer, Vorsila L.
1970 Ethnobotanical Aspects of Snaketown, a Hohokam Village in Southern Arizona. *American Antiquity* 35:413–430.

1987 The Plant Remains from La Ciudad, a Hohokam Site in Phoenix. In *Environmental Data*, edited by JoAnn Kisselburg, Glen Rice, and Brenda Shears, pp. 67–202. Specialized Studies in the Economy, Environment and Culture of La Ciudad, pt. 3. Ciudad Monograph Series Vol. 5. Anthropological Field Studies No. 20. Office of Cultural Resource Management, Arizona State University, Tempe.

Bowen, Thomas
1972 A Survey and Re-Evaluation of the Trincheras Culture, Sonora, Mexico. Manuscript on file,

Arizona State Museum Library Archives, AT-94-85, University of Arizona, Tucson.

n.d. A Survey and Re-Evaluation of the Trincheras Culture, Sonora, Mexico. Manuscript on file, Arizona State Museum Library, University of Arizona, Tucson.

Bradley, Bruce A.

1980 *Excavations at AZ BB:13:72, Santa Cruz Industrial Park*. CASA Paper No. 1. Complete Archaeological Service Associates, Oracle, Arizona.

2002a Biface and Projectile Point Analysis. Manuscript on file, Statistical Research, Tucson, Arizona.

2002b Marsh Station Flaked Stone Analysis. Manuscript on file, Statistical Research, Tucson, Arizona.

Brainerd, George W.

1951 The Place of Chronological Ordering in Archaeological Analysis. *American Antiquity* 16:301–313.

Brantingham, P. Jeffrey

2003 A Neutral Model of Stone Raw Material Procurement. *American Antiquity* 68:487–509.

Braun, David P.

1980 Experimental Interpretation of Ceramic Vessel Use on the Basis of Rim and Neck Formal Attributes. In *The Navajo Project: Archaeological Investigations, Page to Phoenix 500 Kv Southern Transmission Line*, by Donald C. Fiero, R. W. Munson, M. T. McClain, S. M. Wilson, and A. H. Zier, pp. 171–231. Research Paper No. 11. Museum of Northern Arizona, Flagstaff.

1983 Pots as Tools. In *Archaeological Hammers and Theories*, edited by James Moore and Arthur Keene, pp. 107–134. Academic Press, New York.

Bray, Tamara L.

2003 The Commensal Politics of Early States and Empires. In *The Archaeology and Politics of Food and Feasting in Early States and Empires*, edited by Tamara L. Bray, pp. 1–15. Kluwer Academic/Plenum, New York.

Breitburg, Emanuel

1988 Prehistoric New World Turkey Domestication: Origins, Developments, and Consequences. Unpublished Ph.D. dissertation, Department of Anthropology, Southern Illinois University, Carbondale.

Brennan, Thomas C.

2008a Sonora Mud Turtle *Kinosternon sonoriense*. Electronic resource http://www.reptilesofaz.org/Turtle-Amphibs-Subpages/h-k-sonoriense.html accessed June 29, 2011

2008b Arizona Mud Turtle *Kinosternon arizonense*. Electronic resource http://www.reptilesofaz.org/Turtle-Amphibs-Subpages/h-k-arizonense.html accessed June 29, 2011

2008c Yellow Mud Turtle Kinosternon flavenscenc. Electronic resource http://www.reptilesofaz.org/Turtle-Amphibs-Subpages/h-k-flavescens.html accessed June 29, 2011

Bronk Ramsey, Christopher

1995 Radiocarbon Calibration and Analysis of Stratigraphy: The OxCal Program. *Radiocarbon* 37:425–430.

2001 Development of the Radiocarbon Calibration Program. *Radiocarbon* 43:355–363.

2005 OxCal Program v. 3.10 Manual. Electronic document, https://c14.arch.ox.ac.uk/embed.php?File=oxcal.html, accessed July 27, 2006.

Broughton, J. M.

1994 Declines in Mammalian Foraging Efficiency during the Late Holocene, San Francisco Bay, California. *Journal of Anthropological Archaeology* 13:371–401.

Brown, David E. (editor)

1994 *Biotic Communities: Southwestern United States and Northwestern Mexico*. Electronic book. University of Utah Press, Salt Lake City.

Buck, Caitlin E., and J. Andrés Christen

1998 A Novel Approach to Selecting Samples for Radiocarbon Dating. *Journal of Archaeological Science* 25:303–310.

Buckles, Avi, Karen Adams, Bruce Phillips, Andrea Gregory, Jennifer Bower, and William L. Deaver

2010 Environment and Subsistence. In *Mescal Wash, AZ EE:2:51 (ASM), Archaeological Explorations in the Union Pacific Pantano Realignment: Description, Synthesis, and Interpretation*, edited by William L. Deaver, pp. 5.1–5.48. Cultural Resources Report No. 2009-23. WestLand Resources, Tucson, Arizona.

Buckles, Avi, Tom Klimas, and William L. Deaver
2010 Archaeological Features. In *Mescal Wash, AZ EE:2:51 (ASM), Archaeological Explorations in the Union Pacific Pantano Realignment: Description, Synthesis, and Interpretation*, edited by William L. Deaver, pp. 3.1–3.55. Cultural Resources Report No. 2009-23. WestLand Resources, Tucson, Arizona.

Buikstra, Jane, and Douglas Ubelaker (editors)
1994 *Standards for Data Collection from Human Skeletal Remains:Proceedings of a Seminar at the Field Museum of Natural History, Organized by Jonathan Haas*. Research Series No. 44. Arkansas Archeological Survey, Fayetteville.

Bunn, H. T., L. E. Bartram, and E. M. Kroll
1988 Variability in Bone Assemblage Formation from Hadza Hunting, Scavenging, and Carcass Processing. *Journal of Anthropological Archaeology* 7:412–457.

Cairns, K. M., and Richard Ciolek-Torrello
1998 Faunal Analysis. In *Early Farmers of the Sonoran Desert: Archaeological Investigations at the Houghton Road Site, Tucson, Arizona,* edited by Richard Ciolek-Torrello, pp. 169–184. Technical Series 72. Statistical Research, Tucson, Arizona.

Cairns, K. M., and Edgar K. Huber
1999 Faunal Analysis. In *Investigations at Sunset Mesa Ruin: Archaeology at the Confluence of the Santa Cruz and Rillito Rivers, Tucson, Arizona,* edited by Richard Ciolek-Torrello, Edgar K. Huber, and Robert B. Neily, pp. 177–192. Technical Series 66. Statistical Research, Tucson, Arizona.

Calamia, Mark A.
1991 Ground Stone Variability among Jornada Mogollon Sites and Its Implications for Interpreting Residential Mobility. In *Mogollon V*, edited by P. Beckett, pp. 119–132. COAS, Las Cruces, New Mexico.

Callahan, Errett
1979 *The Basics of Biface Knapping in the Eastern Fluted Point Tradition: A Manual for Flintknappers and Lithic Analysts*. Archaeology of Eastern North America Vol. 7, No. 1. Eastern States Archaeological Federation, Washington, Connecticut.

Cameron, Catherine M.
1995 Migration and the Movement of Southwestern Peoples. *Journal of Anthropological Archaeology* 14:104–124.

Cameron, J. L., J. A. Waters, B. Pavao-Zuckerman, V. M. LaMotta, and P. D. Schulz
2006 Faunal Remains. In *Rio Nuevo Archaeology, 2000–2003: Investigations at the San Agustín Mission and Mission Gardens, Tucson Presidio, Tucson Pressed Brick Company, and Clearwater Site*, edited by J. H. Thiel and Jonathan B. Mabry, pp. 13.1–13.59. Technical Report No. 2004-11. Desert Archaeology, Tucson, Arizona.

Campbell, Elizabeth W. C., William H. Campbell, Ernst Antevs, Charles A. Amsden, Joseph A. Barbieri, and Francis D. Bode
1937 *The Archaeology of Pleistocene Lake Mohave: A Symposium*. Paper No. 11. Southwest Museum, Los Angeles, California.

Carmony, Neil B., and David E. Brown
1982 Editors' Summary. In *Man and Wildlife in Arizona: The American Exploration Period, 1824–1865,* by Goode P. Davis, Jr., edited by Neil B. Carmony and David E. Brown, pp. 176–193. Arizona Game and Fish Department in cooperation with Arizona Cooperative Wildlife Research Unit, Phoenix, Arizona.

Carr, P. J., and A. P. Bradbury
2001 Flake Debris Analysis, Levels of Production, and the Organization of Technology. In *Lithic Debitage: Context, Form, Meaning*, edited by William Andrefsky, Jr., pp. 126–146. University of Utah Press, Salt Lake City.

Castetter, Edward F.
1935 *Uncultivated Native Plants Used as Sources of Food*. University of New Mexico Bulletin No. 266. Ethnobiological Studies in the American Southwest 1. Biological Series Vol. 4, No. 1. University of New Mexico Press, Albuquerque.

Castetter, Edward F., and Willis H. Bell
1942 *Pima and Papago Indian Agriculture.* Inter-Americana Studies 1. University of New Mexico School of Inter-American Affairs. University of New Mexico Press, Albuquerque.

Castetter, Edward F., Willis H. Bell, and Alvin R. Grove
1938 *The Early Utilization and Distribution of Agave in the American Southwest*. University of New Mexico Bulletin No. 335. Ethnobiological Studies in the American Southwest 6. Biological Series Vol. 5, No. 4. University of New Mexico Press, Albuquerque.

Castetter, Edward F., and Ruth Underhill
1935 *The Ethnobiology of the Papago Indians*. University of New Mexico Bulletin No. 275. Ethnobiological Studies in the American Southwest 2. Biological Series Vol. 4, No. 3. University of New Mexico Press, Albuquerque.

Cattelain, P., and M. Perpère
1993 Tir Expérimental de Sagaies et de Flèches Emmanchées de Pointes de la Gravette. *Archéo-Situla* 17–20:5–28.

Chandler, Glen
1985 *Market Trade in Rural Java*. Monash Papers on Southeast Asia 0727-6680 No. 11. Centre of Southeast Asian Studies, Monash University, Melbourne, Victoria, Australia.

Chapman, Jefferson, Robert B. Stewart, and Richard A. Yarnell
1974 Archaeological Evidence for Precolumbian Introduction of *Portulaca oleracea* and *Mollugo verticillata* into Eastern North America. *Economic Botany* 28:411–412.

Ciolek-Torrello, Richard, and Carl Halbirt
1987 Rock Terrace Site, NA18,017. In *The Picacho Area Sites*, edited by Richard Ciolek-Torrello, pp. 217–264. Hohokam Settlement along the Slopes of the Picacho Mountains, vol. 3. Research Paper No. 35. Museum of Northern Arizona, Flagstaff.

Clark, Jeffery J.
2001 *Tracking Prehistoric Migrations: Pueblo Settlers among the Tonto Basin Hohokam*. University of Arizona Press, Tucson.

Clark, Jeffery J., and Patrick D. Lyons
2003 Mounds and Migrants in the Classic Period (A.D. 1200–1450). *Archaeology Southwest* 17(3):7–10.

Clark, Jeffery, Patrick D. Lyons, J. Brett Hill, Henry D. Wallace, William H. Doelle, and Stacey Lengyel
2006 Of Migrants and Mound-Builders. In *Migrants and Mounds: Classic Period Archaeology in the Lower San Pedro Valley*, edited by Jeffery J. Clark, Patrick D. Lyons, and J. Brett Hill. Anthropological Papers No. 45. Center for Desert Archaeology, Tucson, Arizona.

Cochran, W. G.
1954 Some Methods of Strengthening the Common Chi-square Tests. *Biometrics* 10:417–451.

Colton, Harold S.
1952 Primitive Pottery Making: The Ceramic Methods of a Hopi Indian Potter. *Faenza* 38(6):135–139.

Colton, Mary-Russell Ferrell
1931 Techniques of the Major Hopi Crafts. *Plateau* 3(12):1–7.

Cosgrove, H. S., and C. B. Cosgrove
1932 *The Swarts Ruin: A Typical Mimbres Site in Southwestern New Mexico; Report of the Mimbres Valley Expedition, Seasons of 1924–1927*. Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 15, No. 1. Harvard University, Cambridge, Massachusetts.

Cowan, Frank L.
1999 Making Sense of Flake Scatters: Lithic Technological Strategies and Mobility. *American Antiquity* 64:593–607.

Crabtree, Don E.
1982 *An Introduction to Flintworking*. 2nd ed. Occasional Paper No. 28. Idaho Museum of Natural History, Pocatello.

Crown, Patricia L.
1990 The Hohokam of the American Southwest. *Journal of World Prehistory* 4:223–255.

1994 *Ceramics and Ideology: Salado Polychrome Pottery*. University of New Mexico Press, Albuquerque.

Culpepper, A. Stanley, and Alan C. York
2000 Weed Management in Ultra Narrow Row Cotton (*Gossypium hirsutum*). *Weed Technology* 14:19–29.

Cummings, Byron
1940 *Kinishba: A Prehistoric Pueblo of the Great Pueblo Period*. Hohokam Museums Association and the University of Arizona, Tucson, Arizona.

Curtin, Leonora S. M.
1984 *By the Prophet of the Earth: Ethnobotany of the Pima*. University of Arizona Press, Tucson. Originally published 1949, San Vicente Foundation, Santa Fe, New Mexico.

Danson, Edward B.
1952 Review of *The Babocomari Village Site on the Babocomari River, Southeastern Arizona*, by Charles C. Di Peso. *American Antiquity* 3:267–268.

Davis, Adam S.
2008 Weed Seed Pools Concurrent with Corn and Soybean Harvest in Illinois. *Weed Science* 56:503–508.

Davis, Owen K., Tom Minckley, Tom Moutoux, Tim Jull, and Bob Kalin
2002 The Transformation of Sonoran Desert Wetlands following the Historic Decrease of Burning. *Journal of Arid Environments* 50:393–412.

Dean, Jeffrey S.
1991 Thoughts on Hohokam Chronology. In *Exploring the Hohokam: Prehistoric Desert Peoples of the American Southwest*, edited by George J. Gumerman, pp. 61–149. Amerind Foundation New World Studies Series 1. University of New Mexico Press, Albuquerque.

Dean, Jeffrey S. (editor)
2000 *Salado*. Amerind Foundation New World Studies Series 4. University of New Mexico Press, Albuquerque.

Dean, Jeffrey S., and John C. Ravesloot
1993 The Chronology of Cultural Interaction in the Gran Chichimeca. In *Culture and Contact: Charles C. Di Peso's Gran Chichimeca*, edited by Anne I. Woosley and John C. Ravesloot, pp. 83–103. Amerind Foundation New World Studies Series No. 2. University of New Mexico Press, Albuquerque.

Dean, Rebecca Marie
2003 *People, Pests, and Prey: The Emergence of Agricultural Economies in the Desert Southwest*. Ph.D. dissertation, University of Arizona, Tucson. University Microfilms, Ann Arbor, Michigan.

2007a Subsistence: Vertebrate Faunal Material. In *Archaeological Investigations at the El Taller, AZ AA:12:92 (ASM), and Rillito Fan, AZ AA:12:788 (ASM), Sites along Eastbound I-10 between Sunset and Ruthrauff Roads, Tucson, Pima County, Arizona*, edited by Helga Wöcherl, pp. 129–148. Technical Report No. 2003-08. Desert Archaeology, Tucson, Arizona.

2007b Rethinking Rabbit Ratios in Hohokam Sites. *Kiva* 73:7–30.

2007c Hunting Intensification and the Hohokam "Collapse." *Journal of Anthropological Archaeology* 26:109–132.

Deaver, William L.
1984 Pottery. In *Hohokam Habitation Sites in the Northern Santa Rita Mountains*, vol. 2, pt. 1, edited by Alan Ferg, Kenneth C. Rozen, William L. Deaver, Martyn D. Tagg, David A. Phillips, Jr., and David A. Gregory, pp. 237–419. Archaeological Series No. 147. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1988 Identifying Contemporary Archaeological Events through a Comparison of Archaeomagnetic Directions. In *The Site and Its Features*, by David A. Gregory, William L. Deaver, Suzanne K. Fish, Ronald Gardiner, Robert W. Layhe, Fred L. Nials, and Lynn S. Teague, pp. 73–120. The 1982–1984 Excavations at Las Colinas, vol. 2, Lynn Teague, general editor. Archaeological Series No. 162. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

2010 The Historical Dimension: Chronology and Settlement History. In *Mescal Wash, AZ EE:2:51 (ASM), Archaeological Explorations in the Union Pacific Pantano Realignment: Description, Synthesis, and Interpretation*, edited by William L. Deaver, pp. 2.1–2.10. Cultural Resources Report No. 2009-23. WestLand Resources, Tucson, Arizona.

Deaver, William L. (editor)
2010 *Mescal Wash, AZ EE:2:51 (ASM), Archaeological Explorations in the Union Pacific Pantano Realignment: Description, Synthesis, and Interpretation*. Cultural Resources Report 2009-23. Draft. WestLand Resources, Tucson, Arizona.

Deaver, William L., Avi Buckles, Mary Prasciunas, and Arthur Vokes
2010 Material Culture. In *Mescal Wash, AZ EE:2:51 (ASM), Archaeological Explorations in the Union Pacific Pantano Realignment: Description, Synthesis, and Interpretation*, edited by William L. Deaver, pp. 4.1–4.63. Cultural Resources Report No. 2009-23. WestLand Resources, Tucson, Arizona.

Deaver, William L., and Richard Ciolek-Torrello
1995 Early Formative Period Chronology for the Tucson Basin. *Kiva* 60:481–529.

deFrance, Susan D.
2009 Zooarchaeology in Complex Societies: Political Economy, Status, and Ideology. *Journal of Archaeological Research* 17:105–168.

De Graaff, G.
1961 Gross Effects of a Primitive Hearth. *South African Archaeological Bulletin* 16:25–26.

Della Croce, Anthony
2001 Stone Artifacts. In *El Macayo: A Prehistoric Settlement in the Upper Santa Cruz River Valley,* edited by William L. Deaver and Carla R. Van West, pp. 95–108. Technical Series 74. Statistical Research, Tucson, Arizona.

Densmore, Frances
1979 *Chippewa Customs*. Reprinted. Minnesota Historical Society Press, St. Paul. Originally published 1929, Bulletin No. 86, Bureau of American Ethnology, Smithsonian Institution, Washington, D.C.

d'Errico, Francesco, Giacomo Giacobini, Jon Hather, Alix H. Power-Jones, and Antonio M. Radmilli
1995 Possible Bone Threshing Tools from the Neolithic Levels of the Grotta dei Piccioni (Abruzzo, Italy). *Journal of Archaeological Science* 22:537–549.

Dibble, Harold L., Utsav A. Schurmans, Radu P. Iovita, and Michael V. McLaughlin
2005 The Measurement and Interpretation of Cortex in Lithic Assemblages. *American Antiquity* 70:545–560.

Diehl, Michael W.
1996 The Intensity of Maize Processing and Production in Upland Mogollon Pithouse Villages, A.D. 200–1000. *American Antiquity* 61:102–116.

Dietler, Michael
1996 Feasts and Commensal Politics in the Political Economy: Food, Power, and Status in Prehistoric Europe. In *Food and the Status Quest: An Interdisciplinary Perspective*, edited by Polly Wiessner and Wulf Schiefenhövel, pp. 87–125. Berghahn Books, Providence, Rhode Island.

2007 Culinary Encounters: Food, Identity, and Colonialism. In *The Archaeology of Food and Identity,* edited by Katheryn C. Twiss, pp. 218–242. Occasional Paper No. 34. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Di Peso, Charles C.
1951 *The Babocomari Village Site on the Babocomari River, Southeastern Arizona.* Publication No. 5. Amerind Foundation, Dragoon, Arizona.

1956 *The Upper Pima of San Cayetano del Tumacacori: An Archaeological Reconstruction of the Ootam of Pimeria Alta*. Publication No. 7. Amerind Foundation, Dragoon, Arizona.

1958 *The Reeve Ruin of Southeastern Arizona: A Study of a Prehistoric Western Pueblo Migration into the Middle San Pedro Valley*. Publication No. 8. Amerind Foundation, Dragoon, Arizona.

1974 *Casas Grandes: A Fallen Trading Center of the Gran Chichimeca*, vols. 1–3. Series No. 9. Amerind Foundation, Dragoon, Arizona.

Di Peso, Charles C., John B. Rinaldo, and Gloria J. Fenner
1974 *Casas Grandes: A Fallen Trading Center of the Gran Chichimeca*, vol. 4–8. Series No. 9. Amerind Foundation, Dragoon, Arizona, and Northland Press, Flagstaff, Arizona.

Doebley, J. F.
1984 Seeds of Wild Grasses: A Major Food of Southwestern Indians. *Economic Botany* 38(1):52–64.

Doelle, William H.
1984 The Tucson Basin during the Protohistoric Period. *The Kiva* 49:195–211.

Doyel, David E., and Mark D. Elson (editors)
1985 *Hohokam Settlement and Economic Systems in the Central New River Drainage, Arizona*. Publications in Archaeology No. 4. Soil Systems, Phoenix, Arizona.

DuBois, Robert
1975 Secular Variation in the Southwestern United States as Suggested by Archaeomagnetic Studies. In *Proceedings of the Takesi Nagata Conference [on] Magnetic Fields, Past and Present: June 3rd and 4th, 1974, Dept. of Earth and Planetary Sciences, University of Pittsburgh*, edited by R. M. Fisher, M. Fuller, V. A. Schmidt, and P. J. Wasilewski, pp. 133–144. Goddard Space Flight Center, Greenbelt, Maryland.

Duff, Andrew I.
2002 *Western Pueblo Identities: Regional Interaction, Migration, and Transformation*. University of Arizona Press, Tucson.

Eddy, Frank W., and Maurice E. Cooley
1983 *Cultural and Environmental History of Cienega Valley, Southeastern Arizona*. Anthropological Papers of the University of Arizona No. 43. University of Arizona Press, Tucson.

eFloras
2010 Flora of North America. Electronic document, http://www.efloras.org/flora_page.aspx?flora_id=1, accessed July 15, 2010.

Eighmy, Jeffrey L., and Jason LaBelle
1996 Radiocarbon Dating of Twenty-Seven Plains Complexes and Phases. *Plains Anthropologist* 41:53–69.

Eighmy, Jeffrey L., Robert S. Sternberg, and Robert F. Butler
1980 Archaeomagnetic Dating in the American Southwest. *American Antiquity* 45:507–517.

Elson, Mark D.
1996 A Revised Chronology and Phase Sequence for the Lower Tonto Basin of Central Arizona. *Kiva* 62:117–114.

Euler, R. Thomas, and David A. Gregory
1988 Pecked, Ground and Polished Stone Artifacts. In *Material Culture*, by David R. Abbott, Kim E. Beckwith, Patricia L. Crown, R. Thomas Euler, David A. Gregory, J. Ronald London, Marylin B. Saul, Larry A. Schwalbe, Mary Bernard-Shaw, Christine R. Szuter, and Arthur W. Vokes, pp. 299–317. The 1982–1984 Excavations at Las Colinas, vol. 4, Lynn Teague, general editor. Archaeological Series No. 162. Arizona State Museum, University of Arizona, Tucson.

Ezzo, Joseph A., and William L. Deaver
1998 *Watering the Desert: Late Archaic Farming at the Costello-King Site; Data Recovery at AZ AA:12:503 (ASM) in the Northern Tucson Basin*. Technical Series 68. Statistical Research, Tucson, Arizona.

Faith, J. T., and A. D. Gordon
2007 Skeletal Element Abundances in Archaeofaunal Assemblages: Economic Utility, Sample Size, and Assessment of Carcass Transport Strategies. *Journal of Archaeological Science* 34:872–882.

Ferg, Alan
1984 Discussion. In *Hohokam Habitation Sites in the Northern Santa Rita Mountains*, by Alan Ferg, Kenneth C. Rozen, William L. Deaver, Martyn W. Tagg, David A. Phillips, Jr., and David A. Gregory, pp. 725–822. Archaeological Series No. 147, vol. 2, pt. 2. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1998 Rare Stone, Fired Clay, Bone, and Shell Artifacts. In *Analyses and Synthesis*, edited by Jonathan B. Mabry, pp. 545–654. Archaeological Investigations of Early Village Sites in the Middle Santa Cruz Valley, pt. 2. Anthropological Papers No. 19. Center for Desert Archaeology, Tucson, Arizona.

Fewkes, J. Walter
1896 Pacific Coast Shells from Prehistoric Tusayan Pueblos. *American Anthropologist* A9(11):359–368.

Fish, Paul R., and Suzanne K. Fish
1999 Reflections on the Casas Grandes Regional System from the Northwestern Periphery. In *The Casas Grandes World*, edited by Curtis F. Schaafsma and Carroll L. Riley, pp. 27–42. University of Utah Press, Salt Lake City.

Fish, Suzanne K., Paul R. Fish, and John H. Madsen
1985 Analyzing Regional Agriculture: A Hohokam Example. Paper presented at the 50th Annual Meeting of the Society for American Archaeology, Denver, Colorado.

1992 Early Sedentism and Agriculture in the Northern Tucson Basin. In *The Marana Community in the Hohokam World*, edited by Suzanne K. Fish, Paul R. Fish, and John H. Madsen, pp. 11–19. Anthropological Papers of the University of Arizona No. 56. University of Arizona Press, Tucson.

Fish, Suzanne K., Paul R. Fish, Charles Miksicek, and John Madsen
1985 Prehistoric Agave Cultivation in Southern Arizona. *Desert Plants* 7:107–112.

Fish, Suzanne K., Paul R. Fish, Guadalupe Sánchez de Carpenter, and Karen R. Adams
2004 Growing Conditions and Crops: The Field Evidence. In *The Safford Valley Grids: Prehistoric Cultivation in the Southern Arizona Desert*, edited by William E. Doolittle and James A. Neely. Anthropological Papers of the University of Arizona No. 70. University of Arizona Press, Tucson.

Flenniken, J. Jeffrey, and Philip J. Wilke
1989 Typology, Technology, and Chronology of Great Basin Dart Points. *American Anthropologist* 91:149–158.

Fowler, Catherine S. (compiler and editor)
1989 *Willard Z. Park's Ethnographic Notes on the Northern Paiute of Western Nevada, 1933–1940*, vol. 1. Anthropological Papers No. 114. University of Utah Press, Salt Lake City. Electronic book.

Fratt, Lee
1991 Ground Stone. In *Homol'ovi II: Archaeology of an Ancestral Hopi Village, Arizona*, edited by E. Charles Adams and Kelley Ann Hays, pp. 57–74. Anthropological Papers of the University of Arizona No. 55. University of Arizona Press, Tucson.

Fratt, Lee, and Maggie Biancaniello
1993 Homol'ovi III Ground Stone in the Raw: A Study of the Local Sandstone Used to Make Ground Stone Artifacts. *Kiva* 58:373–391.

Fulton, William Shirley
1940 Observations. In *An Archaeological Site near Gleeson, Arizona,* by Willliam Shirley Fulton and Carr Tuthill, pp. 63–66. Publication No. 1. Amerind Foundation, Dragoon, Arizona.

Fulton, William Shirley, and Carr Tuthill
1940 *An Archaeological Site near Gleeson, Arizon*a. Publication No. 1. Amerind Foundation, Dragoon, Arizona.

Garraty, Christopher P., Robert A. Heckman, and Resha Shenandoah
2010 Ceramic Artifacts. In *Queen Valley to Queen Creek Prehistoric Analyses,* edited by Robert M. Wegener, Michael P. Heilen, and Richard Ciolek-Torrello, pp. 7.1–7.139. The U.S. 60 Archaeological Project: Early Agricultural, Formative, and Historical-Period Use of the Upper Queen Creek Region, vol. 4, pt. 2. Technical Report 10-01. Statistical Research, Tucson, Arizona.

Geib, Phil R., and Martha M. Callahan
1988 Clay Residue of Polishing Stones. *Kiva* 53:357–362.

Geib, Phil R., and Susan J. Smith
2008 Palynology and Archaeological Inference: Bridging the Gap between Pollen Washes and Past Behavior. *Journal of Archaeological Science* 35:2085–2101.

Gillespie, W. B.
1989 Faunal Remains from Four Sites along the Tucson Aqueduct: Prehistoric Exploitation of Jack Rabbits and Other Vertebrates in the Avra Valley. In *Hohokam Archaeology along Phase B of the Tucson Aqueduct Central Arizona Project*, vol. 1, edited by Jon S. Czaplicki and John C. Ravesloot, pp. 171–238. Archaeological Series No. 178. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1995 Vertebrate Remains from Los Morteros. In *Archaeological Investigations at Los Morteros: A Prehistoric Settlement in the Northern Tucson Basin*, pt. 2, edited by Henry D. Wallace, pp. 673–720. Anthropological Papers No. 17. Center for Desert Archaeology, Tucson, Arizona.

Gilman, Patricia A., Valli S. Powell, and Don L. Dycus
1996 The Role of Agriculture and Residential Movement in the Late Archaic and Early Pit Structure Periods of Southeastern Arizona. In *Early Formative Adaptations in the Southern Southwest*, edited by Barbara J. Roth, pp. 73–84. Monographs in World Archaeology No. 25. Prehistory Press, Madison, Wisconsin.

Gish, Jannifer W.
1991 Current Perceptions, Recent Discoveries, and Future Directions in Hohokam Palynology. *Kiva* 56(3):227–235.

Gladwin, Winifred J., and Harold S. Gladwin
1930 *Some Southwestern Pottery Types: Series I*. Medallion Papers No. 8. Privately printed for the Gila Pueblo, Globe, Arizona.

Glass, Margaret
2000 Animal Bones. In *Archaeological Investigations at AZ V:13:201, Town of Kearny, Pinal County, Arizona,* edited by Caven P. Clark, pp. 6.1–6.12. Report No. 114. Archaeological Consulting Services, Tempe, Arizona.

Goodyear, Albert C. III
1975 *Hecla II and III: An Interpretive Study of Archeological Remains from the Lakeshore Project, Papago Reservation, South Central Arizona.* Anthropological Research Papers No. 9. Arizona State University, Tempe.

Grayson, Donald K.
1984 *Quantitative Zooarchaeology*: *Topics in the Analysis of Archaeological Faunas*. Academic Press, Orlando, Florida.

Greenwald, Dawn M.

1988 Ground Stone. In *Material Culture*, edited by Martha M. Callahan, pp. 127–220. Hohokam Settlement along the Slopes of the Picacho Mountains, vol. 4. Research Paper No. 35. Museum of Northern Arizona, Flagstaff.

1990 A Functional Evaluation of Hohokam Food Grinding Systems. Unpublished Master's thesis, Department of Anthropology, Northern Arizona University, Flagstaff.

1991 Prehistoric Food Grinding Systems in the Hohokam Region. Paper presented at the 62nd Annual Meeting of the Southwestern Anthropological Association, Tucson, Arizona.

1993a The Interpretation of Intrasite Economic Strategies based on the Distribution of Ground Stone Artifacts. Paper presented at the 58th Annual Meeting of the Society for American Archaeology, St. Louis, Missouri.

1993b Ground Stone Artifacts from La Ciudad de los Hornos. In *In the Shadow of South Mountain: The Pre-Classic Hohokam of La Ciudad de los Hornos; 1991–1992 Excavations*, vol. 1, edited by Mark L. Chenault, Richard V. N. Ahlstrom, and Thomas N. Motsinger, pp. 317–358. Archaeological Report No. 93-30. SWCA, Tucson, Arizona.

1996 Intraregional Comparisons of Flaked Stone and Ground Stone Assemblages from Temporarily and Permanently Occupied Sites. In *Special Studies, Synthesis, and Conclusions*, edited by David H. Greenwald and Jean H. Ballagh, pp. 193–216. Early Desert Farming and Irrigation Settlements: Archaeological Investigations in the Phoenix Sky Harbor Center, vol. 4. Anthropological Research Paper No. 4. SWCA, Flagstaff, Arizona.

n.d. *Ground Stone Analysis for the Cerro de Trincheras Excavation Project*. National Science Foundation No. SBR9330224. On file, Four Corners Research, Tularosa, New Mexico.

Greenwald, Dawn M., and David H. Greenwald

1996 Optimizing the Landscape. In *Special Studies, Synthesis, and Conclusions*, edited by David H. Greenwald and Jean H. Ballagh, pp. 107–116. Early Desert Farming and Irrigation Settlements: Archaeological Investigations in the Phoenix Sky Harbor Center, vol. 4. Anthropological Research Paper No. 4. SWCA, Flagstaff, Arizona.

Gregory, David A.

2001 Architectural Features and Their Characteristics. In *Excavations in the Santa Cruz River Floodplain: The Early Agricultural Period Component at Los Pozos*, edited by David A. Gregory, pp. 29–69. Anthropological Papers No. 21. Center for Desert Archaeology, Tucson, Arizona.

Gregory, David A. (editor)

1999 *Excavations in the Santa Cruz River Floodplain: The Middle Archaic Component at Los Pozos*. Anthropological Papers No. 20. Center for Desert Archaeology, Tucson, Arizona.

2001 *Excavations in the Santa Cruz River Floodplain: The Early Agricultural Period Component at Los Pozos*. Anthropological Papers No. 21. Center for Desert Archaeology, Tucson, Arizona.

Griffitts, Janet L.

1993 Experimental Replication and Analysis of Use-Wear on Bone Tools. Unpublished Master's thesis, Department of Anthropology, University of Colorado, Boulder.

2001 Archaic Period Bone Tools from the Los Pozos Site in Southern Arizona. In *Crafting Bone: Skeletal Technologies through Time and Space; Proceedings of the 2nd Meeting of the (ICAZ) Worked Bone Research Group, Budapest, 31 August–5 September 1999*, edited by Alice M. Choyke and László Bartosiewicz, pp. 185–195. BAR International Series 937. Archaeopress, Oxford, England.

2006 Bone Tools and Technological Choice: Change and Stability on the Northern Plains. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

2009 Faunal Remains. In *Data Recovery at Christiansen Border Village: Nonriverine Late Archaic/Early Agricultural and Formative Period Archaeology in the Borderlands of Southeastern Arizona*, edited by Robert M. Wegener, Karry L. Blake, and Richard Ciolek-Torrello, pp. 155–190. Technical Report 09-31. Statistical Research, Tucson, Arizona.

2010 Shell, Bone, and Antler Artifacts. In *Queen Valley to Queen Creek Prehistoric Analyses*, edited by Robert M. Wegener, Michael P. Heilen, and Richard Ciolek-Torrello, pp. 6.1–6.50. The U.S. 60 Archaeological Project: Early Agricultural, Formative, and Historical-Period Use of the Upper Queen Creek Region, vol. 4, pt. 1. Draft. Technical Report 10-01. Statistical Research, Tucson, Arizona.

Griffitts, Janet L., and Clive Bonsall

2001 Experimental Determination of the Function of Antler and Bone "Bevel-Ended Tools" from Prehistoric Shell Middens in Western Scotland. In *Crafting Bone: Skeletal Technologies through Time and Space; Proceedings of the 2nd Meeting of the (ICAZ) Worked Bone Research Group, Budapest, 31 August–5 September 1999*, edited by Alice M. Choyke and László Bartosiewicz, pp. 207–220. BAR International Series 937. Archaeopress, Oxford, Great Britian.

Guernsey, Samuel J.

1931 *Explorations in Northeastern Arizona: Report on the Archaeological Fieldwork of 1920–1923.* Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 12, No. 1. Harvard University, Cambridge, Massachusetts.

Gustafson, Paula

1980 *Salish Weaving*. Douglas & McIntyre, Vancouver, British Columbia, Canada, and University of Washington Press, Seattle.

Hackenberg, Robert A.

1964 *Aboriginal Land Use and Occupancy of the Papago Indians*. Report to the U.S. Department of Justice, Lands Division, Indian Claims Section. Applied Anthropology Documentation Project, aa389. On file at Arizona State Museum Library, University of Arizona, Tucson.

1974 *Aboriginal Land Use and Occupancy of the Pima–Maricopa Indians.* Garland, New York.

Halbirt, Carl D., Kurt E. Dongoske, and T. Kathleen Henderson

1993 Coffee Camp: A Late Archaic Site on the Santa Cruz Flats. In *Archaic Occupation on the Santa Cruz Flats: The Tator Hills Archaeological Project*, edited by Carl D. Halbirt and T. Kathleen Henderson, pp. 55–114. Northland Research, Flagstaff, Arizona.

Halbirt, Carl D., and T. Kathleen Henderson (editors)

1993 *Archaic Occupation on the Santa Cruz Flats: The Tator Hills Archaeological Project*. Northland Research, Flagstaff, Arizona.

Hard, Robert J.

1986 Ecological Relationships affecting the Rise of Farming Economies: A Test from the American Southwest. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.

1988 Emergence of Farming Economies in the American Southwest. Paper presented at the 53rd Annual Meeting of the Society for American Archaeology, Phoenix, Arizona.

1990 Agricultural Dependence in the Mountain Mogollon. In *Perspectives on Southwestern Prehistory*, edited by Paul E. Minnis and Charles L. Redman, pp. 135–149. Investigations in American Archaeology. Westview Press, Boulder, Colorado.

Hard, Robert J., Raymond P. Mauldin, and Gerry R. Raymond

1996 Mano Size, Stable Carbon Isotope Ratios and Macrobotanical Remains as Multiple Lines of Evidence of Maize Dependence in the American Southwest. *Journal of Archaeological Method and Theory* 3:253–318.

Hardin, Garrett

1968 The Tragedy of the Commons. *Science* 162: 1243–1248.

Harrington, Mark R.

1933 *Gypsum Cave, Nevada: Report of the Second Sessions Expedition*. Paper No. 8. Southwest Museum, Los Angeles, California.

Haury, Emil W.

1936 *The Mogollon Culture of Southwestern New Mexico*. Medallion Papers No. 20. Gila Pueblo, Globe, Arizona.

1937a Pottery Types at Snaketown. In *Excavations at Snaketown: Material Culture*, by Harold S. Gladwin, Emil W. Haury, E. B. Sayles, and Nora Gladwin, pp. 169–229. Medallion Papers No. 25. Gila Pueblo, Globe, Arizona.

1937b Shell. In *Excavations at Snaketown: Material Culture*, edited by Harold S. Gladwin, Emil W. Haury, E. B. Sayles, and Nora Gladwin, pp. 135–153. Medallion Papers No. 25. Gila Pueblo, Globe, Arizona.

1950 *The Stratigraphy and Archaeology of Ventana Cave, Arizona*. University of Arizona Press, Tucson, and the University of New Mexico Press, Albuquerque.

1975 *The Stratigraphy and Archaeology of Ventana Cave*. 2nd printing. University of Arizona Press, Tucson.

1976 *The Hohokam: Desert Farmers and Craftsmen; Excavations at Snaketown, 1964–1965*. University of Arizona Press, Tucson.

Haury, Emil W., Ernst Antevs, and John F. Lance
1953 Artifacts with Mammoth Remains, Naco, Arizona. *American Antiquity* 19:1–24.

Haury, Emil W., E. B. Sayles, and William W. Wasley
1959 The Lehner Mammoth Site, Southeastern Arizona. *American Antiquity* 25:2–30.

Hawkey, Diane
1988 Assessment of Subsistence Strategy through Dental Pathology: Classic Period Southern and Central Arizona Hohokam. Unpublished manuscript, Department of Anthropology, Arizona State University, Tempe.

Hayden, Brian
1981 Research and Development in the Stone Age: Technological Transitions among Hunter-Gatherers. *Current Anthropology* 22:519–531.

Hayden, Brian, Edward Bakewell, and Rob Gargett
1996 The World's Longest-Lived Corporate Group: Lithic Analysis Reveals Prehistoric Social Organization near Lillooet, British Columbia. *American Antiquity* 61:341–356.

Hayden, Brian, and Aubrey Cannon
1984 *The Structure of Material Systems: Ethnoarchaeology in the Maya Highlands.* Papers No. 3. Society for American Archaeology, Washington, D.C.

Hayden, Julian D.
1967 A Summary Prehistory and History of the Sierra Pinacate, Sonora. *American Antiquity* 32:335–344.

1969 Gyratory Crushers of the Sierra Pinacate, Sonora. *American Antiquity* 34:154–161.

1972 Hohokam Petroglyphs of the Sierra Pinacate, Sonora, and the Hohokam Shell Expeditions. *The Kiva* 37:74–83.

Haynes, C. Vance, Jr.
1993 Clovis-Folsom Geochronology and Climatic Change. In *From Kostenki to Clovis: Upper Paleolithic–Paleo-Indian Adaptations*, edited by Olga Soffer and N. D. Praslov, pp. 219–236. Plenum Press, New York.

Heckman, Robert A.
2000a The Babocomari Tradition. In *Prehistoric Painted Pottery of Southeastern Arizona*, by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 23–42. Technical Series 77. Statistical Research, Tucson, Arizona.

2000b The Dragoon Tradition. In *Prehistoric Painted Pottery of Southeastern Arizona*, by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 43–62. Technical Series 77. Statistical Research, Tucson, Arizona.

2000c The San Simon Tradition. In *Prehistoric Painted Pottery of Southeastern Arizona*, by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 63–74. Technical Series 77. Statistical Research, Tucson, Arizona.

2000d The Trincheras Tradition. In *Prehistoric Painted Pottery of Southeastern Arizona*, by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 75–82. Technical Series 77. Statistical Research, Tucson, Arizona.

2000e The Tucson Basin Tradition. In *Prehistoric Painted Pottery of Southeastern Arizona*, by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 83–94. Technical Series 77. Statistical Research, Tucson, Arizona.

2001 Ceramics at El Macayo. In *El Macayo: A Prehistoric Settlement in the Upper Santa Cruz River Valley*, edited by William L. Deaver and Carla R. Van West, pp. 73–94. Technical Series 74. Statistical Research, Tucson, Arizona.

2002 Culinary Vestiges: Form and Function of Prehistoric Ceramic Containers from Tonto Basin, Arizona. Unpublished Master's thesis, Northern Arizona University, Flagstaff.

Heckman, Robert A., Barbara K. Montgomery, and Stephanie M. Whittlesey
2000 *Prehistoric Painted Pottery of Southeastern Arizona*. Technical Series 77. Statistical Research, Tucson, Arizona.

Heckman, Robert A., and Stephanie M. Whittlesey
2000 Concluding Thoughts. In *Painted Pottery of Southeastern Arizona*, edited by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 117–128. Technical Series 77. Statistical Research, Tucson, Arizona.

Hegmon, Michelle, Margaret C. Nelson, and Mark J. Ennes
2000 Corrugated Pottery, Technological Style, and Population Movement in the Mimbres Region of the American Southwest. *Journal of Anthropological Research* 56:217–240.

Heidke, James M.
1999 Cienega Phase Incipient Plain Ware from Southeastern Arizona. *Kiva* 64:311–338.

Heidke, James M., and Alan Ferg
2001 Ceramic Containers and Other Artifacts of Clay. In *Excavations in the Santa Cruz River Floodplain: The Early Agricultural Period Component at Los Pozos*, edited by David A. Gregory, pp. 163–194. Anthropological Papers No. 21. Center for Desert Archaeology, Tucson, Arizona.

Heilen, Michael P.
2005 Santa Ana and the Kohatk Landscape. In *Collection of Cultural Resource Information at Santa Ana de Cuiquiburitac*, edited by J. Jefferson Reid and Michael P. Heilen, pp. 58–98. Statistical Research, Tucson, Arizona. Submitted to the USDI Bureau of Land Management, Tucson Office, Arizona.

Heilman, Jill, Michael M. Margolis, and Stephen Reichert
2010 Human Remains. In *The Marsh Station Community in Southeastern Arizona: Archaeological Data Recovery for the Marsh Station Traffic Interchange Relocation Project on Interstate 10, Pima County, Arizona*, edited by Anna A. Neuzil. Archaeological Data Recovery Report No. 07-071043:1. EcoPlan Associates, Tucson, Arizona.

Hemmings, Ernest Thomas
1970 Early Man in the San Pedro Valley, Arizona. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Henderson, T. Kathleen
1989 *Prehistoric Agricultural Activities on the Lehi-Mesa Terrace: Excavations at La Cuenca del Sedimento*. Northland Research, Flagstaff, Arizona.

Hendrickson, Dean A., and W. L. Minckley
1985 Cienegas—Vanishing Climax Communities of the American Southwest. *Desert Plants* 6:130–176.

Herr, Sarah A.
2009 Las Capas. *Archaeology Southwest* 23(1):9−11.

Hewlett, B., J. M. H. van de Koppel, and L. L. Cavalli
1982 Exploration Ranges of Aka Pygmies of the Central African Republic. *Man, New Series* 17(3): 418–430.

Hill, J. Brett, Jeffery J. Clark, William H. Doelle, and Patrick D. Lyons
2004 Prehistoric Demography in the Southwest: Migration, Coalescence, and Hohokam Population Decline. *American Antiquity* 69:689–716.

Hill, W. W.
1937 *Navajo Pottery Manufacture*. University of New Mexico Bulletin No. 137. Anthropological Series Vol. 2, No. 3. University of New Mexico Press, Albuquerque.

Hiscock, Peter
2002 Quantifying the Size of Artefact Assemblages. *Journal of Archaeological Science* 29:251–258.

Hiscock, Peter, and Val Attenbrow
2003 Early Australian Implement Variation: A Reduction Model. *Journal of Archaeological Science* 30:239–249.

Hodge, Frederick Webb
1920 *Hawikuh Bonework*. Indian Notes and Monographs Vol. 3, No. 3. Museum of the American Indian, Heye Foundation, New York.

Hodgson, Wendy
2001 *Food Plants of the Sonoran Desert*. University of Arizona Press, Tucson.

Hoffman, Charles M.
1997 *Alliance Formation and Social Interaction during the Sedentary Period: A Stylistic Analysis of Hohokam Arrowpoints.* Ph.D. dissertation, Arizona State University, Tempe. University Microfilms, Ann Arbor, Michigan.

Hoffmeister, Donald F.
1986 *Mammals of Arizona*. University of Arizona Press and Arizona Game and Fish Department, Tucson.

Holman, Darryl J.
2000 mle: A Programming Language for Building Likelihood Models. Version 2. Electronic document, http://faculty.washington.edu/djholman/mle, accessed March 15, 2010.

Holmer, R. N.

1986 Common Projectile Points of the Intermountain West. In *Anthropology of the Desert West: Essays in Honor of Jesse D. Jennings,* edited by Carol J. Condie and Don D. Fowler, pp. 91−110. Anthropological Papers No. 110. University of Utah Press, Salt Lake City.

Horsfall, Gayel

1987 A Design Theory Perspective on Variability in Grinding Stones. In *Lithic Studies among the Contemporary Highland Maya,* edited by Brian Hayden, pp. 332–378. University of Arizona Press, Tucson.

Howard, A. V.

1983 The Organization of Interregional Shell Production and Exchange within Southwestern Arizona. Unpublished Master's thesis, Department of Anthropology, Arizona State University, Tempe.

Huckell, Bruce B.

1984a *The Archaic Occupation of the Rosemont Area, Northern Santa Rita Mountains, Southeastern Arizona*. Archaeological Series No. 147, vol. 1. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1984b The Paleo-Indian and Archaic Occupation of the Tucson Basin: An Overview. *The Kiva* 49:133–145.

1987 Summary and Conclusions. In *The Corona de Tucson Project: Prehistoric Use of a Bajada Environment,* by Bruce B. Huckell, Martyn D. Tagg, and Lisa W. Huckell, pp. 261–296. Archaeological Series No. 174. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1990 Late Preceramic Farmer-Foragers in Southern Arizona: A Cultural and Ecological Consideration of the Spread of Agriculture into the Arid Southwestern United States. Unpublished Ph.D. dissertation, Arid Lands Resource Sciences, University of Arizona, Tucson.

1995 *Of Marshes and Maize: Prehistoric Agricultural Settlements in the Cienega Valley, Southeastern Arizona*. Anthropological Papers of the University of Arizona No. 59. University of Arizona Press, Tucson.

1998 An Analysis of the Flaked Stone Artifacts. In *Early Farmers of the Sonoran Desert: Archaeological Investigations at the Houghton Road Site, Tucson, Arizona,* edited by Richard Ciolek-Torrello, pp. 89−117. Technical Series 72. Statistical Research, Tucson, Arizona.

Huckell, Bruce B., Lisa W. Huckell, and Suzanne K. Fish

1995 *Investigations at Milagro, a Late Preceramic Site in the Eastern Tucson Basin*. Technical Report No. 94-5. Center for Desert Archaeology, Tucson, Arizona.

Huckell, Bruce B., Martyn Tagg, and Lisa W. Huckell

1987 *The Corona de Tucson Project: Prehistoric Use of a Bajada Environment*. Archaeological Series No. 174, vol. 1. Arizona State Museum, University of Arizona, Tucson.

Huckell, Lisa W.

1993a The Shell Assemblage from Coffee Camp. In *Archaic Occupation on the Santa Cruz Flats: The Tator Hills Archaeological Project*, edited by Carl D. Halbirt and T. Kathleen Henderson, pp. 305–316. Northland Research, Flagstaff, Arizona.

1993b Plant Remains from the Pinaleño Cotton Cache. *Kiva* 59(2):147–203.

Hudson, Travis, and Thomas C. Blackburn

1987 *Manufacturing Processes, Metrology, and Trade*. The Material Culture of the Chumash Interaction Sphere, vol. 5. Anthropological Papers No. 31. Ballena Press, Menlo Park, California.

Hurlbert, Stuart H.

1971 The Nonconcept of Species Diversity: A Critique and Alternative Parameters. *Ecology* 52:577–586.

Irwin, Donald C.

1990 Variability in Tabular Tool Morphology at the Pine Creek Sites. In *Hohokam Utilization of the Intermontane Mazatzal Region: The State Route 87 Pine Creek Project*, edited by Margerie Green, pp. 349–386. Cultural Resources Report No. 66. Archaeological Consulting Services, Tempe, Arizona.

James, George Wharton

1972 *Indian Basketry*. Reprinted from the 1909 ed. Dover, New York. Originally published 1901, Malkin, New York.

James, Steven R.

1993 Archaeofaunal Analyses of the Tator Hills Sites, South-Central Arizona. In *Archaic Occupation on the Santa Cruz Flats: The Tator Hills*

Archaeological Project, edited by Carl D. Halbirt and T. Kathleen Henderson, pp. 345–372. Northland Research, Flagstaff, Arizona.

1994 Hohokam Hunting and Fishing Patterns at Pueblo Grande: Results of the Archaeofaunal Analysis. In *Environment and Subsistence*, edited by Scott Kwiatkowski, pp. 249–318. The Pueblo Grande Project, vol. 5. Publications in Archaeology No. 20. Soil Systems, Phoenix, Arizona.

1997 Methodological Issues concerning Screen Size Recovery Rates and Their Effects on Archaeofaunal Interpretations. *Journal of Archaeological Science* 24:385–397.

Jernigan, E. Wesley
1978 *Jewelry of the Prehistoric Southwest*. School of American Research, Santa Fe, New Mexico, and University of New Mexico Press, Albuquerque.

Jeske, Robert
1989 Economies in Lithic Use among Prehistoric Hunter-Gatherers. In *Time, Energy and Stone Tools*, edited by Robin Torrence, pp. 34–45. Cambridge University Press, Cambridge, England.

Jones, Bruce A., and Steven D. Shelley
1996 Vertebrate Faunal Remains from the Garden Canyon Site (AZ EE:11:13 ASM). In *On the Border: Analysis of Materials Recovered from the 1964 and 1991–1992 Excavations at the Garden Canyon Site (AZ EE:11:13 ASM)*, edited by Steven D. Shelley and Jeffrey H. Altschul, pp. 99–128. Technical Series 61. Statistical Research, Tucson, Arizona.

Justice, Noel D.
1987 *Stone Age Spear and Arrow Points of the Midcontinental and Eastern United States: A Modern Survey and Reference*. Indiana University Press, Bloomington.

2002 *Stone Age Spear and Arrow Points of the Southwestern United States*. Indiana University Press, Bloomington.

Kapp, Ronald O., Owen K. Davis, and James E. King
2000 *Ronald O. Kapp's Pollen and Spores*. 2nd ed. American Association of Stratigraphic Palynologists Foundation, College Station, Texas.

Kearney, Thomas H., and Robert H. Peebles
1960 *Arizona Flora*. 2nd ed. University of California Press, Berkeley.

Kearns, Timothy M., Thomas J. Lennon, D. L. Webb, and Steven F. Mehls
2001 *An Archaeological Survey of the Arizona Portion of Link Two of the AT&T NexGen/Core Project*. Report No. WCRM (F) 174. Western Cultural Resource Management, Farmington, New Mexico.

Kearns, T., D. Webb, C. Burt, and J. Searle
2000 Site card for the Mescal Wash site. On file, Arizona State Museum Archives, University of Arizona, Tucson.

Keeley, Lawrence H.
1980 *Experimental Determination of Stone Tool Uses*. Prehistoric Archeology and Ecology Series. University of Chicago Press, Chicago, Illinois.

Keen, A. Myra
1971 *Sea Shells of Tropical West America: Marine Mollusks from Baja California to Peru*. 2nd ed. Stanford University Press, Stanford, California.

Kelly, Isabel T.
1978 *The Hodges Ruin: A Hohokam Community in the Tucson Basin*. With the collaboration of James E. Officer and Emil W. Haury. Edited by Gayle Harrison Hartmann. Anthropological Papers of the University of Arizona No. 30. University of Arizona Press, Tucson.

Kelly, Robert L.
1988 The Three Sides of a Biface. *American Antiquity* 53:717−734.

1992 Mobility/Sedentism: Concepts, Archaeological Measures, and Effects. *Annual Review of Anthropology* 21:43−66.

1995 *The Foraging Spectrum: Diversity in Hunter-Gatherer Lifeways*. Smithsonian Institution Press, Washington, D.C.

1997 Great Basin Late Holocene Prehistory. *Journal of World Prehistory* 11:1–49.

Kelly, Robert L., and Lawrence C. Todd
1988 Coming into the Country: Early Paleoindian Hunting and Mobility. *American Antiquity* 53:231–244.

Kintigh, Keith W.
1998 *Tools for Quantitative Archaeology: Programs for Quantitative Analysis in Archaeology.* Privately published for the author. Tempe, Arizona.

Kluckhohn, Clyde, W. W. Hill, and Lucy Wales Kluckhohn
1971 *Navaho Material Culture*. Belknap Press of Harvard University Press, Cambridge, Massachusetts.

Koerper, Henry C.
1996 A Glycymeris Shell Bracelet from Orange County, California. *Pacific Coast Archaeological Society Quarterly* 32:82–109.

Koon, H. E. C., R. A. Nicholson, and M. J. Collins
2003 A Practical Approach to the Identification of Heated Bone Using TEM. *Journal of Archaeological Science* 30:1393–1399.

Kooyman, Brian P.
2000 *Understanding Stone Tools and Archaeological Sites*. University of Calgary Press, Calgary, Alberta, Canada, and University of New Mexico Press, Albuquerque.

Kruse, Melissa
2009 The Scale and Role of Agave Production in the Perry Mesa Region, Central Arizona, A.D. 1275–1400. Poster presented at the 74th Annual Meeting of the Society for American Archaeology, Atlanta, Georgia.

Kuhn, Steven L.
1991 "Unpacking" Reduction: Lithic Raw Material Economy in the Mousterian of West-Central Italy. *Journal of Anthropological Archaeology* 10:76−106.

1992 On Planning and Curated Technologies in the Middle Paleolithic. *Journal of Anthropological Research* 48:185−214.

1994 A Formal Approach to the Design and Assembly of Mobile Toolkits. *American Antiquity* 59:426−442.

1995 *Mousterian Lithic Technology: An Ecological Perspective.* Princeton University Press, Princeton, New Jersey.

2004a Evolutionary Perspectives on Technology and Technological Change. *World Archaeology* 36(4):561−570.

2004b Upper Paleolithic Raw Material Economies at Üçagizli Cave, Turkey. *Journal of Anthropological Archaeology* 23:431−448.

Kurdeka, John L.
1985 The Christiansen Border Village Site (AZ:FF:9:1). *Cochise Quarterly* 15(3):25–40.

LaBelle, Jason M., and Jeffrey L. Eighmy
1997 Additional Archaeomagnetic Data on the South-West USA Master Geomagnetic Pole Curve. *Archaeometry* 39:431–439.

Lancaster, James W.
1984 Groundstone Artifacts. In *The Galaz Ruin: A Prehistoric Mimbres Village in Southwestern New Mexico*, edited by Roger Anyon and Steven A. LeBlanc, pp. 247–262. Maxwell Museum of Anthropology and University of New Mexico Press, Albuquerque.

1986 Ground Stone. In *Short-Term Sedentism in the American Southwest: The Mimbres Valley Salado*, edited by Ben A. Nelson and Steven A. LeBlanc, pp. 177–190. Maxwell Museum of Anthropology and University of New Mexico Press, Albuquerque.

LeBlanc, Raymond
1992 Wedges, Pièces Esquillées, Bipolar Cores, and Other Things: An Alternative to Shott's View of Bipolar Industries. *North American Archaeologist* 13(1):1−14.

LeBlanc, Steven A.
1982 The Advent of Pottery in the Southwest. In *Southwestern Ceramics: A Comparative Review*, edited by Albert H. Schroeder, pp. 27–51. The Arizona Archaeologist No. 15. Arizona Archaeological Society, Phoenix, Arizona.

Lekson, Steven H.
1990 *Mimbres Archaeology of the Upper Gila, New Mexico.* Anthropological Papers of the University of Arizona No. 53. University of Arizona Press, Tucson.

LeMoine, Genevieve Mary
1991 Experimental Analysis of the Manufacture and Use of Bone and Antler Tools among the Mackenzie Inuit. Unpublished Ph.D. dissertation, Department of Archaeology, University of Calgary, Calgary, Alberta, Canada.

Lengyel, Stacey N., and Jeffrey L. Eighmy
2002 A Revision to the U.S. Southwest Archaeomagnetic Master Curve. *Journal of Archaeological Science* 29:1423–1433.

Lightfoot, Kent G., and Antoinette Martinez
1995 Frontiers and Boundaries in Archaeological Perspective. *Annual Review of Anthropology* 24:471–492.

Lincoln-Babb, Lorrie
1995 The Matty Canyon Population: Dental Observations of Late Archaic Individuals from Southern Arizona. *Dental Anthropology Newsletter* 9(2):10–12.

2001 Dental Analysis of the TCAP Burial Population. In *Tonto Creek Archaeological Project: Life and Death along Tonto Creek*, edited by Jeffery J. Clark and Penny Dufoe Minturn, pp. 333–352. Anthropological Papers No. 24. Center for Desert Archaeology, Tucson, Arizona.

Lincoln-Babb, Lorrie, Penny Dufoe Minturn, Christopher P. Garraty, and Joseph T. Hefner
2010 A Bioarchaeological Study of Human Remains and Mortuary Behavior in the U.S. 60 Project Area. In *Queen Valley to Queen Creek Prehistoric Analyses*, edited by Robert W. Wegener, Michael P. Heilen, and Richard Ciolek-Torrello, pp. 11.1–11.54. The U.S. 60 Archaeological Project: Early Agricultural, Formative, and Historical-Period Use of the Upper Queen Creek Region, vol. 4, pt. 2. Technical Report 10-1. Draft. Statistical Research, Tucson, Arizona.

Lindeman, Michael, and Henry Wallace
2004 A Revised Chronology of the Plain Ware and Red Ware Horizons in South and Central Arizona. *Kiva* 70:97–120.

Lindsay, Alexander J., Jr.
1987 Anasazi Population Movement to Southeastern Arizona. *American Archaeology* 6:190–198.

1992 Tucson Polychrome: History, Dating, Distribution and Design. In *Proceedings of the Second Salado Conference, Globe, AZ, 1992*, edited by Richard C. Lange and Stephen Germick, pp. 230–237. Occasional Paper. Arizona Archaeological Society, Phoenix.

Lira, Rafael, and Javier Caballero
2002 Ethnobotany of the Wild Mexican Cucurbitaceae. *Economic Botany* 56:380–398.

Lovejoy, C. Owen, Richard S. Meindl, Thomas R. Pryzbeck, Thomas S. Barton, Kingsbury G. Heiple, and David Kotting
1977 Paleodemography of the Libben Site, Ottawa County, Ohio. *Science* 198:291–293.

Lyman, R. Lee
2008 *Quantitative Paleozoology*. Cambridge University Press, Cambridge, England.

Lyon, Jerry D., Mark C. Slaughter, and David B. Tucker
2008 Shell Trade and Subsistence in the Western Paguería: The View from Growler Valley. In *Fragile Patterns: The Archaeology of the Western Papaguería*, edited by Jeffrey H. Altschul and Adrianne G. Rankin, pp. 401–417. SRI Press, Tucson, Arizona.

Lyons, Patrick
2003 *Ancestral Hopi Migrations*. Anthropological Papers of the University of Arizona No. 68. University of Arizona Press, Tucson.

Mabry, Jonathan B.
1994 Discovery of an Early "Big House" at Vacas Muertas. *Archaeology in Tucson* 8(3):6–7.

1998 Conclusion. In *Archaeological Investigations of Early Village Sites in the Middle Santa Cruz Valley: Analyses and Synthesis*, edited by Jonathan B. Mabry, pp. 757–792. Anthropological Papers No. 19. Center for Desert Archaeology, Tucson, Arizona.

2005a Diversity in Early Southwestern Farming and Optimization Models of Transitions to Agriculture. In *Subsistence and Resource Use Strategies of Early Agricultural Communities in Southern Arizona*, edited by Michael W. Diehl, pp. 113–152. Anthropological Papers No. 34. Center for Desert Archaeology, Tucson, Arizona.

2005b Reading the Traces of Early Farming Villages. In *Material Cultures and Lifeways of Early Agricultural Communities in Southern Arizona*, edited by R. Jane Sliva, pp. 1−17. Anthropological Papers No. 35. Center for Desert Archaeology, Tucson, Arizona.

2006a Radiocarbon Dating of the Early Occupations. In *Rio Nuevo Archaeology Program, 2000–2003: Investigations at the San Agustín Mission and Mission Gardens, Tucson Presidio, Tucson Pressed Brick Company, and Clearwater Site,* edited by J. Homer Thiel and Jonathan B. Mabry, pp. 19.1–19.5. Technical Report No. 2004−11. Center for Desert Archaeology, Tucson, Arizona.

2006b Radiocarbon Dating of the Early Occupations. In *Rio Nuevo Archaeology Program, 2000–2003: Investigations at the San Agustín Mission and Mission Gardens, Tucson Presidio, Tucson Pressed Brick Company, and Clearwater Site*, edited by

J. Homer Thiel and Jonathan B. Mabry, pp. 19.1–19.5. Technical Report No. 2004-11. Center for Desert Archaeology, Tucson, Arizona. Electronic document, http://www.cdarc.org/pdf/rn/rio_nuevo_ch19.pdf, accessed August 6, 2010.

Mabry, Jonathan B. (editor)
1998 *Archaeological Investigations of Early Village Sites in the Middle Santa Cruz Valley: Analyses and Synthesis*. 2 vols. Anthropological Papers No. 19. Center for Desert Archaeology, Tucson, Arizona.

2008 *Las Capas: Early Irrigation and Sedentism in a Southwestern Floodplain*. Anthropological Papers No. 28. Center for Desert Archaeology, Tucson, Arizona.

Mabry, Jonathan B., Deborah L. Swartz, Helga Wöcherl, Jeffery J. Clark, Gavin H. Archer, and Michael W. Lindeman
1997 *Archaeological Investigations of Early Village Sites in the Middle Santa Cruz Valley: Descriptions of the Santa Cruz Bend, Square Hearth, Stone Pipe, and Canal Sites*. Anthropological Papers No. 18. Center for Desert Archaeology, Tucson, Arizona.

Magne, Martin P., and David Pokotylo
1981 A Pilot Study in Bifacial Lithic Reduction Sequences. *Lithic Technology* 10:34−47.

Mann, Robert W., and Sean P. Murphy
1990 *Regional Atlas of Bone Disease: A Guide to Pathologic and Normal Variation in the Human Skeleton.* Charles C Thomas, Springfield, Illinois.

Marmaduke, William S., and J. Strand
1993 Faunal Remains from Shelltown and the Hind Site. In *Shelltown and the Hind Site: A Study of Two Hohokam Craftsman Communities in Southwestern Arizona,* vol. 1, edited by William S. Marmaduke and Richard J. Martynec, pp. 583–602. Northland Research, Flagstaff, Arizona.

Martin, Alexander Campbell, and William D. Barkley
1961 *Seed Identification Manual*. University of California Press, Berkeley.

Martin, Paul Schultz
1963 *The Last 10,000 Years: A Fossil Pollen Record of the American Southwest*. University of Arizona Press, Tucson.

Martin, Paul Sidney, and Fred Plog
1973 *The Archaeology of Arizona: A Study of the Southwest Region*. Published for the American Museum of Natural History by Natural History Press, Garden City, New York.

Mauldin, Raymond P.
1993 The Relationship between Ground Stone and Agricultural Intensification in Western New Mexico. *Kiva* 58:317–330.

Mayer-Oakes, William J., and A. W. Portnoy
1993 Paleo-Indian Studies at San José, Ecuador. *Lithic Technology* 18:28–36.

McFadden, Phillip L., and F. J. Lowes
1981 The Discrimination of Mean Directions Drawn From Fisher Distributions. *Geophysical Journal of the Royal Astronomical Society* 67:19–33.

McGregor, Samuel Emmett
1976 *Insect Pollination of Cultivated Crop Plants*. Agriculture Handbook No. 496. USDA Agricultural Research Service, Washington, D.C. For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C.

McGuire, Kelly R., and William R. Hildebrandt
2005 Re-thinking Great Basin Foragers: Prestige Hunting and Costly Signaling during the Middle Archaic Period. *American Antiquity* 70:695–712.

McGuire, Randall H., and Michael B. Schiffer (editors)
1982 *Hohokam and Patayan: Prehistory of Southwestern Arizona*. Academic Press, New York.

McGuire, Randall H., and María Elisa Villalpando C. (editors)
1993 *An Archaeological Survey of the Altar Valley, Sonora, Mexico*. Archaeological Series No. 184. Arizona State Museum, University of Arizona, Tucson.

McKusick, Charmion R.
1986 *Southwest Indian Turkeys: Prehistory and Comparative Osteology*. Southwest Bird Laboratory, Globe, Arizona.

Meltzer, David
1993 *Search for the First Americans*. Exploring the Ancient World. Smithsonian Books, Washington, D.C.

Meltzer, David J., R. D. Leonard, and S. K. Stratton
1992 The Relationship between Sample Size and Diversity in Archaeological Assemblages. *Journal of Archaeological Science* 19:375–387.

Meltzer, David J., and Jim I. Mead
1985 Dating Late Pleistocene Extinctions: Theoretical Issues, Analytical Bias, and Substantive Results. In *Environments and Extinctions: Man in Late Glacial North America*, edited by Jim I. Mead and David J. Meltzer, pp. 145–174. Center for the Study of Early Man, University of Maine, Orono.

Miksicek, Charles H.
1987 Formation Processes of the Archaeobotanical Record. In *Advances in Archaeological Method and Theory*, vol. 1, edited by Michael B. Schiffer, pp. 211–247. Academic Press, San Diego, California.

Millikan, Ian M., and Paul M. Rawson
2009 *Results of Monitoring SFPP, LP, ADOT Relocation Project, Marsh Station, Arizona, Pima County.* William Self Associates, Tucson, Arizona.

Minckley, Tom A., and Andrea Brunelle
2007 Paleohydrology and Growth of a Desert Cienega. *Journal of Arid Environments* 69:420–431.

Mitchell, Douglas R.
1988 Analysis of the La Lomita Pequeña Lithic Assemblage. In *Excavations at La Lomita Pequeña: A Santa Cruz/Sacaton Phase Hamlet in the Salt River Valley,* edited by Douglas R. Mitchell, pp. 179–230. Publications in Archaeology No. 10. Soil Systems, Phoenix, Arizona.

Moerman, Daniel E.
1998 *Native American Ethnobotany*. Timber Press, Portland, Oregon.

Moore, Peter D., J. A. Webb, and Margaret E. Collinson
1991 *Pollen Analysis*. 2nd ed. Blackwell Scientific Publications, Oxford, England.

Morris, Donald H.
1990 Changes in Groundstone following the Introduction of Maize into the American Southwest. *Journal of Anthropological Research* 46:177–194.

Motsinger, Thomas N.
1993 Mortuary Features at La Ciudad de los Hornos. In *In the Shadow of South Mountain: The Pre-Classic Hohokam of La Ciudad de los Hornos; 1991–1992 Excavations,* vol. 1, edited by Mark L. Chenault, Richard V. N. Ahlstrom, and Thomas N. Motsinger, pp. 215–228. Archaeological Report No. 93-30. SWCA, Tucson, Arizona.

Munro, Natalie D.
1994 An Investigation of Anasazi Turkey Production in Southwestern Colorado. Unpublished Master's thesis, Department of Archaeology, Simon Fraser University, Burnaby, British Columbia, Canada.

Murray, Shawn S., and Karen R. Adams
2008 Ethnobotanical Compendium. In *Environmental Studies*, edited by James M. Potter, Appendix D. Animas–La Plata Project, vol. 10, James M. Potter, principal investigator. Anthropological Research Paper No. 10. SWCA Environmental Consultants, Phoenix, Arizona.

Murrell, Jesse B.
2007 *Differential Persistence of Variation in Prehistoric Milling Tools from the Middle Rio Puerco Valley, New Mexico*. BAR International Series 1594. Archaeopress, Oxford, England.

Nelson, Margaret C.
1991 The Study of Technological Change. In *Archaeological Method and Theory*, vol. 3, edited by Michael B. Schiffer, pp. 57–100. University of Arizona Press, Tucson.

1999 *Mimbres during the Twelfth Century: Abandonment, Continuity, and Reorganization.* University of Arizona Press, Tucson.

Nelson, Margaret C., and Heidi Lippmeier
1993 Grinding-Tool Design as Conditioned by Land-Use Pattern. *American Antiquity* 58:286–305.

Nelson, Richard S.
1991 *Hohokam Marine Shell Exchange and Artifacts*. Archaeological Series No. 179. Arizona State Museum, University of Arizona, Tucson.

Neusius, Sarah W.
2008 Game Procurement among Temperate Horticulturists: The Case for Garden Hunting by the Dolores Anasazi. In *Case Studies in Environmental Archaeology*, edited by Elizabeth Jean Reit, C. Margaret Scarry, and Sylvia J. Scudder, pp. 297–314. 2nd ed. Springer, New York.

Neuzil, Anna A.
2009a *Results of Archaeological Monitoring or Geotechnical Investigations associated with the Relocation of the Marsh Station Traffic Interchange on Interstate 10, Pima County, Arizona.* EcoPlan Associates, Mesa, Arizona.

2009b Letter report detailing the results of fieldwork at AZ EE:2:51 (ASM), AZ EE:2:325 (ASM), AZ EE:2:326 (ASM), AZ EE:2:437 (ASM), and AZ EE:2:438 (ASM). EcoPlan Associates, Tucson, Arizona.

Newman, Sandra Corrie
1974 *Indian Basket Weaving: How to Weave Pomo, Yurok, Pima, and Navajo Baskets*. Northland Press, Flagstaff, Arizona.

O'Brien, Patrick M., J. Simon Bruder, David Gregory, and A. E. Rogge
1987 *Cultural Resources Technical Report for the U.S. Telecom Fiber Optic Cable Project from San Timoteo Canyon, California, to Socorro, Texas: The Arizona Segment,* Dames & Moore, Phoenix, Arizona.

Odell, George H.
1996 *Stone Tools and Mobility in the Illinois Valley: From Hunter-Gatherer Camps to Agricultural Villages*. Archaeological Series 10. International Monographs in Prehistory, Ann Arbor, Michigan.

2004 *Lithic Analysis*. Manuals in Archaeological Method, Theory, and Technique. Kluwer Academic/Plenum, New York.

Officer, James E.
1978 Shell. In *The Hodges Ruin: A Hohokam Community in the Tucson Basin*, by Isabel T. Kelly, with the collaboration of James E. Officer and Emil W. Haury, edited by Gayle Harrison Hartmann, pp. 110–120. Anthropological Papers of the University of Arizona No. 30. University of Arizona Press, Tucson.

Olsen, Sandra
1980 Bone Artifacts from Kinishba Ruin: Their Manufacture and Use. *The Kiva* 46:39–67.

1989 On Distinguishing Natural from Cultural Damage on Archaeological Antler. *Journal of Archaeological Science* 16:125–135.

Ortner, Donald J.
2003 *Identification of Pathological Conditions in Human Skeletal Remains.* 2nd ed. Academic Press, San Diego, California.

Orton, C. R.
1993 How Many Pots Make Five? A Historical Review of Pottery Quantification. *Archaeometry* 35:169–184.

Orton, C. R., and P. A. Tyers
1990 Statistical Analysis of Ceramic Assemblages. *Archeologia e Calcolatori* 1:81–110.

Outram, Alan K., Christopher J. Knüsel, Stephanie Knight, and Anthony F. Harding
2005 Understanding Complex Fragmented Assemblages of Human and Animal Remains: A Fully Integrated Approach. *Journal of Archaeological Science* 32(12):1699–1710.

Parry, William J.
1987 Technological Change: Temporal and Functional Variability in Chipped Stone Debitage. In *Prehistoric Stone Technology on Northern Black Mesa, Arizona*, by William J. Parry and Andrew L. Christenson, pp. 199–256. Occasional Paper No. 12. Center for Archaeological Investigations, Southern Illinois University, Carbondale.

Parry, William J., and Robert L. Kelly
1987 Expedient Core Technology and Sedentism. In *The Organization of Core Technology*, edited by Jay K. Johnson and Carol A. Morrow, pp. 285–304. Westview Special Studies in Archaeological Research. Westview Press, Boulder, Colorado.

Parsons, Jeffrey R., and Mary H. Parsons
1990 *Maguey Utilization in Highland Central Mexico: An Archaeological Ethnography*. Anthropological Papers No. 82. Museum of Anthropology, University of Michigan, Ann Arbor.

Pavao, Barnet, and P. W. Stahl
1999 Structural Density Assays of Leporid Skeletal Elements with Implications for Taphonomic, Actualistic, and Archaeological Research. *Journal of Archaeological Science* 26:53–66.

Peet, R. K.
1974 The Measurement of Species Diversity. *Annual Review of Ecology and Systematics* 5:285–307.

Peterson, Roger Tory
1990 *A Field Guide to Western Birds.* 3rd ed. Houghton Mifflin, Boston, Massachusetts.

Phelps, Alan L.
1966 *Cruciform: An Unusual Artifact of the El Paso Southwest*. Special Report No. 5. El Paso Archaeological Society, El Paso, Texas.

Pima Association of Governments
2003 Geologic Influences on the Hydrology of Lower Cienega Creek. Electronic document, http://www.pagnet.org/documents/Water/LIB/cienega_geology.pdf, accessed March 29, 2010.

Popper, Virginia S.
1988 Selecting Quantitative Measurements in Paleoethnobotany. In *Current Paleoethnobotany: Analytical Methods and Cultural Interpretations of Archaeological Plant Remains*, edited by Christine A. Hastorf and Virginia S. Popper, pp. 53–71. University of Chicago Press, Chicago, Illinois.

Rainey, Katharine D., and Karen R. Adams
2004 Plant Use by Native Peoples of the American Southwest: Ethnographic Documentation. Electronic document, http:/www.crowcanyon.org/plantuses, accessed July 15, 2010.

Rasic, Jeffrey, and William Andrefsky, Jr.
2001 Alaskan Blade Cores as Specialized Components of Mobile Toolkits: Assessing Design Parameters and Toolkit Organization through Debitage Analysis. In *Lithic Debitage: Context, Form, Meaning*, edited by William Andrefsky, Jr., pp. 61–79. University of Utah Press, Salt Lake City.

Ravesloot, John C., Michael J. Boley, and Melanie A. Medeiros (editors)
2010 *Results of Testing and Data Recovery, SFPP, LP, El Paso to Phoenix Expansion Project, Arizona Portion: Cochise and Pima Counties, Arizona*. Draft. Technical Report No. 2008-49. William Self Associates, Tucson, Arizona.

Ravesloot, John C., and Stephanie M. Whittlesey
1987 Inferring the Protohistoric Period in Southern Arizona. In *The Archaeology of the San Xavier Bridge Site (AZ BB:13:14), Tucson Basin, Southern Arizona*, edited by John C. Ravesloot, pp. 81–98. Archaeological Series No. 171. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

Rawson, Paul M., Morgan Reider, and Michael J. Boley
2006a *Class III Cultural Resources Survey, SFPP, LP, El Paso to Phoenix Expansion Project, Arizona Portion, Addendum*. Technical Report No. 2006-08. William Self Associates, Tucson, Arizona.

2006b *Class III Cultural Resources Survey, SFPP, LP, El Paso to Phoenix Expansion Project, Arizona Portion: Addendum Cochise and Pima Counties, Arizona Final Report.* Technical Report No. 2006-12. William Self Associates, Tucson, Arizona.

Rea, Amadeo M.
1991 Gila River Pima Dietary Reconstruction. *Arid Lands Newsletter* 31:3–10.

1997 *At the Desert's Green Edge: An Ethnobotany of the Gila River Pima*. University of Arizona Press, Tucson.

1998 *Folk Mammalogy of the Northern Pimans*. University of Arizona Press, Tucson.

2007 *Wings in the Desert: A Folk Ornithology of the Northern Pimans.* University of Arizona Press, Tucson.

Rehder, Harald A.
2005 *National Audubon Society Field Guide to North American Seashells*. Chanticleer Press ed. Knopf, New York. Distributed by Random House.

Reid, Jefferson, and Stephanie Whittlesey
1999 *Grasshopper Pueblo: A Story of Archaeology and Ancient Life.* University of Arizona Press, Tucson.

Reimer, Paula J., Mike G. L. Baillie, Edouard Bard, Alex Bayliss, J. Warren Beck, Chanda J. H. Bertrand, Paul G. Blackwell, Caitlin E. Buck, George S. Burr, Kirsten B. Cutler, Paul E. Damon, Richard L. Edwards, Richard G. Fairbanks, Michael Friedrich, Thomas P. Guilderson, Alan G. Hogg, Konrad A. Hughen, Bernd Kromer, Gerry McCormac, Sturt Manning, Christopher Bronk Ramsey, Ron W. Reimer, Sabine Remmele, John R. Southon, Minze Stuiver, Sahra Talamo, F. W. Taylor, Johannes van der Plicht, and Constanze E. Weyhenmeyer
2004 IntCal04 Terrestrial Radiocarbon Age Calibration, 0–26 cal kyr B.P. *Radiocarbon* 46:1029–1058.

Rinaldo, John B.
1964 Artifacts. In *Chapters in the Prehistory of Eastern Arizona, II,* edited by Paul S. Martin, John B. Rinaldo, William A. Longacre, Leslie G. Freeman, James A. Brown, Richard H. Hevly, and Maurice E. Cooley, pp. 63–109. Fieldiana: Anthropology Vol. 55. Publication 984. Chicago Natural History Museum, Chicago, Illinois.

Roberts, Heidi
1993 *An Archaeological Survey of the Marsh Station Traffic Interchange on U.S. Interstate 10 East of Tucson, Pima County, Arizona.* Archaeological Report No. 93-63. SWCA, Tucson, Arizona.

Robinson, George
1951 A Method of Chronologically Ordering Archaeological Deposits. *American Antiquity* 16:293–301.

Rockman, Marcy H., and Steven D. Shelley
2001 Faunal Remains. In *El Macayo: A Prehistoric Settlement in the Upper Santa Cruz River Valley,* edited by William L. Deaver and Carla R. Van West, pp. 117–122. Technical Series 74. Statistical Research, Tucson, Arizona.

Rodgers, James B.
1987 *Studies along the Lower Agua Fria River: The Eastwing Site and the Marinette Canal.* Research Paper No. 37. Museum of Northern Arizona, Flagstaff.

Rohn, Arthur H.
1971 Miscellaneous Objects. In *Mug House, Mesa Verde National Park–Colorado: Wetherill Mesa Excavations*, by Arthur H. Rohn, pp. 241–253. Archeological Research Series No. 7-D. USDI National Park Service, Washington, D.C.

Roth, Barbara J.
1996 Regional Land Use in the Late Archaic of the Tucson Basin: A View from the Upper Bajada. In *Early Formative Adaptations in the Southern Southwest*, edited by Barbara J. Roth, pp. 37–48. Monographs in World Archaeology No. 25. Prehistory Press, Madison, Wisconsin.

Roth, Barbara J., and Bruce B. Huckell
1992 Cortaro Points and the Archaic of Southern Arizona. *Kiva* 57:353−370.

Russell, Frank
1908 The Pima Indians. In *Twenty-Sixth Annual Report of the Bureau of American Ethnology to the Secretary of the Smithsonian Institution, 1904–1905,* edited by William Henry Holmes, pp. 3–390. U.S. Government Printing Office, Washington, D.C.

1975 *The Pima Indians.* Re-edition with introduction, citation sources, and bibliography by Bernard L. Fontana. University of Arizona Press, Tucson.

Sayles, E. B.
1945 *The San Simon Branch: Excavations at Cave Creek and in the San Simon Valley I: Material Culture*. Medallion Papers No. 34. Gila Pueblo, Globe, Arizona.

1983 *The Cochise Cultural Sequence in Southeastern Arizona.* Anthropological Papers of the University of Arizona No. 42. University of Arizona Press, Tucson.

Sayles, E. B., and Ernst Antevs
1941 *The Cochise Culture*. Medallion Papers No. 29. Privately printed for the Gila Pueblo, Globe, Arizona.

Schiffer, Michael B.
1976 *Behavioral Archaeology*. Academic Press, New York.

1982 Hohokam Chronology: An Essay on History and Method. In *Hohokam and Patayan: Prehistory of Southwestern Arizona*, edited by Randall H. McGuire and Michael B. Schiffer, pp. 299–344. Academic Press, New York.

1987 *Formation Processes of the Archaeological Record*. University of New Mexico Press, Albuquerque.

Schlanger, Sarah H.
1990 Artifact Assemblage Composition and Site Occupation Duration. In *Perspectives on Southwestern Prehistory,* edited by Paul E. Minnis and Charles L. Redman, pp. 103–121. Investigations in American Archaeology. Westview Press, Boulder, Colorado.

1991 On Manos, Metates and the History of Site Occupations. *American Antiquity* 56:460–473.

1992 Recognizing Persistent Places in Anasazi Settlement Systems. In *Space, Time, and Archaeological Landscapes*, edited by Jacqueline Rossignol and LuAnn Wandsnider, pp. 91–112. Plenum Press, New York.

Schmidt, Kari M.
2008 An Assessment of Settlement and Subsistence in Emergent Agricultural Economies in the Tucson Basin, United States, and Chihuahua, Mexico. Unpublished Ph.D. dissertation, Department of Anthropology, University of New Mexico, Albuquerque.

Seymour, Deni
1989 The Dynamics of Sobaipuri Settlement in the Eastern Pimería Alta. *Journal of the Southwest* 31:205–222.

Seymour, Gregory R., Mark C. Slaughter, R. Thomas Euler, Lee Fratt, and Linda Gregonis
1992 *Archaeological Test Excavations at Eight Sites in the San Pedro Valley, Cochise County, and*

near Cienega Creek, Pima County, Arizona. Archaeological Report No. 92-09. SWCA, Tucson, Arizona.

Shaffer, Brian S.
1992 Quarter-Inch Screening: Understanding Biases in Recovery of Vertebrate Faunal Remains. *American Antiquity* 57:129–136.

Shaffer, Brian S., and Julia L. J. Sanchez
1994 Comparison of $^1/_8$”- and $^1/_4$”-Mesh Recovery of Controlled Samples of Small-to-Medium-Sized Mammals. *American Antiquity* 59:525–530.

Sheridan, Thomas E.
1996 The O’odham (Pimas and Papagos): The World Would Burn without Rain. In *Paths of Life: American Indians of the Southwest and Northern Mexico*, edited by Thomas E. Sheridan and Nancy J. Parezo, pp. 115−140. University of Arizona Press, Tucson.

Shott, Michael J.
1993 Spears, Darts, and Arrows: Late Woodland Hunting Techniques in the Upper Ohio Valley. *American Antiquity* 58:425–443.

2000 The Quantification Problem in Stone-Tool Assemblages. *American Antiquity* 65:725–738.

Shott, Michael J., and Paul Sillitoe
2005 Use Life and Curation in New Guinea Experimental Used Flakes. *Journal of Archaeological Science* 32:653–663.

Simpson, E. H.
1949 Measurement of Diversity. *Nature* 163:688.

Sluyter, Andrew
1993 Long-Distance Staple Transport in Western Mesoamerica: Insights through Quantitative Modeling. *Ancient Mesoamerica* 4:193–199.

Smith, Monica L.
1999 The Role of Ordinary Goods in Premodern Exchange. *Journal of Archaeological Method and Theory* 6:109–135.
2007 Inconspicuous Consumption: Non-display Goods and Identity Formation. *Journal of Archaeological Method and Theory* 14:412–438.

Smith, Susan J.
1998 Processing Pollen Samples from Archaeological Sites in the Southwest United States: An Example of Differential Recovery from Two Heavy Liquid Gravity Separation Procedures. In *New Developments in Palynomorph Sampling, Extraction, and Analysis*, edited by Vaughn M. Bryant, Jr., and John H. Wrenn, pp. 29–33. Contributions Series No. 33. American Association of Stratigraphic Palynologists Foundation, Houston, Texas.

2010 Pollen Analysis from Canals and Archaeological Features. Report submitted to Mike Foster, Logan Simpson Designs, Phoenix, Arizona, for the Salt River Project’s Pinal Central to Dinosaur Transmission Line Corridor Project.

Solomon, Allen M., T. J. Blasing, and J. A. Solomon
1982 Interpretation of Floodplain Pollen in Alluvial Sediments from an Arid Region. *Quaternary Research* 18(1):52–71.

South, Stanley
1978 Research Strategies for Archaeological Pattern Recognition on Historic Sites. *World Archaeology* 10: 36–50.

Speller, C. F., B. M. Kemp, S. D. Wyatt, C. Monroe, W. D. Lipe, U. M. Arndt, and D. Y. Yang
2010 Ancient Mitochondrial DNA Analysis Reveals Complexity of Indigenous North American Turkey Domestication. *Proceedings of the National Academy of Sciences* 107:2807–2812.

Spence, Michael D.
1992 Tlailotlacan: A Zapotec Enclave in Teotihuacan. In *Art, Ideology, and the City of Teotihuacan: A Symposium at Dumbarton Oaks, 8th and 9th October 1988*, edited by Janet Catherine Berlo, pp. 59–88. Dumbarton Oaks Research Library and Collection, Washington, D.C.

1996 A Comparative Analysis of Ethnic Enclaves. In *Arqueología Mesoamericana: Homenaje a William T. Sanders*, vol. 1, edited by Alba Guadalupe Mastache de Escobar, Jeffrey R. Parsons, Robert S. Santley, and Mari Carmen Serra Puche, pp. 333–353. Instituto de Antropología e Historia, Mexico City, Mexico.

Spencer, Jon E., Charles A. Ferguson, Stephen M. Richard, Tim R. Orr, Philip A. Pearthree, Wyatt G. Gilbert, and Robert W. Krantz
2002 *Geologic Map of the Narrows $7^1/_2$’ Quadrangle and the Southern Part of the Rincon Peak $7^1/_2$’ Quadrangle, Eastern Pima County, Arizona*, scale 1:24,000. Digital Geologic Map 10. Arizona Geological Survey, Tucson, Arizona.

Spielmann, Katherine (editor)
1998 *Migration and Community Reorganization: The Pueblo IV Period in the American Southwest*. Anthropological Research Papers No. 51. Arizona State University, Tempe.

Stark, Miriam T., Mark D. Elson, and Jeffery J. Clark
1998 Social Boundaries and Technical Choices in Tonto Basin Prehistory. In *The Archaeology of Social Boundaries*, edited by Miriam T. Stark, pp. 208–231. Smithsonian Institution Press, Washington, D.C.

Sternberg, Robert S.
1982 *Archaeomagnetic Secular Variation of Direction and Paleointensity in the American Southwest*. Ph.D. dissertation, Department of Geosciences, University of Arizona, Tucson. University Microfilms, Ann Arbor, Michigan.

1990 The Geophysical Basis of Archaeomagnetic Dating. In *Archaeomagnetic Dating*, edited by Jeffrey L. Eighmy and Robert S. Sternberg, pp. 5–30. University of Arizona Press, Tucson.

Sternberg, Robert S., and Randall McGuire
1990a Archaeomagnetic Secular Variation in the American Southwest, A.D. 700–1450. In *Archaeomagnetic Dating*, edited by Jeffrey L. Eighmy and Robert S. Sternberg, pp. 199–225. University of Arizona Press, Tucson.

1990b Techniques for Constructing Secular Variation Curves and for Interpreting Archaeomagnetic Dates. In *Archaeomagnetic Dating*, edited by Jeffrey L. Eighmy and Robert S. Sternberg, pp. 109–136. University of Arizona Press, Tucson.

Stevens, Michelle N.
2001 Archaic and Early Agricultural Period Land Use in Cienega Valley, Southeastern Arizona. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Stevens, Michelle N., and R. Jane Sliva
2002 Empire Points: An Addition to the San Pedro Phase Lithic Assemblage. *Kiva* 67:297–326.

Stiner, M. C., S. Kuhn, S. Weiner, and O. Bar-Yosef
1995 Differential Burning, Recrystallization, and Fragmentation of Archaeological Bone. *Journal of Archaeological Science* 22:223–237.

Stone, Tammy
1994 The Impact of Raw-Material Scarcity on Ground-Stone Manufacture and Use: An Example from the Phoenix Basin Hohokam. *American Antiquity* 59:680–694.

2003 Social Identity and Ethnic Interaction in the Western Pueblos of the American Southwest. *Journal of Archaeological Method and Theory* 10:31–67.

Strohmayer, Jodi, Matt McDermott, and Jason Ramsey
2005 *A Cultural Resource Survey and the Final Results of a Feasibility Study for the Relocation of the Marsh Station Traffic Interchange on Interstate 10, Pima County, Arizona.* EcoPlan Associates, Mesa, Arizona.

Stuiver, Minze, Paula J. Reimer, Edouard Bard, J. Warren Beck, G. S. Burr, Konrad A. Hughen, Bernd Kromer, Gerry McCormac, Johannes van der Plicht, and Marco Spurk
1998 IntCal98 Radiocarbon Age Calibration 24,000–0 cal B.P. *Radiocarbon* 40:1,041–1,083.

Sullivan, Alan P. III
1988 Prehistoric Southwestern Ceramic Manufacture: The Limitations of Current Evidence. *American Antiquity* 53:23–35.

1995 Artifact Scatters and Subsistence Organization. *Journal of Field Archaeology* 22(1):49–64.

Surovell, Todd A.
2003 The Behavioral Ecology of Folsom Lithic Technology. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

2009 *Toward a Behavioral Ecology of Lithic Technology: Cases from Paleoindian Archaeology.* University of Arizona Press, Tucson.

Swedlund, Alan C., and George J. Armelagos
1976 *Demographic Anthropology*. W. C. Brown, Dubuque, Iowa.

Szuter, Christine R.
1983 The Bone Artifact Assemblage from the Salt-Gila Aqueduct Project Sites. In *Material Culture*, edited by Lynn S. Teague and Patricia L. Crown, pp. 577–600. Hohokam Archaeology along the Salt-Gila Aqueduct Central Arizona Project, vol. 8. Archaeological Series No. 150. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1984 Faunal Exploitation and the Reliance on Small Animals among the Hohokam. In *Environment* *and Subsistence*, edited by Lynne S. Teague and Patricia L. Crown, pp. 139–169. Hohokam Archaeology along the Salt-Gila Aqueduct, Central Arizona Project, vol. 7. Archaeological Series No. 150. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1988 Bone Artifacts. In *Material Culture*, by David R. Abbott, Kim E. Beckwith, Patricia L. Crown, R. Thomas Euler, David A. Gregory J. Ronald London, Marilyn B. Saul, Larry A. Schwalbe, Mary Bernard-Shaw, Christine R. Szuter, and Arthur W. Vokes, pp. 385–407. The 1982–1984 Excavations at Las Colinas, vol. 4, Lynn Teague, general editor. Archaeological Series No. 162. Cultural Resource Management Division, Arizona State Museum, Tucson.

1989 Hunting by Prehistoric Horticulturalists in the American Southwest. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Szuter, Christine R., and Frank E. Bayham

1989 Sedentism and Prehistoric Animal Procurement among Desert Horticulturalists of the North American Southwest. In *Farmers as Hunters: The Implications of Sedentism*, edited by Susan Kent, pp. 80–95. Cambridge University Press, Cambridge, England.

Talma, A. S., and J. C. Vogel

1993 A Simplified Approach to Calibrating ^{14}C Dates. *Radiocarbon* 35:317–322.

Tanner, Clara Lee

1983 *Indian Baskets of the Southwest*. University of Arizona Press, Tucson.

Taylor, R. E.

1987 *Radiocarbon Dating: An Archaeological Perspective*. Academic Press, Orlando, Florida.

Teague, Lynn S.

1981 *Test Excavations at Painted Rock Reservoir: Sites AZ Z:1:7, AZ Z:1:8, and AZ S:16:36*. Archaeological Series No. 143. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

Thomas, David Hurst

1978 Arrowheads and Atlatl Darts: How the Stones Got the Shaft. *American Antiquity* 43:461–472.

1988 *Survey and Additional Excavations.* The Archaeology of Monitor Valley, vol. 3. Anthropological Papers Vol. 66, Pt. 2. American Museum of Natural History, New York.

Tomka, Steven A.

1989 Differentiating Lithic Reduction Techniques: An Experimental Approach. In *Experiments in Lithic Technology*, edited by Daniel S. Amick and Raymond P. Mauldin, pp. 137−162. BAR International Series 528. B.A.R., Oxford, England.

Torrence, Robin

1983 Time-Budgeting and Hunter-Gatherer Technology. In *Hunter-Gatherer Economy in Prehistory: A European Perspective*, edited by Geoff Bailey, pp. 11–22. Cambridge University Press, Cambridge, England.

1989 Re-tooling: Towards a Behavioral Theory of Stone Tools. In *Time, Energy, and Stone Tools*, edited by Robin Torrence, pp. 57–66. Cambridge University Press, Cambridge, England.

Trischka, Carl

1933 *Hohokam: A Chapter in the History of Red-on-Buff Culture of Arizona*. Reprinted from *Scientific Monthly* 37.

Turner, Christy G. II, Christian R. Nichol, and G. Richard Scott

1991 Scoring Procedures for Key Morphological Traits of the Permanent Dentition: The Arizona State University Dental Anthropology System. In *Advances in Dental Anthropology*, edited by Mark A. Kelley and Clark Spencer Larsen, pp. 13–31. Wiley-Liss, New York.

Tuthill, Carr

1947 *The Tres Alamos Site on the San Pedro River, Southeastern Arizona*. Publication No. 4. Amerind Foundation, Dragoon, Arizona.

Ugan, Andrew, and Jason Bright

2001 Measuring Foraging Efficiency with Archaeological Faunas: The Relationship between Relative Abundance Indices and Foraging Returns. *Journal of Archaeological Science* 28:1309–1321.

Ugan, Andrew, Jason Bright, and Alan Rogers

2003 When is Technology Worth the Trouble? *Journal of Archaeological Science* 30:1315–1329.

Underhill, Ruth M.
1951 *People of the Crimson Evening*. Indian Life and Customs 7. Branch of Education, USDI Indian Service, Sherman Institute, Riverside, California.

1993 *Singing for Power: The Song Magic of the Papago Indians of Southern Arizona*. Reprinted. University of Arizona Press, Tucson. Originally published 1938, University of California Press, Berkeley.

Urban, Sharon F.
2001 Shell Artifacts: Beads by the Hundreds. In *El Macayo: A Prehistoric Settlement in the Upper Santa Cruz River Valley*, edited by William L. Deaver and Carla R. Van West, pp. 109–116. Technical Series 74. Statistical Research, Tucson, Arizona.

Van Buren, Mary, James M. Skibo, and Alan P. Sullivan III
1992 The Archaeology of an Agave Roasting Location. In *The Marana Community in the Hohokam World*, edited by Suzanne K. Fish, Paul R. Fish, and John H. Madsen. Anthropological Papers of the University of Arizona No. 56. University of Arizona Press, Tucson. Electronic document, http://www.uapress.arizona.edu/onlinebks/Fish/chapter8.htm (online version of original printed volume), accessed July 15, 2008.

Vanderpot, Rein
1997 From Foraging to Farming: Prehistoric Settlement and Subsistence Dynamics in the San Pedro Valley. In *Prehistory of the Borderlands: Recent Research in the Archaeology of Northern Mexico and the Southern Southwest*, edited by John Carpenter and Guadalupe Sánchez, pp. 33–45. Archaeological Series No. 186. Arizona State Museum, University of Arizona, Tucson.

2001 *Preliminary Report of Phase 2 Archaeological Investigations at the Mescal Wash Site (AZ EE:2:51 [ASM]), Pima County, Arizona*. Technical Report 01-57. Statistical Research, Tucson, Arizona.

Vanderpot, Rein, and Jeffrey H. Altschul
2000 *Preliminary Report of Phase I Archaeological Investigations and Phase II Data Recovery Plan, Mescal Wash Site (AZ EE:2:51 [ASM]), Pima County, Arizona*. Technical Report 00-51. Statistical Research, Tucson, Arizona.

2007 The Mescal Wash: A Persistent Place in Southeastern Arizona. In *Hinterlands and Regional Dynamics in the Ancient Southwest*, edited by Alan P. Sullivan III and James M. Bayman, pp. 50–69. University of Arizona Press, Tucson.

Vanderpot, Rein, and Robert A. Heckman
2002 *Archaeological Testing of a Cable Easement and a Proposed Bore Pad Location for the AT&T NexGen/Core Project at the Mescal Wash Site (AZ EE:2:51 [ASM]), Pima County, Arizona*. Technical Report 02-61. Statistical Research, Tucson, Arizona.

VanPool, Todd L., and Robert D. Leonard
2002 Specialized Ground Stone Production in the Casas Grandes Region of Northern Chihuahua, Mexico. *American Antiquity* 67:711–730.

Van West, Carla R., Mark T. Swanson, and Jeffrey H. Altschul
1997 *Cultural Resources Management Plan for Fort Huachuca Military Reservation, Arizona*. Technical Series 67. Statistical Research, Tucson, Arizona.

Vascular Plants of Arizona Editorial Committee
1992–2001 *A New Flora for Arizona in Preparation*. Arizona-Nevada Academy of Science, Tempe Arizona. Published as *Journal of the Arizona-Nevada Academy of Science* 26(1) [1992], 27(2) [1994], 29(1) [1995], 30(2) [1998], 32(1) [1999], 33(1) [2001].

Vaughan, Patrick C.
1985 *Use-Wear Analysis of Flaked Stone Tools*. University of Arizona Press, Tucson.

Vierra, Bradley J.
1995 *Subsistence and Stone Tool Technology: An Old World Perspective.* Anthropological Research Papers No. 47. Arizona State University, Tempe.

Vokes, Arthur W.
1984 The Shell Assemblage of the Salt-Gila Aqueduct Project Sites. In *Material Culture*, pt. 3, edited by Lynn S. Teague and Patricia L. Crown, pp. 465–574. Hohokam Archaeology along the Salt-Gila Aqueduct, Central Arizona Project, vol 8. Archaeological Series No. 150. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1986 The Tanque Verde Wash Shell Assemblage. In *Archaeological Investigations of the Tanque Verde Wash Site: A Middle Rincon Settlement in the Eastern Tucson Basin*, by Mark D. Elson, pp. 313–324. Anthropological Papers 7. Institute for American Research, Tucson, Arizona.

1988 Architecture. In *Excavations at Fastimes (AZ AA:12:384), a Rillito Phase Site in the Avra Valley*, edited by Jon S. Czaplicki and John C. Ravesloot, pp. 37–47. Hohokam Archaeology along Phase B of the Tucson Aqueduct, Central Arizona Project, vol. 2. Archaeological Series No. 78. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

1995 Shell Artifacts. In *Archaeological Investigations at Los Morteros, a Prehistoric Settlement in the Northern Tucson Basin*, by Henry D. Wallace, pp. 567–604. Anthropological Papers No. 17. Center for Desert Archaeology, Tucson, Arizona.

1999 Shell Analysis. In *Investigations at Sunset Mesa Ruins*, edited by Richard Ciolek-Torrello, Edgar K. Huber, and Robert B. Neily, pp. 149–160. Technical Series 66. Statistical Research, Tucson, Arizona.

2001 The Shell Ornament Assemblage. In *Tonto Creek Archaeological Project: Life and Death along Tonto Creek*, edited by Jeffery J. Clark and Penny Dufoe Minturn, pp. 353–419. Anthropological Papers No. 24. Center for Desert Archaeology, Tucson, Arizona.

2009 Julian Wash Site, AZ BB:13:127 (ASM), Shell Assemblage. In *Craft Specialization in the Southern Tucson Basin: Archaeological Excavations at the Julian Wash Site, AZ BB:13:17 (ASM)*, edited by Henry D. Wallace, pp. 375–797. Anthropological Papers No. 40. Center for Desert Archaeology, Tucson, Arizona.

Waguespack, Nicole M., and Todd A. Surovell
2003 Clovis Hunting Strategies, or How to Make Out on Plentiful Resources. *American Antiquity* 68:333–352.

Walker, Phillip L., Rhonda R. Bathhurst, Rebecca Richman, Thor Gjerdrum, and Valerie A. Andrushko
2009 The Causes of Porotic Hyperostosis and Cribra Orbitalia: A Reappraisal of the Iron-Deficiency-Anemia Hypothesis. *American Journal of Physical Anthropology* 139:109–125.

Wallace, Henry D.
1995 Mortuary Remains. In *Archaeological Investigations at Los Morteros, a Prehistoric Settlement in the Northern Tucson Basin*, pt. 2, edited by Henry D. Wallace, pp. 721–762. Anthropological Papers No. 17. Center for Desert Archaeology, Tucson, Arizona.

Ward, G. K., and S. R. Wilson
1978 Procedures for Comparing and Combining Radiocarbon Age Determinations: A Critique. *Archaeometry* 20:19–31.

Waters, Michael R.
1986 *The Geoarchaeology of Whitewater Draw, Arizona*. Anthropological Papers of the University of Arizona No. 45. University of Arizona Press, Tucson.

Webb, George
1959 *A Pima Remembers.* University of Arizona Press, Tucson.

Wegener, Robert M.
2000 *A Cultural Resources Survey of Five Proposed Temporary Construction Easements and Two Proposed Right-of-Way Modifications along U.S. Interstate 10, Marsh Station Traffic Interchange, near Milepost 289, Pima County, Arizona.* Technical Report 00-37. Statistical Research, Tucson, Arizona.

2007 Vertebrate Faunal Remains. In *Ak Chin Farmers of the Desert: Archaeological and Historical Investigations at the Ak Chin Site (TO:GA:6 [TO]), Gu Achi District of the Tohono O'odham Nation, Arizona*, edited by Jeffrey A. Homburg, pp. 369–382. Technical Series 89. Statistical Research, Tucson, Arizona.

Wegener, Robert M., Karry L. Blake, and Richard Ciolek-Torrello (editors)
2009 *Data Recovery at Christiansen Border Village: Nonriverine Late Archaic/Early Agricultural and Formative Period Archaeology in the Borderlands of Southeastern Arizona*. Technical Report 09-31. Statistical Research, Tucson, Arizona.

Wenzel, Kristen E., and Phillip H. Shelley
2001 What Put the Small in the Arctic Small Tool Tradition: Raw Material Constraints on Lithic Technology at the Mosquito Lake Site, Alaska. In *Lithic Debitage: Context, Form, Meaning*, edited by William Andrefsky, Jr., pp. 106−123. University of Utah Press, Salt Lake City.

Whalen, Norman M.
1971 Cochise Culture Sites in the Central San Pedro Drainage, Arizona. Unpublished Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson.

Wheat, Margaret M.
1967 *Survival Arts of the Primitive Paiutes.* University of Nevada Press, Reno.

White, J. Peter, with James F. O'Connell
1982 *A Prehistory of Australia, New Guinea and Sahul.* Academic Press, Sydney, New South Wales, Australia.

Whittaker, John C.
1984 *Arrowheads and Artisans: Stone Tool Manufacture and Individual Variation at Grasshopper Pueblo.* Ph.D. dissertation, Department of Anthropology, University of Arizona, Tucson. University Microfilms, Ann Arbor, Michigan.

1994 *Flintknapping: Making and Understanding Stone Tools.* University of Texas Press, Austin.

Whittlesey, Stephanie M.
1994 Ceramics. In *Prehistoric Rural Settlements in the Tonto Basin*, edited by Richard Ciolek-Torrello, Steven D. Shelley, and Su Benaron, pp. 377–468. The Roosevelt Rural Sites Study, vol. 2, pt. 2. Technical Series 28. Statistical Research, Tucson, Arizona.

2003 Culture History: Prehistoric Narratives for Southern Arizona. In *Background and Research Issues*, by Carla R. Van West and Stephanie M. Whittlesey, pp. 51–89. Prehistoric Archaeological Resources on Canoa Ranch, Pima County, Arizona, vol. 1. Technical Report 03-35. Statistical Research, Tucson, Arizona.

Whittlesey, Stephanie M., and Richard Ciolek-Torrello
1996 The Archaic-Formative Transition in the Tucson Basin. In *Early Formative Adaptations in the Southern Southwest*, edited by Barbara J. Roth, pp. 49–64. Monographs in World Archaeology No. 25. Prehistory Press, Madison, Wisconsin.

Whittlesey, Stephanie M., Richard Ciolek-Torrello, and Matthew A. Sterner
1994 *Southern Arizona: The Last 12,000 Years; A Cultural-Historic Overview for the Western Army National Guard Aviation Training Site*. Technical Series 48. Statistical Research, Tucson, Arizona.

Whittlesey, Stephanie M., and Robert A. Heckman
2000 Culture History and Research Background. In *Prehistoric Painted Pottery of Southeastern Arizona*, by Robert A. Heckman, Barbara K. Montgomery, and Stephanie M. Whittlesey, pp. 1–22. Technical Series 77. Statistical Research, Tucson, Arizona.

Whittlesey, Stephanie M., S. Jerome Hesse, and Michael S. Foster (editors)
2007 *Recurrent Sedentism and the Making of Place: Archaeological Investigations at Las Capas, a Preceramic Period Farming Community in the Tucson Basin, Southern Arizona*. Cultural Resources Report No. 07-556. SWCA Environmental Consultants, Tucson, Arizona.

Wilcox, David R., and Charles Sternberg
1983 *Hohokam Ballcourts and Their Interpretation*. Archaeological Series No. 160. Cultural Resource Management Division, Arizona State Museum, University of Arizona, Tucson.

Willey, Gordon R., and Philip Phillips
1958 *Method and Theory in American Archaeology*. University of Chicago Press, Chicago, Illinois.

Windmiller, Ric
1973 The Late Cochise Culture in the Sulphur Spring Valley, Southeastern Arizona: Archaeology of the Fairchild Site. *The Kiva* 39:131–169.

Winterhalder, Bruce, and Eric Alden Smith (editors)
1981 *Hunter-Gatherer Foraging Strategies: Ethnographic and Archeological Analyses.* University of Chicago Press, Chicago, Illinois.

Woodbury, Richard B.
1954 *Prehistoric Stone Implements of Northeastern Arizona.* Reports of the Awatovi Expedition No. 6. Papers of the Peabody Museum of American Archaeology and Ethnology Vol. 34. Harvard University, Cambridge, Massachusetts.

Woodson, M. Kyle
1995 The Goat Hill Site: A Western Anasazi Pueblo in the Safford Valley of Southeastern Arizona. Unpublished Master's thesis, Department of Anthropology, University of Texas, Austin.

1999 Migrations in Late Anasazi Prehistory: The Evidence from the Goat Hill Site. *Kiva* 65:63–84.

Yellen, John E.

1977 *Archaeological Approaches to the Present: Models for Reconstructing the Past*. Academic Press, New York.

1991 Small Mammals: !Kung Utilization and the Production of Faunal Assemblages. *Journal of Anthropological Archaeology* 10:1–26.

Zedeño, María Nieves

1994 *Sourcing Prehistoric Ceramics at Chodistaas Pueblo, Arizona: The Circulation of People and Pots in the Grasshopper Region.* Anthropological Papers of the University of Arizona No. 58. University of Arizona Press, Tucson.

Zeder, Melinda A.

1991 *Feeding Cities: Specialized Animal Economy in the Ancient Near East.* Smithsonian Institution Press, Washington, D.C.